

The ISO received comments on the topics discussed at the May 28, 2019 stakeholder call from the following:

1. [Bay Area Municipal Transmission group \(BAMx\)](#)
2. [California Public Utilities Commission – Staff \(CPUC-Staff\)](#)
3. [EDF-Renewables \(EDF-R\)](#)
4. [First Solar](#)
5. [Golden State Clean Energy \(GSCE\)](#)
6. [GridLiance West](#)
7. [San Diego & Electric \(SDG&E\)](#)
8. [The Cities of Anaheim, Azusa, Banning, Colton, Pasadena and Riverside \(Six Cities\)](#)

Copies of the comments and economic study requests submitted are located under the Transmission Capability Estimates as an input to the CPUC Integrated Resource Plan meeting.

The following are the ISO's responses to the comments.

1. Bay Area Municipal Transmission group (BAMx) Submitted by: Paulo Apolinario		
No	Comment Submitted	CAISO Response
1a	<p>1. Stakeholder Involvement, and Timing and Frequency of Updates</p> <p>BAMx appreciates the CAISO’s description of the steps involved in transmission capability estimation and how these estimates are used to assist the CPUC and the California Energy Commission (CEC) in developing the renewable portfolios used in the CPUC’s IRP process and the CAISO’s annual Transmission Planning Process (TPP). BAMx welcomes the CAISO’s due diligence in providing the CPUC with updated transmission capability amounts as well as renewable resource location selections (or, resource mapping) for developing the portfolio for the 2019-2020 TPP, which would help avoid artificial transmission congestion/overload issues that were found in the 2018-2019 TPP.</p> <p>Although the White paper has alleviated many of BAMx’s concerns about the lack of transparency into the resource mapping aspect of the feedback loop between the CPUC IRP and the CAISO TPP, we believe that the stakeholders need to have an adequate opportunity to review and provide input into the resource mapping process. BAMx expects several resource mapping issues could be discovered as the CAISO and the stakeholders alike have the opportunity to review and assess the implications of the TPP renewable portfolios for the base and sensitivity cases. Therefore, BAMx suggests that the CEC involve stakeholders, as it has the CAISO, in the resource mapping process. Overall, BAMx urges the CAISO to continue to engage the stakeholders in the process of modeling these renewable portfolios in the transmission planning power flow and production cost modeling cases, and acknowledges that the issuance of the White Paper is the first constructive step in that direction.</p> <p>We understand that the CPUC IRP being on a two-year cycle versus the CAISO TPP being on an annual cycle, presents challenges to manage the information flow between these two processes. In the BAMx comments on the CAISO 2018-19 Transmission Plan, dated November 30, 2018, we had included a timeline for CAISO’s consideration entailing an exchange of data and information among CAISO TPP, CPUC IRP, and involved stakeholders. In Attachment A, we have included excerpts from those prior comments –</p>	<p>Regarding the comment about stakeholder involvement in resource mapping process, the ISO believes that CPUC’s IRP proceeding would be an appropriate forum to provide this input because the mapping process is led by the CPUC and precedes the transmittal of portfolios to the ISO for study in the TPP. This ISO initiative is an appropriate forum for stakeholder input on the development of the estimates.</p> <p>The proposed timeline for data exchange provided by BAMx is not feasible because of two main factors – (i) insufficient time between the different proposed milestones to conduct the necessary analysis, especially as the planning staff have other overlapping responsibilities in the same time frames, and (ii) the precise timeline for the CPUC’s IRP process can vary somewhat from year to year, making this level of scheduling precision infeasible.</p> <p>The comment about the need to refine the transmission capability estimates using TPP studies as well as GIDAP studies is aligned with how the ISO currently refines the transmission capability estimates. As explained during the stakeholder call, GIDAP studies are the primary source of information but not the only source. The ISO takes into account the results of production cost simulations and reliability studies to refine the transmission capability estimates.</p> <p>Regarding the comment about providing stakeholders with an opportunity to review and provide feedback into the refined transmission capability estimates, draft production cost simulation and deliverability results are usually presented at the November stakeholder meeting and the stakeholders are provided the opportunity to comment. The ISO will explore with the CPUC how the draft transmission capability estimates can be presented to the stakeholders, and in which forum (TPP or IRP).</p>

No	Comment Submitted	CAISO Response
	<p>specifically on the Policy Assessment subject matter. Although the CAISO had found the BAMx-proposed timeline to be unrealistic “given the resource requirements necessary to conduct these studies and other planning activities”, we continue to believe that this process/timeline is feasible and will ensure that the TPP portfolios used to determine the reliability and policy-driven projects are vetted by stakeholders and would also minimize the likelihood any inefficient and unneeded Area Delivery Network Upgrades (ADNU) being approved under any given TPP cycle. Two key aspects of the BAMx-proposed approach and timeline are as follows.</p> <p>First, it envisions the CAISO refining its transmission capability estimates that would be provided to the CPUC IRP - not only using the current and past Generator Interconnection Deliverability Allocation Procedures (GIDAP) studies, but also utilizing the available production cost simulations studies results for the prior year’s TPP portfolios. If the prior year’s portfolios result in an excessive amount of renewable curtailments and congestion, the CAISO would use its judgment, in consultation for the CPUC and CEC, in determining whether those results were credible or have resulted purely from unrealistic and/or inefficient resource mapping.</p> <p>Second, this timeline allows stakeholders with an opportunity to review and provide feedback into the CAISO’s refined transmission capability estimates. In addition to the feedback stakeholders would provide on the refined transmission capability estimates at the end of February, they also could provide feedback on the preliminary results associated with those portfolios in the mid-November timeframe.</p> <p>In summary, we believe that meaningful stakeholder participation, and the use of production cost simulations studies in the TPP that address potential excessive generation curtailments, in addition to the TPP reliability and GIDAP studies, would significantly improve the transmission capability estimation process.</p>	

No	Comment Submitted	CAISO Response
1b	<p>2. Need to Delay Major Transmission Approval Decisions Under Changing Environment</p> <p>As the CAISO pointed out during the May 28th stakeholder call, the fundamental elements driving the transmission capability estimates are fluid. In particular, the CAISO explained how the nested constraints and therefore the boundaries of the transmission zones could change the transmission capability estimates as a result of some factors, such as new transmission upgrades and the overall transmission system topology. We also note that the CAISO is considering revisions to the existing Deliverability Assessment Methodology (DAM), which is expected to result in having reduced level of ADNUs needed to accommodate full capacity deliverability status (FCDS) generation. In other words, the revised DAM would likely result in having a greater amount of FCDS resources that can be accommodated in a given transmission zone/area relative to the existing transmission capability estimates. We appreciate that the CAISO will use the existing DAM until the methodology is changed. However, in case any ADNUs are identified in the 2019-2020 TPP cycle as a Category 1 policy-driven transmission upgrade, we urge the CAISO to consider whether their answer would be substantially different under the revised DAM. That is, if, under the revised DAM, no such ADNU would be identified in Category 1, thus any upgrade that is identified under the existing DAM should be classified as a Category 2 policy-driven upgrade to be further evaluated in the subsequent TPP cycle.</p>	<p>Given other initiatives and venues underway, the scope of this meeting was limited to Transmission Capability Estimates as an input to the CPUC Integrated Resource Plan. While several comments relate to issues beyond the scope of the initiative, responses have been provided to some extent to be helpful.</p> <p>The ISO considers the criteria listed in tariff section 24.4.6.6 in identifying Category 1 and/or Category 2 policy-driven transmission solutions. One of the criteria is “the effect of uncertainty associated with the above criteria, and any other considerations, that could affect the risk of stranded investment”.</p>

2. California Public Utilities Commission – Staff (CPUC-Staff)		
Submitted by: Karolina Maslanka		
No	Comment Submitted	CAISO Response
2a	<p>1. CPUC staff thanks the CAISO for hosting the stakeholder call on the development of transmission capability estimates and looks forward to continued transparency.</p> <p>The transmission capability estimates and upgrade costs are an important input to the RESOLVE model used within the CPUC IRP process. The CPUC relies on stakeholder input as an additional layer of IRP input and assumption vetting. For this reason, it is important that parties have insight into how the transmission capability constraints and estimates for potential upgrades are developed by the CAISO. Additionally, it is important that parties are able to apply the transmission estimates developed by CAISO to the specific geographic areas pertinent to them. In order to do so, parties need to know what geographic area is within the bounds of each subzone referred to in the table on the following page. Acknowledging the evolving nature of busbar mapping as well as the confidentiality surrounding critical energy infrastructure, CPUC staff requests that to the extent possible the CAISO provide additional information regarding the definition of each transmission zone and sub-zone and its boundaries.</p>	<p>The ISO will continue to update information provided in the white paper and presentation slides and support for the resource mapping effort, while respecting the confidentiality requirements regarding information relating to critical infrastructure. It is not clear what additional information is being requested beyond the definition of each transmission zone and sub-zone and boundary information already provided by the ISO in the white paper and presentation slides, and the ISO will follow up with CPUC staff.</p>
2b	<p>2. CPUC staff requests that the CAISO include in the white paper or elsewhere a definition of “minor upgrades” and “major upgrades” as seen in the table on slide 10.</p> <p>Understanding potential differences between the two upgrade types can inform how they are used as inputs within RESOLVE and what post processing occurs when CPUC staff collaborate with CEC staff to ensure that all constraints are met as resources are mapped to specific busbars. For example, if a minor upgrade can be distinguished from a major upgrade by the fact that it does not entail any significant environmental impacts, this point should be considered by CPUC staff within the RIP process. For this reason, CPUC staff request the CAISO define the two upgrade types or at a minimum provide a description of the primary differences (i.e., no significant environmental impacts, costs greater than \$50 million, etc.).</p>	<p>The ISO will work with the CPUC staff to clarify what is a “minor upgrade and what is a “major upgrade”.</p>

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	<p>Transmission Capability Estimates as of May 20, 2019</p> <p>Table Source: CAISO White Paper on Transmission Capability Estimates as an input to the CPUC IRP Portfolio Development</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="3">Transmission zones and sub-zones</th> <th colspan="8">Transmission capability estimates to support CPUC's IRP process (May 20, 2019)</th> <th rowspan="3">Estimated EDDS Capability** (MW)</th> </tr> <tr> <th colspan="4">Estimated FCDS Capability (MW)</th> <th colspan="4">Incremental Upgrade Cost Estimate (\$million)</th> </tr> <tr> <th>Existing System</th> <th>Minor Upgrades</th> <th>Major Upgrade #1</th> <th>Major Upgrade #2</th> <th>Existing System</th> <th>Minor Upgrades</th> <th>Major Upgrade #1</th> <th>Major Upgrade #2</th> </tr> </thead> <tbody> <tr> <td>Northern CA</td> <td>2,000</td> <td></td> <td>2,000</td> <td></td> <td></td> <td></td> <td>\$ 285</td> <td></td> <td>3,900</td> </tr> <tr> <td>- Round 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2c	<p>3. CPUC staff affirms that a smoother transmission upgrade cost profile would benefit the CPUC IRP process.</p> <p>The upgrade estimates provided in the CAISO table are primarily all for major upgrades and the high incremental capability and cost amounts are lumpy in nature. The size and cost of identified major transmission upgrades may pose a significant hurdle to further generation resource buildout in that specific zone. The RESOLVE model used for IRP planning may instead select a different zone for generation buildout as a more cost-effective option. It is important for the CPUC to be aware of smaller potential upgrades that may exist. A smoother cost profile with more intermediate options for lower cost transmission investments would improve the ability with which RESOLVE could select the most optimal portfolio of resources. Can the CAISO provide estimates for more incremental transmission upgrades?</p> <p>In addition, CPUC staff seeks to better understand to what extent minor upgrades and major upgrades will be identified within the CAISO processes in the future. The estimates recently provided by the CAISO only identified one minor upgrade and no secondary upgrades (refer to “major upgrades #2” columns in table above”). Is the lack of these type of upgrades a function of the</p>	<p>The upgrade costs provided a range from \$53 M to \$2.3 B. For the zones and subzones defined, these upgrades generally represent the next most cost effective upgrade for increasing the transmission capability out of each zone. For example, one of the lowest cost upgrades is the addition of another transformer inside of an existing substation to address overloading of the existing transformation. This is obviously the next most cost effective upgrade. The more expensive upgrades are new 500 kV lines that would be added to address overloading of the existing 500 kV lines. A lower cost incremental upgrade to address overloading of the existing 500 kV lines is to add a generation dropping remedial action scheme (RAS), but this upgrade has already been assigned to generation in the interconnection queue and has already been assumed in the capability of the existing system. After the RAS, an additional, electrically parallel 500 kV line is the next most cost effective upgrade.</p>																																																																																																																																																																																																																																		

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	<p>TPP and GIDAP process not being well-suited to identify them, is it an outcome specific to the resource portfolios transmitted to the CAISO by the CPUC, or is there a different reason for the low prevalence of information regarding these upgrade types?</p>	

3. EDF Renewables Submitted by: Justin Radl		
No	Comment Submitted	CAISO Response
3a	1. The CAISO indicates in the white paper that the primary resource for the information in the capability estimates comes from the GIDAP studies. The white paper does not address the deliverability methodology (i.e. ELCC?) being used, adding information related to the deliverability methodology could better help the audience understand the system capability.	Thank you for the comments. The information presented in the white paper is based on the existing deliverability methodology. Although a stakeholder initiative is underway regarding revising the existing deliverability methodology, the ISO does not have a final recommendation for revising the deliverability methodology.
3b	2. Considering the various resources on the CAISO grid, some are better suited as capacity resources while others are better suited as energy only resources. EDF appreciates that the CAISO takes this into consideration by considering both FCDS and EODS transmission capability levels. However, the CAISO should clarify in the white paper why Energy Only resources can only be added incrementally to the FCDS. FCDS status does not grant preference to the transmission system in the market dispatch and therefore the current amount of FCDS resources in a zone should not be a factor in determining the amount of EODS resources that can utilize that transmission capacity in a specific zone.	Generators that connect to the ISO system have the choice to select FCDS or EODS. These generator selections will ultimately determine how much FCDS and how much EODS generation will utilize the transmission system in a specific zone. The ISO does not intend to indicate that EODS resources can only be incrementally added to the FCDS resources. The CPUC's IRP process makes the decision about EO vs FC resource mix selected as part of the renewable portfolios. The ISO only utilizes the FCDS transmission capability estimate as a starting point to estimate the incremental room for accommodating additional EO resources with a reasonable expectation of renewable curtailment.
3c	3. The white paper does a nice job of describing the interaction of the zones and how the zones can be nested. Additional information on how the zones are developed and at what would change a zones boundary would be a helpful section in the white paper.	The white paper and the stakeholder presentation clarified that the zone boundaries for transmission capability estimation purpose are dictated by the transmission constraints identified in the studies used as key sources of information. Detailed maps showing various zonal boundaries and their interrelationships are posted to the ISO market participant portal. Information has been provided regarding the approximate increase in the transmission capability for most of the zones and the cost of the transmission upgrade that would increase the capability. It is possible that the boundary of zones would change if those upgrades were built, but how those boundaries would change has not been determined.
3d	4. The table listing the Transmission Capability estimates is a valuable tool for anyone trying to understand where transmission capacity may be available. The table shows the increased capability and estimated cost of the upgrade. A suggestion to enhance table 2-1 would be to include the in-service date for the upgrade to convey when it could be operational.	The upgrades utilized for incremental capability estimation purpose are conceptual in nature. Because most of these upgrades are not firm and because the portfolios selected by the CPUC are for the 2030 timeframe, the ISO believes that including conceptual in-service dates would have limited value.

No	Comment Submitted	CAISO Response
		Estimated development and construction durations for many of the conceptual upgrades are available to the interconnection customers in the respective study area in the queue cluster reports, and can be included with the Transmission Capability estimates, if available.
3e	5. It is not clear in the whitepaper how the CAISO sequences this study with the GIDAP study and the TPP study. A timeline showing what GIDAP study and TPP study this effort is based on will help the audience assess the outlook in the specific Transmission zones and sub-zones.	As explained during the stakeholder presentation, the ISO typically relies on the latest available GIDAP cluster reports. In some cases the ISO relies on the GIDAP cluster that studied the highest amount of generation (this may not always be the latest cluster).

4. First Solar Submitted by: John Sterling		
No	Comment Submitted	CAISO Response
4a	<p>First Solar appreciates the opportunity to provide comments on the CAISO's recent white paper outlining transmission capability estimates for the CPUC's Integrated Resource Plan (IRP). This white paper provides much-needed transparency on an important input to the State's long-term planning process. Understanding the trade-offs between transmission upgrades for full capacity deliverability status (FCDS) and relying upon energy only deliverability status (EODS) for incremental renewables provides the opportunity for a more thoughtful dialogue on how resources get incorporated into the grid. It is important to note that these EODS estimates are just that: estimates, which should be treated as indicative values for what could be possible.</p> <p>In the white paper, the CAISO states that when calculating EODS, it is assumed that non-zero marginal cost fossil fuel resources and imports are displaced. The resulting maximum amount of incremental resources, prior to the triggering of an upgrade, determines the EODS for that portion of the transmission system. While this provides a reasonable maximum benchmark value, First Solar is concerned that it may overstate the potential for new resources to effectively take EODS service in the future. To that end, we would like the CAISO to provide additional clarity on the resources being displaced and how they fit into traditional system dispatch.</p>	<p>Once the ISO receives the portfolios from the CPUC, they are studied in full detail to confirm that the amount of EODS generation in the portfolio can be accommodated. The resources and imports that are assumed to be displaced by the incremental EO resources in a specific zone for the purpose of EO capability estimation are the existing non-zero marginal cost resources and any imports that come from such resources.</p>
4b	<p>1. For the fossil fuel resources and imports being displaced, has the CAISO reviewed their operating characteristics and relative flexibility? For example, are these resources predominantly quick start, fast ramping assets, or do they include a non-trivial amount of resources that are characterized by long lead times to start/stop and slow ramping capabilities? Our concern is whether or not a significant portion of the gas generation assumed to be offline is actually needed for evening ramps, and is not capable of coming online close to the operating hour of need for that ramp. If those resources have restrictions regarding start/stop times, then they be required to be online at their Pmins during the peak of the day, when many of the EODS projects would presumably be on the grid as well. This would result in either more curtailment than anticipated, or an overstatement of the true nameplate EODS additions that are realistically feasible. First Solar raises this question predominantly to gain a</p>	<p>As mentioned in the comment above, the EODS capability estimates are just that – estimates. These are not intended to be precisely calculated numbers. Once the ISO receives the portfolios from the CPUC, they are studied in detail to confirm that the amount of EODS generation in the portfolio can be accommodated, including reviewing the operating characteristics, as needed. The EO resources selected as part of renewable portfolios are studied as part of the production cost simulation runs. If these studies show unreasonable amounts of curtailment, the ISO performs further investigations and refines the capability estimates.</p>

No	Comment Submitted	CAISO Response
	clearer understanding of whether or not system dispatch considerations are factored into these transmission capability estimates, as well as to highlight the potential importance of pursuing the major upgrades identified in Table 2-1, column B, to ensure FCDS status for the most resources possible.	
4c	2. Were these specific upgrades provided as inputs to the RESOLVE model, or were just the costs and associated increases in capability associated with them provided to the CPUC?	The table as shown in the white paper is provided to the CPUC. It is our understanding that the CPUC uses the data in this table to provide direct input to the RESOLVE model.
4d	3. How does the RESOLVE model identify the tradeoff between FCDS with additional transmission related costs versus adding EODS? If the EODS limit were reached, how would that impact the incremental cost and FCDS MW value for new transmission?	Please refer to RESOLVE documentation. The CPUC's IRP process is a more appropriate forum to submit this question. The ISO and CPUC are collaborating on ensuring that the inputs provided by the CAISO align with the RESOLVE modeling needs.

5. Golden State Clean Energy (GSCE) Submitted by: Daniel Kim		
No	Comment Submitted	CAISO Response
5a	<p>A. Planning Scenarios</p> <p>As the CAISO is aware, the CPUC is considering multiple 2045 framing study scenarios whose results may inform “least regrets” scenarios for 2030 and beyond. GSCE fully supports this type of longer-term planning approach being pursued by the CPUC. We strongly encourage the CAISO to work with the CPUC in assessing the current transmission capabilities and limitations, not only for meeting California’s 2030 requirements, but also for meeting, or at a minimum putting California on a pathway for the requirements for 2045 and beyond.</p> <p>In addition to the CPUC’s three proposed framing scenarios (2045 high electrification scenario, 2045 high biofuel scenario, and 2045 high hydrogen scenario), GSCE submitted comments in the IRP proceeding urging the CPUC to consider a high electrification scenario with a existing bulk storage facilities (e.g., Helms) for renewable integration and long-term storage. We believe the CAISO should support the CPUC with data needed to test such a scenario and to help facilitate this effort. This proposed scenario will promote California’s GHG reduction goals and provide direct benefits for disadvantaged communities by reducing gas-fired generation in Northern California and the Central Valley.</p> <p>California’s energy agencies need to model the grid for how the future will look, meaning a future with little to no fossil generation; more long duration energy storage; significantly more solar generation dispersed across the entire State; a fully electrified economy in commercial buildings, homes, and transportation; and more redundancy in the system to account for wildfire hazard and climate change impacts. The CAISO should use its authority under Order 1000 and in the TPP to study scenarios that include all the above future conditions. The planning for investment in new transmission has to begin now even though during the interim we will have to rely on more curtailment of solar as a solution to manage overgeneration. The CAISO cannot only rely on curtailment and energy-only solar development as a long-term solution since these tools are only interim band aids for our low or no carbon future.</p>	<p>The comment has been noted. The ISO will continue to coordinate with the state agencies on the matters highlighted in your comments.</p>

No	Comment Submitted	CAISO Response
	<p>GSCE also supported a stakeholder proposal in the IRP proceeding that the CPUC include a sensitivity analysis for full capacity deliverability service (“FCDS”). We share a concern that without an FCDS sensitivity analysis, the total system costs may be missing important assumptions about transmission upgrades needed to support renewable energy development within the state.</p>	
<p>5b</p>	<p>B. Transmission Needs</p> <p>For California to successfully meet the critical (but still aspirational) targets of 100 percent carbon-free electricity by 2045, a significant electrical system build-out is required over the next 25 years. GSCE has the experience to appreciate the challenges and timing requirements for large-scale resource development. It is not too early to begin planning and identifying trunk line transmission required for the next 25 years. Given it can take a decade or longer to develop linear infrastructure projects, GSCE believes the time is now to act on California’s transmission needs.</p> <p>Table 2-1 in the White Paper represents an excellent starting point regarding what the current transmission system may be able to do to meet future California renewable energy development. But as the CAISO correctly identifies, “before the 2019-2020 TPP, the last official renewable portfolio transmitted to the ISO was the 33% RPS portfolio.” Understanding how the existing and currently planned transmission grid can and will meet California’s statutorily required 60% RPS by 2030 is of utmost importance to all market participants.</p> <p>GSCE believes it is important for the CAISO to help California regulators understand the limitations of the current transmission system for meeting California’s policy and demand needs, and that it is also important to help them understand the development difficulties and timing requirements of the corresponding build-out. If a significant build-out of the intra- or inter-state grid is required to meet the State’s 2045 objectives, GSCE fears current planning in the TPP-IRP space is not adequately ramping up and preparing for such a build-out. Our concern is that the significant and laudable efforts to plan for California’s 33% RPS have not transitioned quickly enough to meet the increased RPS requirements, and that planning for this next phase will require even more lead time to plan and develop new transmission corridors. Planning</p>	<p>The ISO will continue to coordinate with the state agencies on the matters highlighted in your comments.</p>

No	Comment Submitted	CAISO Response
	<p>cannot lag behind; developers need to know what California requires over the next two plus decades.</p> <p>In addition to our concerns for transmission planning, several hurdles exist that will slow the end goal of building more renewable generation that is procured to serve California’s load. For one, the impact of new market participants that serve load and procure energy has created some uncertainty in the market. Irrespective of this, we know that more renewable energy will need to be developed to serve California’s load and meet California’s 2045 requirements. Establishing more certainty on the resource development side (i.e., transmission and generation) should only benefit LSEs that are determining what and when to procure. Another hurdle is the uncertainty around understanding and modelling intertie limitations for out-of-state (“OOS”) projects. There are extreme challenges with new OOS transmission, including cost allocation issues, and stakeholders need to better understand if proposed OOS transmission projects help or hinder California’s efforts.</p>	

6. GridLiance West Submitted by: Michael Landgraf		
No	Comment Submitted	CAISO Response
6a	<p>GLW encourages development of more robust practices to determine and impose capability limits. Sometimes, a conservative approach from CAISO benefits ratepayers. However, in this case, is providing to the CPUC capabilities that overly constrain the IRP solution. Specifically, CAISO by limits its analysis to support full deliverability, identifies only large-scale upgrades, and ignores system costs in setting additional energy-only limits. These limits preclude the CPUC from considering in the IRP renewables that are located in development areas that are environmentally beneficial and less expensive to develop. This situation should be remedied.</p> <p>Instead of basing capabilities and upgrade costs on interconnection studies that look to peak deliverability, the capabilities should consider grid impacts from smaller resource additions and should look at societal costs, not full capital costs for upgrades to support full deliverability. While CAISO may view its capabilities as rough estimates for the CPUC's and CEC's consideration, these capabilities are impacting the IRP outcomes and raising the expected portfolio costs in addition to potentially delaying California meeting its goals.</p>	<p>The reason for utilizing large-scale upgrades is that the portfolio development process is done at a zonal level as opposed to a nodal level. Constraints identified in GIDAP studies that align well with the renewable zones tend to be area-wide constraints that need commensurate upgrades. Small-scale local upgrades are assumed to be assigned directly to the generators responsible for the respective upgrades in the respective GIDAP study areas.</p> <p>As described in the white paper and in the stakeholder presentation, the interconnection studies are utilized because these studies lend themselves particularly well to the capability estimation effort owing to the fact that these studies evaluate amounts of generation in excess of a typical portfolio size. It allows the ISO to identify constraints which otherwise would not be identified in any other studies.</p> <p>The purpose of the transmission capability estimates is to compare relative transmission costs between different zones. Capital costs are generally considered adequate for this relative comparison.</p>
6b	<p>GLW urges CAISO to:</p> <ol style="list-style-type: none"> 1. Not apply new capabilities before a portfolio has been studied. In the short run, this means, not remap resources outside of RESOLVE's solution from the 2017 – 2018 CPUC IRP and instead fully study them in this current Transmission Planning Process (TPP), yielding better information about congestion, constraints and costs and benefits of required upgrades; 2. Develop capability and cost parameters for the IRP that have more steps, or gradations, than just a single step, such that initial build outs in the short run are not penalized by presuming very large upgrade costs; 3. Employ an alternative energy-only methodology that recognizes that a small amount of curtailment may still yield a cost-effective siting at some level in a generation pocket; 	<p>The scope of this meeting was limited to the transmission capability estimates to be used as an input to the CPUC Integrated Resource Plan. The use of transmission capability information in RESOLVE is within the scope of the IRP process and these comments can be submitted to that process.</p> <p>While several comments relate to issues beyond the scope of the initiative, responses have been provided to some extent to be helpful.</p> <p>The initial mapping was studied and the curtailment and congestion results were presented in the November 2018 stakeholder meeting. The 2019-2020 TPP cycle has received a new set of portfolios and the</p>

No	Comment Submitted	CAISO Response
	<p>4. Recognize that upgrades for additional renewable siting have benefits and provide net cost results – not simply full upgrade costs – to the CPUC for its use in RESOLVE; and</p> <p>5. Provide stakeholder information for any new or revised capability specifying the basis for the new or changed limit, including the presumed solution to remedy the constraint and the method employed to develop cost estimates for that constraint. Allow stakeholders to comment on these methods and findings before advising the CPUC or CEC to invoke them.</p>	<p>process calls for updated mapping based on the latest information at hand.</p> <p>The transmission capability estimates were intended to leverage the information about large area-wide limitations. Small, local constraints and upgrades are assumed to be handled in GIDAP. Also, please note that in most of the renewable zones the RESOLVE model does not fully utilize the transmission capability estimated for the existing system. So the upgrade size and costs do not seem to impact resource selection in many areas. In one of the zones where RESOLVE selected resources to fully utilize the capability estimate, the ISO considered five different upgrade options that incrementally tested the additional capability at lower renewable build out levels and incorporated this information in the capability estimates provided in the white paper.</p>
6c	<p>GLW comments on various aspects of CAISO's transmission capability estimate process herein.</p> <p>1. Need for Robust Determination of the Capabilities</p> <p>The reason CAISO provides capability estimates to the CPUC is that CAISO and CPUC have divided roles in optimizing the resource and grid buildout in California. No single model is employed to perform a full optimization across the TPP and the renewable resource selection. Rather CAISO uses portfolios from the CPUC – portfolios that do not fully consider transmission constraints, and the CPUC uses transmission constraints from the CAISO – constraints that do not fully consider the generating resource trade-offs. GLW believes the goal of CAISO's provision of transmission information to the CPUC is to emulate as best as possible an optimization of both transmission build-out and resource selection. If a single optimization model was used to consider both transmission and resources, the resulting transmission and renewable portfolios would meet the constraints and values embedded in the optimization at least cost.</p> <p>Given the “hand off” of transmission information from CAISO to the CPUC; however, such discrete “limits” create a risk of deviation from what otherwise would be an optimal grid and resource buildout result.</p>	<p>The scope of this meeting was limited to the transmission capability estimates as an input into the CPUC Integrated Resource Planning proceedings. The transmission capability estimates table is one of the inputs to the RESOLVE model which co-optimizes investment and dispatch for identifying the least-cost resource portfolios. This optimization is primarily within the scope of the IRP process and these comments can be submitted to that process.</p> <p>While several comments relate to issues beyond the scope of the initiative, responses have been provided to some extent to be helpful.</p> <p>The ISO understands the desire to make the estimates as accurate as possible. Therefore the ISO primarily relies on the GIDAP studies which use the rigorous deliverability assessment methodology which has been vetted by stakeholders. The amount of diligence and rigor that goes into identifying constraints in GIDAP studies is the same as the TPP studies. The estimation aspects arises when the ISO is asked to provide a MW capability number for large geographical zones which may contain nuances such as nested constraints, looped systems and evolving constraints. The ISO will explore with the CPUC how the</p>

No	Comment Submitted	CAISO Response
	<p>GLW recognizes through our analysis the importance of these capabilities being set properly. There are two primary reasons why this is the case.</p> <ol style="list-style-type: none"> 1. Additional constraints imposed by CAISO will cause the IRP solution to consist of renewable resources that are more expensive than the resource mix that would be chosen without the constraints. 2. Further, an IRP resource solution constrained in this way will effectively never cause CAISO to fully study in its Transmission Planning Process the same constraints it “estimated” and fed into the CPUC analysis. <p>For both reasons it is important to both the IRP process and the TPP process that CAISO’s “estimates” are very accurate and representative of what would have resulted from a full TPP study.</p> <p>The goal of the CPUC and CAISO individual studies should be to emulate what would result from a joint optimization as best as possible. GLW believes it is important that CAISO apply the same level of rigor when declaring constraints that it would during a full TPP study, and when that is not feasible, that CAISO should offer its full methodology and findings for stakeholder review as CAISO is beginning to do with the subject white paper.</p>	<p>draft transmission capability estimates can be presented to the stakeholders, and in which forum (TPP or IRP).</p>
6d	<p>2. CAISO May Burden Ratepayers with Unnecessary Costs if It Is Overly Conservative</p> <p>From CAISO’s white paper and discussion during the May 28, 2019 stakeholder meeting, it seems there has been a tendency on the part of CAISO to oversize the constraints and solutions. For example, CAISO looks to generation interconnection queue information and suggests that the queues provide useful insights because of the very large quantities of renewables that are in the queue. However, accommodating this high level of renewables results in network constraints arising that may not exist at lower levels of buildout. Considering high levels of renewable penetration to determine for capability information also results in CAISO identifying large-scale upgrades, upgrades that when priced into RESOLVE or the renewable mapping outcome result in renewables being shifted out of desirable renewable areas and into areas that</p>	<p>The area deliverability network upgrades (ADNU) identified in GIDAP are intended to reflect the next cost effective incremental upgrade for the associated area constraint. ADNUs are not required to make all the queued generation deliverable.</p> <p>Also, please note that in most of the renewable zones the RESOLVE model does not fully utilize the transmission capability estimated for the existing system. So the upgrade size and costs do not seem to impact resource selection in many areas. In one of the zones where RESOLVE selected resources to fully utilize the capability estimate, the ISO considered five different upgrade options that incrementally tested the additional capability at lower renewable build out and incorporated this information in the capability estimates provided in the white paper.</p>

No	Comment Submitted	CAISO Response
	<p>are, by their nature, less desirable – either environmentally or cost-wise. Further, CAISO is using a methodology that limits energy-only (EO) buildout to a level that would imply zero curtailment in an area, and as discussed further in Section 3 of our comments, this also negatively impacts the IRP solution. Being overly conservative, or supersizing the buildout assumptions of the proposed solutions, has adverse impacts to California in the IRP by biasing away from low-cost, high quality renewables that could otherwise be sited economically.</p>	<p>The EO capability estimates do not imply zero curtailment. The starting point for these estimates is the FCDS capability estimates and these do not imply zero curtailment either.</p>
6e	<p>3. Methodology is Oriented Toward Deliverability; Deliverability is Only One Quality of Renewable Deployment in the Grid CAISO relies on generation interconnection studies to identify upgrades. However, the bulk of the renewable portfolio new capacity is EO. Thus, the focus on full capacity deliverability status (FCDS) in the analysis creates a mismatch with the majority of renewable capacity being indicated in the CPUC's analysis. GLW urges CAISO, CPUC and stakeholders to consider a methodology that supports EO interconnection beyond FCDS interconnection of resources.</p>	<p>Deliverability constraints are used as a starting point because they provide a definite answer to the question of how many MWs can be accommodated behind a constraint. The methodology supports EO interconnection beyond FCDS interconnection as evident from the numbers presented in Table 2-1.</p>
6f	<p>4. The CAISO's Energy Only Methodology Needs Further Refinement to Reflect the Economics of the Grid. CAISO has proposed to convey EO capabilities in excess of FCDS capabilities only to the extent there is thermal generation or imports to back down in the generation pocket of relevance. As discussed above in Section 1, the goal of CAISO's capabilities should be to satisfy the renewable requirements and other buildout limitations at least cost – subject to grid reliability. CAISO's proposed EO assessment effectively would assign an infinite cost to any curtailment of the renewable resource wishing to interconnect as EO. That is if the capacity of the generation pocket to reduce thermal or imports is zero, no additional MWs of capacity are accommodated unless the resource is less expensive than the next best alternative by at least as much as the major upgrade cost (the FCDS upgrade cost) identified by CAISO. Consider the following example.</p> <ul style="list-style-type: none"> • In Gen pocket A, the levelized cost of a solar plant is \$50/MWh; • Outside of Gen pocket A, the levelized cost of a solar plant is \$55/MWh; 	<p>"Unilaterally" satisfying renewable requirements and other buildout limitations at least cost is not the goal of transmission capability estimation. Transmission capability estimation is an input to the RESOLVE tool as part of the CPUC's IRP process. The capability estimation does not intend to satisfy any renewable requirements; it does not try to optimize any transmission costs. It is merely one of a number of pieces of information considered in resource selection performed by RESOLVE.</p> <p>The ISO uses the CPUC provided portfolios developed using the RESOLVE tool to determine if new transmission should be approved. In the hypothetical example provided, not building the transmission upgrade is the correct outcome, and the generation in Gen pocket A can still be developed. The portfolio is not a cap on the amount of EO generation that is permitted to be developed in the area. Developers and load serving entities are free to develop and contract with EO</p>

No	Comment Submitted	CAISO Response
	<ul style="list-style-type: none"> • There is no thermal generation or imports to decrement down to accommodate the energy during peak production; • An EO 500 MW facility added in Gen pocket A would experience 5% curtailment for local conditions; • CAISO's identified major upgrade cost on a levelized basis is \$200/MWh. <p>The effective cost of the 500 MW facility in Gen pocket A could be thought of as $(\\$50/\text{MWh})/0.95$, or $\\$52.6/\text{MWh}$. This cost would still be less than procuring renewables outside of the gen pocket at $\\$55/\text{MWh}$. Yet the cost difference between the resources does not come close to overcoming CAISO's major upgrade cost determined for the FCDS resources. This means that even though Gen pocket A would fail CAISO's test, it would have been lower cost to Californians to site some MWs within the Gen pocket A.</p> <p>An interesting result of CAISO's approach is that it biases away from smaller amounts of incremental EO by virtue of requiring any EO capacity to bear the full burden of a major upgrade. It also biases against smaller generation pockets on the grid – those that may not encompass significant thermal generation or be adjacent to import and export points. This bias serves no productive value and only harms the resultant IRP solution.</p> <p>GLW believes that it is important to be more specific in the determination and articulation of the algorithms that yield constraints and their costs. Constraints and capabilities determined as part of the generation interconnection process may only be based on peak case conditions, and they would represent snapshot views catered well to questions of deliverability, but would not be appropriate to question the overall value proposition of siting more renewable capacity inside the zone as compared to siting outside of the zone. GLW expects that it will be necessary that CAISO invoke production cost studies to properly set the capacities and the impact of exceeding the FCDS capacities for purposes of accommodating more EO capacity. GLW encourages robust discussion on alternatives, be it that CAISO runs a production cost model to determine the system cost at various buildout levels and/or the amount of curtailment for different EO buildout levels.</p>	<p>generation in the area that exceeds the amount of generation in the portfolio.</p>

No	Comment Submitted	CAISO Response
	<p>Certainly, it is not appropriate to assume zero MWs of EO should be accommodated beyond the FDCS capacity simply because no thermal generation or imports deliver directly to that area. Even in the short run, GLW recommends that instead CAISO work with the CPUC and stakeholders to otherwise define any EO limitations consistent with the true cost of adding resources on a grid that has constraints, for example, by adding a cost factor (such as a multiplier) at given incremental additional EO levels that reflects the fact that additional curtailment of the resource's energy may be necessary as buildout increases.</p>	
6g	<p>5. Using full capital cost as a “hurdle rate” for new constrained areas will overly constrain the IRP solution and likely lead to sub optimal solution. CAISO’s estimates of the cost to exceed the capabilities seem to be based on the full cost of upgrading lines. Adding the full cost of transmission system upgrades, without considering any adjunct benefits – even the economic ones – will result in a distorted renewable and grid buildout. Consider an example.</p> <ul style="list-style-type: none"> • Gen pocket C and Gen pocket D both are great renewable areas where equally inexpensive, high quality renewables can be built out at prices lower than any other area. • Gen pocket C requires an upgrade costing \$25 million. Gen pocket D requires an upgrade costing \$30 million, and at these prices building out either area is cheaper than siting elsewhere. Based on these costs alone CAISO’s constraint costs would result in RESOLVE siting Gen pocket C resources first, resulting in a portfolio heavy in Gen pocket C and the need for the \$25 million upgrade. • However, consider the possibility that the upgrade in Gen pocket D resulted in other grid benefits of \$15 million, while the gen pocket C upgrade had no impact on grid benefits beyond delivering the renewables. The adjunct benefits of the Gen pocket D upgrade means that it would be the least cost solution (assuming of course all else is equal). <p>The example shows that using capital cost alone to drive the IRP portfolios provides no confidence that the upgrade results in an optimal renewable and grid buildout. Instead CAISO should ensure that the constraints embedded in RESOLVE represent costs including other production cost benefits for the grid.</p>	<p>The hypothetical example does not seem realistic and assumes a level of precision that may not be currently feasible. However the ISO is open to reviewing specific examples based on real system comparisons.</p> <p>Economic benefits of conceptual transmission upgrades are not considered as part of the transmission capability estimation stage. Transmission capability estimation is an input into the portfolio creation process. It is not an exercise in determining the optimal transmission build out before receiving renewable portfolios from the CPUC.</p> <p>Economic benefits of transmission projects are accounted for in the larger TPP framework and should not be confused with the exercise of estimating the planning level cost of an upgrade required to accommodate additional resources in a constrained area. Transmission capability estimation is intended to be an input into the CPUC’s IRP process and is not intended to a cost-benefit assessment of conceptual transmission upgrades as part of the TPP.</p> <p>Also, the comment about capital costs of upgrades alone driving the IRP portfolios is inaccurate. Please note that in most of the renewable zones the RESOLVE model does not fully utilize the transmission capability estimated for the existing system. So the upgrade size and costs do not seem to impact resource selection in many areas. In one of the zones where RESOLVE selected resources to fully utilize the capability estimate, the ISO considered five different upgrade options that incrementally tested the additional capability at lower renewable</p>

No	Comment Submitted	CAISO Response
	<p>Akin to how CAISO performs the TPP, it is important to look at both the costs and the benefits of any upgrades being considered. This is another example of why it is beneficial for CAISO to conduct a full TPP round on a portfolio before settling on a constraint. A portfolio that results in congestion creates the ability to define upgrades that resolve the congestion, and an additional simulation run can then determine what additional benefits the upgrades accrue.</p> <p>While this approach may sound involved and hypothetical, GLW's own analysis found this to be meaningful and not overly time consuming. The analysis presented in GLW's Jan 2019 CPUC IRP Comments on the proposed Preferred System Plan shows that the upgrades necessary to accommodate substantial levels of renewables in GridLiance West's footprint, though costing over \$150 million, would produce benefits of significantly more than \$150 million with the buildout at the levels indicated by the CPUC's portfolios. Thus, if these the transmission projects were evaluated consistently with how they would be under CAISO's economic planning studies, it is expected that the projects would be found to be beneficial, because they produce net savings (benefits – costs). To assess the pros and cons of renewable siting based on the transmission upgrade costs alone and ignoring the benefits of those projects – benefits that may include congestion relief beyond the congestion caused by the renewable build out – will not produce an optimal IRP solution.</p> <p>Studying the portfolios in the TPP (without first constraining the portfolios based on the FCDS-based capability estimates) then determining the best upgrades would yield upgrade costs net of benefits, and the net benefits could be invoked in the CPUC's RESOLVE model. This would be much more appropriate than using the full upgrade costs and ignoring any other transmission upgrade benefits.</p>	<p>build out and incorporated this information in the capability estimates provided in the white paper. This is one case where the ISO went beyond the information available through GIDAP studies and refined the conceptual upgrade cost number after testing different build out options under different levels of renewable build out in the TPP policy-driven assessment.</p>
6h	<p>6. More information is needed about how CAISO designs the upgrades that would resolve the constraint</p> <p>It is unclear how CAISO arrives on its proposed resolution to remedy the constraints. More information is needed for changes in the capability numbers if transparency for stakeholders is valued. Specifically, CAISO should offer (i) what study identified the constraint, including what was being studied, (ii) what method or case was being used, and (iii) what the findings were. CAISO should</p>	<p>Specific details of all the constraints including the queued projects responsible for triggering the upgrades and their corresponding locations are already available in the GIDAP cluster reports for respective study areas. These study reports are posted to the Market Participant Portal. The methodology to identify these constraints and upgrades has been vetted by stakeholders and is publicly available on the ISO website. Any conceptual upgrades that rely on information from</p>

No	Comment Submitted	CAISO Response
	<p>also provide information about what remedy was presumed and how the cost was derived. GLW would also expect that constraints would not be as lumpy (e.g., large-scale) as they seem to be. For example, with the constraint affecting GLW's footprint, the definition seems to suggest for siting beyond 700 MWs, any additional MWs – be it 1 MW or 350 MWs would cost \$150 million, and the cost to site an additional MW over the 700 MWs + 350 MWs would be infinite. Again, these constraints simply drive up the portfolio cost to ratepayers.</p> <p>Not only will costs be driven up, but the siting itself could be significantly delayed. For example, assume CAISO identifies a constraint in Gen pocket E, and places a new limitation for Gen pocket E; when the CPUC runs the RESOLVE model again two years later sites those constrained MWs in Gen pocket F. CAISO may then identify a new constraint for Gen pocket F, add costs to that siting and not studying those MWs. Two years later the MWs may show up in Gen pocket G, and so forth. If on the other hand CAISO's evaluation of these constraints yields a more refined constraint representation (e.g., Gen pocket E can take 50 more MWs at \$25 million, up to 100 MWs at \$30 million, up to 400 MWs at \$35 million, etc.) then perhaps more of those low-cost renewables identified by the CPUC in that current cycle's IRP could be accommodated. The constraints should be defined smoothly with smaller MW increments; a more sophisticated treatment is warranted and that can be accomplished without adding additional complexity.</p> <p>An earlier rendition of the implementation of these capabilities from the CPUC's RPS calculator days indicated that upgrades were priced assuming 500 kV paths were being added at published costs.² As the grid gets built out, it becomes increasingly likely that generation pockets will arise for which the remedy to constraints will be not a large 500 kV line, but rather could be one or more limited component upgrades. Necessarily supersizing solutions does a disservice to Californians by creating a strong likelihood that buildout in desirable areas will then be deemed not cost effective as a result of the added cost of the super-sized solution.</p> <p>GLW requests that for each new capability limitation CAISO defines, that CAISO provide the specific details on the derivation of the quantities and costs.</p>	<p>the TPP are presented at stakeholder meetings and stakeholders are provided the opportunity to comment on it.</p> <p>The transmission capability estimation focuses on large area upgrades because portfolio resource selection is on a zonal basis. Therefore area-wide constraints lend themselves well for the purpose of capability estimation. Local upgrades are assumed to be captured as the responsibility of generators that contribute towards local constraints in GIDAP studies.</p> <p>The upgrades identified in the transmission capability estimates are intended to be the next most cost effective incremental transmission upgrade for the associated large area constraint.</p>

No	Comment Submitted	CAISO Response
6i	<p>7. More information is needed about when a constraint becomes an IRP constraint</p> <p>It is unclear what criteria CAISO uses to recommend a new constraint or not. Surely constraints must arise in many locations across the grid. Yet CAISO only recommend a few new constraints for the CPUC's model. GLW encourages CAISO to articulate for stakeholders their proposed basis for including that constraint in the CPUC's RESOLVE model or not.</p>	<p>Typically area constraints observed in GIDAP studies or previous TPP studies that limit resources on a zonal basis are identified for the purpose of transmission capability estimation.</p>
6j	<p>8. Portfolios should flow into the TPP and be studied before being limited by "estimated" new constraints not studied through the TPP</p> <p>As touched upon in GLW comment Section 5, GLW believes it is better for CAISO to err on the side of not including limiting renewable capabilities in an IRP cycle for which a portfolio has not already been studied in a prior TPP cycle. A case in point is the constraint that CAISO has proposed for GLW's footprint in southern Nevada. It would seem much better to study portfolios that result from the IRP in the TPP, rather than never studying them in the TPP and yet limiting the buildout in the IRP based not on TPP results but on generation interconnection studies. Studying a portfolio in the TPP would yield specific, production cost model-based results about the MWs of the portfolio unable to be accommodated as well as the benefits of relieving a constraint through the proposed upgrades.</p> <p>If instead CAISO anticipates a constraint without studying it through production cost modeling in the TPP and then imposes the constraint through a new capability limit with the CPUC, there is no ability for CAISO, CPUC, or stakeholders to see in detail the impacts of the portfolio on the grid and the costs and benefits of possible remedies. An approach such as this simply ensures that no policy projects are ever built even if such projects would have resulted in a much better portfolio and transmission solution for Californians.</p>	<p>The transmission capability estimates are provided to the CPUC upon their request. The ISO relies on the best available information to fulfill the CPUC's request. The decision to request and use this information is beyond the scope of this stakeholder meeting.</p> <p>Regarding the comment about this approach ensuring that no policy project is ever built, please note that the ISO has approved seven policy-driven projects since the introduction of policy-driven assessment framework.</p>

7. San Diego Gas & Electric (SDG&E) Submitted by: Henry McIntosh		
No	Comment Submitted	CAISO Response
7a	<p>Although SDG&E supports how Full Capability/Deliverability Status (FCDS) estimates are derived through the Generation Interconnection Deliverability studies, SDG&E believes that more information is needed to understand and improve the rough estimates made around the Energy Only (EO) components. SDG&E appreciates the CAISO acknowledging that the Energy Only estimates are made using a generalized assumption reflecting that future zero-marginal-cost renewable resources will displace all non-zero-carbon resources and imports within a study area. This is a good starting point that can be further improved with additional efforts such as:</p> <ul style="list-style-type: none"> • The CAISO should augment the white paper with a breakdown of how much MW of non-zero-carbon resources and imports are used to come up with the EO components for each transmission zones and sub-zones • The CAISO should consider leveraging existing assessments or performing an assessment using one of its production cost simulation tools (PLEXOS or GridView) to determine a more accurate count of how much new renewable could displace non-zero-carbon resources and imports. 	<p>The purpose of EO generation has been to avoid building transmission. To the extent that the EO transmission estimates provided are too high, then that estimate can be corrected after studying the portfolio in the TPP. To the extent that the EO transmission estimate is too low, there is nothing stopping generation from developing beyond the portfolio amount identified in a particular area.</p>