

March 11, 2021

GridLiance West 2021 – 2022 TPP Economic Study Request**Summary**

GridLiance West (GLW) respectfully requests that the CAISO conduct two economic studies in this current 2021 – 2022 TPP. These requests are presented herein. The first, is to examine congestion on the GLW system associated with the generation from GLW baseline renewable generation and the generation from the CPUC's Base Case portfolio for the CAISO's 2021-2022 TPP and to study economic benefits of upgrades to facilities ("GLW Conversion and Upgrades") to alleviate the congestion. The second is to study congestion resulting from development of Nevada CAISO grid-connected geothermal generation interconnected through the Oxbow 230 kV transmission line or directly connected to the GLW system – geothermal generation being sought after by LSEs and further implicated by the February 22, 2021 CPUC Ruling mandating procurement of geothermal capacity – and the benefits of alleviating this congestion and providing a reliability loop to aid in the Bishop, California Control substation constraint ("Silverado Renewable Connection 2 or SRC2").

1. GLW Conversion and Upgrade Project - Economic Study to Relieve Congestion/Curtailment of GLW-sited IRP Resources

The CPUC Base Case portfolio for the CAISO's 2021-2022 TPP includes 2,024 MWs of solar resources on the GLW system.¹ This siting was supported in part by the CAISO's analysis in its 2020-2021 TPP of the CPUC's Policy Sensitivity Case 2, seeking study of 2,170 MWs of renewable generation on the GLW system. In the CAISO's study of Policy Sensitivity Case the CAISO forecasted curtailment that would be necessary absent some GLW-area upgrades. The CAISO's analysis also found that upgrades were expected to alleviate the curtailment on the GLW system. In particular, the CAISO found that its "Option 3" set of upgrades had the most cost-effective results and were found to alleviate all the curtailment associated with the 2,170 MWs of additional renewable siting at GLW-estimated cost of \$90 million.²

1.1. Study Request

GLW requests that the CAISO conduct economic, reliability and policy studies of upgrades to the GLW facilities given the CPUC's 2021-2022 TPP Base Case portfolio siting of 2,024 MWs, including studying the benefits of the CAISO's previously identified "Option 3" upgrades under the Base Case build out. Demonstration of the reliability, economic, and policy benefits of transmission solutions in lieu of congestion management and RAS mitigations are crucial to understanding how CAISO will implement the CPUC portfolio.

¹ Innovation 230kV (445 MW), Desert View 230kV (344 MW), Crazy Eyes (aka Trout Canyon) 230kV (1234 MWs). (The CPUC's bus mapping workbook allocates the 2024 MWs to busses that only sum to 2023 MWs for reasons unbeknownst to GLW.)

² CAISO 2020-2021 Transmission Plan (Draft), p. 212.

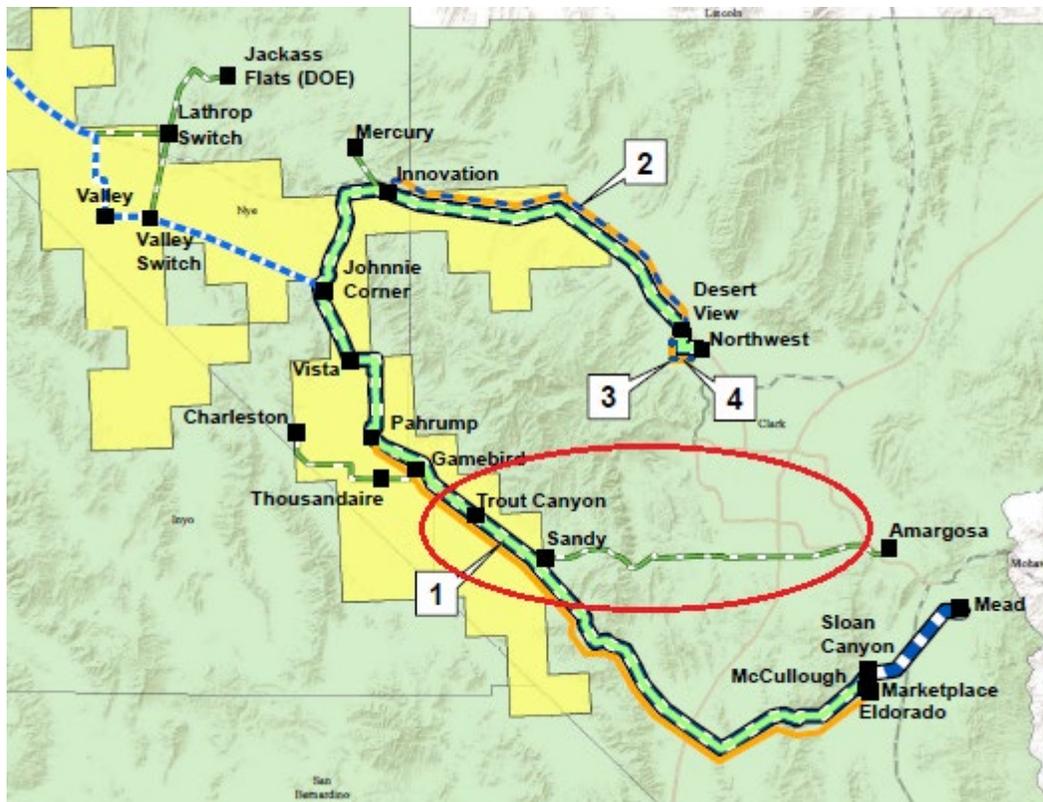
1.2 Project Description - GLW Conversion and Upgrade Project

The GLW Conversion and Upgrade Project includes the following:

- 1) Conversion of the VEA Gamebird to Arden 138 kV path to 230 kV including:
 - Converting the Gamebird circuit to near Trout Canyon 138 kV to 230 kV;
 - Adding two 230 kV breakers to Trout Canyon;
 - Converting Trout Canyon to Sandy 138 kV to 230 kV;
 - Upgrading Sandy 138 kV substation to 230 kV and adding two 230/24.9 kV transformers;
 - Converting the Sandy circuit to near NVE Arden (proposed connection) 138 kV to 230 kV;
 - Adding three 230 kV breakers to NVE Arden;
 - Opening the existing 138 kV line to Amargosa;
- 2) A second 230 kV circuit between Innovation and Desert View substations;
- 3) A second 230 kV circuit between Desert View and Northwest substations;
- 4) Rebuild existing 230 kV circuit between Desert View and Northwest substations.³

The GLW Conversion and Upgrade Project is shown in Figure 1.

Figure 1



³ This segment may have not been included in the “Option 3” suite of projects the CAISO included in its 2020 – 2021 TPP. Its capital cost is estimated at \$2 million and since it enhances benefits well beyond its costs, it is proposed for study herein.

1.3 Summary of Benefits of GLW Conversion and Upgrade Project

The GLW Conversion and Upgrade Project is projected to have the following benefits:

1.3.1 Alleviation of Congestion and Curtailment

The CAISO’s Off-Peak analysis for its 2020-2021 TPP Policy Sensitivity Case 2 showed that the project relieved 100% of the curtailment associated with the study case. GLW’s own analysis (discussed further in the following “Economic Benefits” section) also found significant reductions in annual curtailment as a result of the project being in place – not only reductions in congestion in the GLW area but also increased throughput alleviating curtailment through the broader WECC region.

1.3.2 Economic Benefits

GLW conducted production cost modeling analyses of the GLW Conversion and Upgrade project. GLW found in its analysis that these upgrades generate benefits well in excess of the CAISO’s standard 1.3 benefits to cost ratio – essentially paying for the project’s costs in one to two years.

The modeling was performed using GridView and the CAISO’s topography, as well as the consistent IRP portfolios and IEPR input assumptions.⁴ GridLiance’s study of the Gamebird – Arden 230kV upgrade, for example, shows upgrading this path alone has a significant impact at reducing the renewable curtailment, and it produces benefits that essentially would pay for the upgrade costs (estimated at \$69M) in just one year (2030 simulation year). The annual savings resulting for this upgrade path alone are shown below in Table 1.

Table 1 - Economic Analysis Results of GLW Conversion and Upgrade Project

CAISO	Base Case (\$M)	With Gamebird – Arden 230kV Upgrade (\$M)	Difference (Base – Upgrade) (\$M)
Load payment	7,106	7,000	106
Generation profits	2,736	2,644	-92
Transmission revenue	200	255	54
Net Payment of CAISO Load Customer	4,169	4,101	69

Based on GridLiance’s production cost modeling, inclusion of additional circuits between the GLW substations Innovation to Desert View and Desert View to NVE Northwest further enhances the reduction in

⁴ upgrades based on the 2020-2021 TPP Policy Sensitivity Case 2 presumed build out of 2,170 MWs – a build out level that should provide generally comparable benefits.

curtailment and produces additional benefits to CAISO load of \$81.6M. The additional Innovation to Desert View and Desert View to Northwest upgrades are expected to cost \$24M. Together with the Gamebird to Arden upgrade (total cost of \$93M) the benefits would again nearly pay for the upgrades within one year.⁵

1.3.3 Delivery of Location Constrained Resources/Integration of New Generation Resources

The GLW Conversion and Upgrade Project would increase the deliverability of resources within the GLW footprint. Although a dedicated deliverability assessment has not yet been performed with these projects presumed to be in place, the GLW Conversion and Upgrade Project alleviates deliverability bottlenecks that were identified in GI Queue Cluster 12 and 13 studies and mitigated with congestion management, including overloads of Pahrump – Gamebird 230 kV, Gamebird – Trout Canyon 230 kV, Trout Canyon – Sloan Canyon 230 kV, Pahrump – Innovation 230 kV, Innovation – Desert View 230 kV, Gamebird – Sandy 138 kV, and Sandy – Amargosa 138 kV.

1.3.4 Resource Adequacy Benefits

The GLW Conversion and Upgrade Project is expected to support CAISO Resource Adequacy by allowing both greater deliverability of interconnecting resources as discussed above in 1.3.3. In addition to solar resources presumed in the 2021 – 2022 TPP the upgrades would support deliverability of storage assets co-located with solar or separately interconnected. It would also support deliverability of production-diverse wind resources should commercial interest or procurement result in a procurement shifting toward wind production over solar production. Lastly, the GLW Conversion and Upgrade Project will, in conjunction with the SRC2 project presented below, enhance deliverability of geothermal capacity from the Dixie Valley and surrounding CAISO-grid connected areas.

1.3.5 Reliability Benefits

The GLW Conversion and Upgrade project would enhance reliability by increasing access to GLW-interconnected generation and storage capacity and ensuring these resources are available to meet CAISO bulk loads during shortage conditions. The project also reduces reliance on remedial action schemes by conversion of lower capacity 138 kV lines to higher capacity 230 kV and alleviates known grid bottlenecks and weaknesses described in 1.3.3 above. The project was shown in GLW's production cost analysis to reduce curtailment in the service areas of the large California investor-owned electric utilities and other utilities, such as the Imperial Irrigation District and PacifiCorp, and throughout several balancing areas in the Energy Imbalance Market and the greater Western Interconnect. Thus, renewable resources as far away as the Pacific Northwest, including wind resources, had reduced curtailment with these grid enhancements to the Southern Nevada portion of the CAISO's grid. Improving the flow of energy by providing enhanced flow paths where constraints otherwise exist can have far-reaching grid and supply resilience improvements reaching far beyond the current CAISO practices of congestion managing base case overloads and applying RAS to contingencies.

⁵ GLW's analysis included an interregional project included in the CAISO's topology in its 2020-2021 TPP. If that project is not presumed to be included and it, or a comparable mitigation, is required GLW finds that the project benefits pay for the project with two years of benefits to CAISO load.

2. Silverado Renewable Connection 2 - Economic Study to Reduce Curtailment at Southern Nevada Geothermal and Provide Loop for Control Substation

Geothermal generation has vastly growing importance to the CAISO supply stack given increasing penetration of variable renewable generation and the impending retirement of Diablo Canyon Nuclear Generating Station and other once-through-cooling resources. Diablo Canyon's retirement leaves a substantial gap of baseload capacity that service system RA needs, and geothermal across the grid can serve that same purpose. The CAISO's consideration of additional geothermal assets located in the Nevada CAISO grid-connected region would ensure the grid can support LSE procurement by 2025 of substantial geothermal capacity to meet RA and renewable needs.⁶

GLW's second economic study request seeks CAISO analysis in its 2021-2022 TPP of benefits of enhancing interconnectivity to the Nevada CAISO grid-connected geothermal fields with baseload and dispatchable production capacity exceeding 1000 MW. These geothermal assets can be production ready within 18 months from final permitting approvals, making them readily available to meet the CPUC's proposed procurement deadline of 2025. Currently the Oxbow line can support hundreds of MW of additional geothermal capacity to the CAISO, however constraints at the Control substation near Bishop, CA drastically limit further resource adequacy deliveries from such resources. Absent alternatives, California LSEs are seeking power purchase agreements (PPAs) from geothermal assets in this region for delivery through NVE's grid, resulting in massive wheeling costs for those near 8760 deliveries. NVE's current wheeling and ancillary charges are \$6/MWh, and contracting for transmission service for base-load (24x7) geothermal assets would cost \$52,560/MW-year or \$26M to deliver the 500 MWs recommended for siting in this region of Nevada. (While the Salton Sea area has been the foci of presumed geothermal asset development, such deliveries are hampered by IID-region transmission constraints and would also result in wheeling charges⁷ for CAISO LSEs.)⁸

In both instances of geothermal buildout in IID's Salton Sea area and in the case of siting in Nevada and delivery through NVE substantial costs for wheeling would be incurred and LSEs would unlikely be able to count the assets toward the CAISO's RA requirement given limitations on available Maximum Import Capabilities.

Costs to CAISO LSEs could be substantially lessened by CAISO grid enhancements, alleviating wheeling charges and providing resilience enhancements within the CAISO grid, and the geothermal could also meet CAISO RA needs if interconnected directly through GLW. GLW respectfully requests the CAISO study the SRC2 project, which provides an alternate delivery path of the output of this high-quality capacity to the CAISO bulk system.

2.1 Study Request – SRC2

GLW requests that the CAISO study a new interconnection to Oxbow looping Nevada geothermal energy interconnections to the CAISO bulk system through GLW.

⁶ GLW presents further information about, and benefits associated with, Nevada CAISO grid-connected geothermal assets in its comments presented in response to the CAISO's 2021-2022 TPP study plan. These are being provided in parallel with these GLW economic study requests.

⁷ IID wheeling charges currently are \$20,280 MW-year.

⁸ *Id.*

2.2 Project Description – SRC2

The SRC2 includes the following:

- A new substation in the Oxbow 230 kV line northwest of GLW’s existing 230 kV system;
- A new 230 kV circuit from that new substation to the VEA Beatty 138 kV substation;
- Conversion of the VEA Beatty 138 kV substation to 230 kV and addition of two 230/24.9/14.4 kV transformers (25 MVA);
- Conversion of the existing 138 kV line from Beatty – Lathrop Wells – Valley Switch – Johnnie Corner to 230 kV;
- Addition of 230 kV high side substations to Lathrop Well and Valley Switch switching stations;
- A new 230 kV substation at Johnnie Corner bisecting the Pahrump – Innovation 230 kV line.

The SRC2 project is shown in Figure 2.

Figure 2



2.3 Summary of Benefits of SRC2

SRC2 is expected to provide economic, renewable interconnection, and RA and other grid resilience and reliability benefits to the grid.

2.3.1 Alleviation of Congestion and Curtailment

Generation developers’ ability to interconnect Nevada CAISO grid-connected geothermal resources has been, and will continue to be, limited by the transmission equipment in Southern California if grid

enhancements are not made. The transmission system in the Bishop, CA area within Southern California Edison's ("SCE") system has historically been subject to local congestion, voltage instability concerns, and operating conditions with very high system voltages. SCE manages these issues today via one or more RAS schemes that drop local generation to operate the system in a safe and reliable condition. Further, these local issues have prevented integration of even modest levels of new Nevada CAISO grid-connected geothermal capacity. The SRC2 project could enable further interconnect and significantly reduce the level of curtailment required of future resources.

With the addition of 500 MW of geothermal capacity interconnected to the Oxbow 230 kV line, consistent with the GLW request that this geothermal be included in the CAISO's 2021 – 2022 TPP⁹, the SRC2 project is expected to result in significant cost savings CAISO load customers through reduced congestion and curtailment.

2.3.2 Delivery of Location Constrained Resources/Integration of New Generation Resources

SCR2 will provide for the delivery of substantial levels of incremental Nevada CAISO grid-connected geothermal capacity. GLW's preliminary modeling indicates that additional interconnection of resources in this geothermal-rich region would otherwise be drastically curtailed given existing bottlenecks in the Bishop, CA area. The looped SRC2 project provides a networked corridor for the delivery of the output of incremental geothermal capacity.

2.3.3 Resource Adequacy Benefits

Of incremental renewable options available to the CAISO, geothermal offers the most needed generation profile. The grid does not yet have other areas with high geothermal potential that are readily able to satisfy the CAISO's RA shortfalls identified in the CPUC's February 22 Procurement ruling. 2021 – 2022 TPP portfolio capacity was primarily mapped to the Salton Sea area. However, this area does not directly connect to the CAISO grid, and it has very little – if any – excess Maximum Import Capability (MIC). LSEs cannot therefore use procured geothermal resources from this area to satisfy their RA needs and fill the CAISO's RA shortfall. Nevada geothermal assets connected to via NVE would have similar issues in filling the CAISO RA shortfalls. CAISO-grid interconnected geothermal resources through Nevada would provide incredible benefit to meeting the CAISO's RA needs and filling the gap that will be created when Diablo Canyon retires.

2.3.4 Reliability Benefits

In addition to the RA benefits articulated above SRC2 provides additional reliability benefits by providing an alternate path for congested deliveries of existing and planned resources into Control. A loss of the Control to CAISO bulk area transmission or the lower Oxbow to Control will still enable delivery of Nevada CAISO grid-connected geothermal resources. Generation interconnection at Control will also be enhanced with the grid's ability to flow through the new looped SRC2 project.

⁹ See footnote 7.

2.3.5 Renewable Build Out Benefit

Increasing levels of geothermal procurement requirements can impose substantial costs on LSEs. Avoiding transmission grid investments to aid in the delivery of the geothermal energy through the CAISO grid only shifts the cost burdens into the PPAs of LSEs by requiring LSEs to pay for potential long generation intertie costs, to pay the wheeling fees of neighboring BAAs and to find alternate sources of RA given limited MIC supplies. GLW urges the CAISO to recognize the other cost savings that are available to CAISO loads by ensuring the bulk transmission system is properly upsized and interconnected to receiving these significant levels of geothermal energy.

Conclusion

GLW has proposed herein two study requests. The first directly results from the need to cost-effectively transmit the energy from CPUC IRP portfolio renewable resources transmitted in the IRP base case. The GLW Conversion and Upgrade Projects have been before the CAISO in one form or another through previous IRP sensitivity case studies and through generation interconnection studies. At this time it is appropriate for the CAISO to formally study these projects as part of its base case.

The SRC2 project study is directly responsive to the CPUC's analysis of the anticipated 2025 RA and base load reliability shortfalls, proposed to be filled by geothermal energy. The CPUC is acting progressively to subvert what could otherwise be significant adverse reliability issues when Diablo Canyon retires and as CAISO load is served to an even greater extent from mid-day peaking energy sources. While the CPUC can, and is, considering procurement directives, they cannot ensure the grid infrastructure is sufficient to deliver new base-load energy to load centers. The CAISO must not delay in the study of grid solutions for geothermal generation sources. To this end GLW urges the CAISO to study SRC2, including the multifaceted benefits it will create. When the geothermal build out is necessary for RA purposes, it is critical for the CAISO to include RA benefits as well as congestion relief in assessing this project. GLW looks forward to working further with the CAISO and stakeholders on designing the proper study of SRC2 for this purpose.

GridLiance appreciates CAISO's consideration in studying these economic study requests in its 2021-2022 TPP.

Sincerely,



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