2018 Interconnection Process Enhancements

Draft Final Proposal

September 4, 2018

Table of Contents

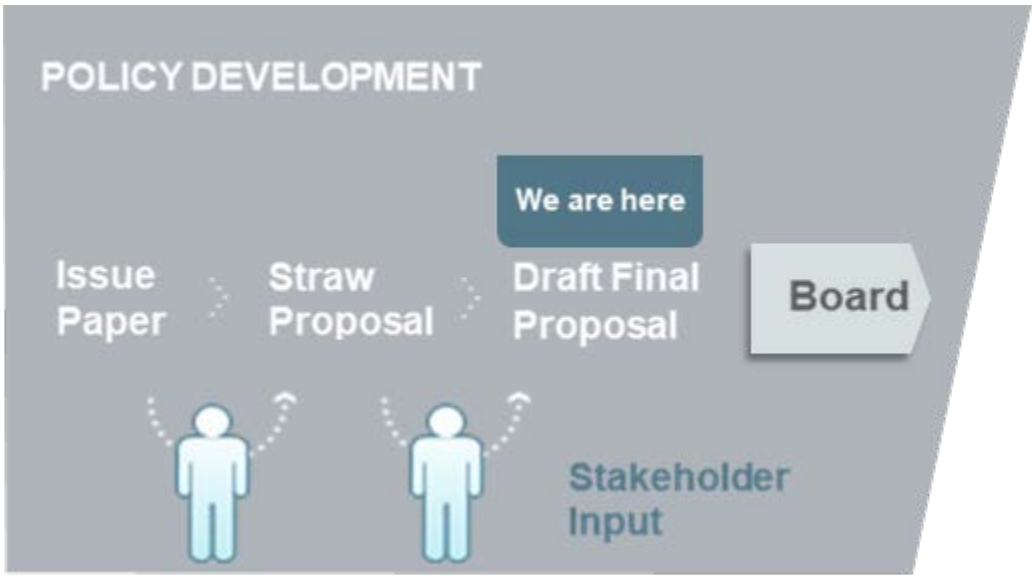
1. Introduction

Previous iterations of the California Independent System Operator Corporation's (CAISO) Interconnection Process Enhancement (IPE) initiative focused on several enhancements to the CAISO's interconnection and deliverability allocation procedures. The 2018 IPE will address some substantial concepts, but also a myriad of minor concepts that have not been addressed in some time, along with issues that have surfaced since the 2015 IPE that need to be resolved. This draft final proposal reviews topics still under development. Topics included in the 2018 IPE initiative fall into six broad categories; deliverability, energy storage, generator interconnection agreements, interconnection cost responsibility and financial security, interconnection requests, and modifications.

2. Stakeholder Process

The 2018 IPE stakeholder process is now at the Draft Final Proposal stage. Figure 1, below, shows the current status within the overall 2018 IPE stakeholder process. The draft final proposal is intended to present the scope and proposed solutions to topics that are in track 3 related to generator interconnection agreements and interconnection cost responsibility and financial security. Track 1 includes the issues that were approved at the July Board meeting. Track 2 includes the issues that will be presented for approval at the September Board meeting. Track 3 includes issues that are still being discussed and are anticipated to be presented at the November Board meeting. The CAISO has reviewed and considered stakeholder feedback provided through comments submitted on the revised straw proposal and have incorporated and addressed these comments in this draft final proposal.

Figure 1: Stakeholder Process for 2018 IPE Stakeholder Initiative



3. Scope

As described above, topics included in track 1 were finalized in the straw proposal and were approved at the July 2018 Board of Governors meeting, topics in track 2 were finalized in the revised straw proposal will be presented for approval at the September 2018 Board of Governors meeting, and topics in track 3 are targeted for the November Board of Governors meeting. The table below reflects the scope for this initiative and includes the identification of the Board of Governors meetings that each topic included in this initiative will be presented for approval.

Table 1: Overall Topic Status

Category	Section	Topic	Targeted Board of Governors Meeting
Deliverability	4.1	Transmission Plan Deliverability Allocation	September 2018
	4.2	Balance Sheet Financing	September 2018
	4.3	Participating in the Annual Deliverability Allocation	September 2018
	4.4	Change in Deliverability Status to Energy Only	September 2018
	4.5	Energy Only Projects' Ability to Re-enter the Queue for Full Capacity	September 2018
	4.6	Options to Transfer Deliverability	September 2018
Energy Storage	5.2	Replacing Entire Existing Generator Facilities with Storage	September 2018
Generator Interconnection Agreements	6.1	Suspension Notice	BPM Change
	6.2	Affected Participating Transmission Owner	November 2018
	6.3	Clarify New Resource Interconnection Requirements	July 2018
	6.4	Ride-through Requirements for Inverter-based Generation	November 2018
Interconnection Financial Security and Cost Responsibility	7.1	Maximum Cost Responsibility for NUs and potential NUs	November 2018
	7.3	Eliminate Conditions for Partial IFS Recovery upon Withdrawal	September 2018
	7.5	Shared SANU and SANU Posting Criteria Issues	BPM Change
	7.6	Clarification on Posting Requirements for PTOs	July 2018
	7.7	Reliability Network Upgrade Reimbursement Cap	November 2018
	7.9	Impact of Modifications on Initial Financial Security Posting	July 2018
Interconnection Requests	8.1	Study Agreements	July 2018
	8.4	Project Name Publication	September 2018
Modifications	9.1	Timing of Fuel Type Changes	September 2018
	9.2	Commercial Viability – PPA Path Clarification	September 2018
	9.3	PPA Transparency	July 2018
	9.4	Increase Repowering Deposit	July 2018
	9.5	Clarify Measure for Modifications After COD	July 2018
	9.6	Short Circuit Duty Contribution Criteria for Repower Projects	BPM Change

Note: The topics in yellow were combined into one topic.

6 Generator Interconnection Agreements

6.2 Affected Participating Transmission Owner

Background/Issue

Generating facilities interconnecting to the CAISO controlled grid may affect the transmission system of a PTO that is not the PTO at the Point of Interconnection (POI). In these instances, the PTO being impacted is referred to as an affected PTO. The current GIDAP does not address how the interconnection customer's financial security postings, cost responsibility, and affected PTO repayment will be disbursed among the interconnecting and affected PTOs.

The CAISO currently documents the contractual rights and obligations of the CAISO, interconnection customer, interconnection PTO and affected PTO in two separate agreements.

The CAISO enters into a *pro forma* small or large generator interconnection agreement with the interconnection customer and interconnecting PTO under which interconnection service is provided to the interconnection customer. The non *pro forma* affected participating transmission owner upgrade facilities agreement (UFA) among the CAISO, interconnection customer and affected PTO establishes the mitigation measures required on the affected PTO's electric system due to the interconnection of the interconnection customer's generating facility to the CAISO controlled grid.

Stakeholder Input

SCE supports the revised straw proposal to have separate cost estimates for the interconnecting PTO and any affected PTOs documented in the interconnection studies and the GIA or affected PTO's facilities agreement as appropriate, and the ISO's revised proposal that such separate cost estimates sum to set a single maximum cost responsibility for the interconnections customer's entire project. SCE continues to believe the interconnection customers should make all financial security postings to each PTO separately.

While not precisely the ISO's proposal, PG&E comments stated that they support the ISO's proposal to separate maximum cost responsibility (ISO proposes separate cost estimates) for each PTO in the event that another PTO is affected by the interconnection of a generator project.

While stakeholders generally support the express and memorialized separation of the interconnection customer's financial security postings, cost responsibility, and affected PTO repayment, regarding how that separation is memorialized, there is little consensus. NextEra, EDF and LSA strongly support a single GIA that incorporates the affected PTOs upgrade facilities. First Solar believes the issue is still under development and suggests adding it to the list of topics taken up after another round of comments. SDG&E and PG&E support the current structure of the GIA and a separate upgrade facilities agreement. SCE agrees and opposes the potential adoption of a single four-party agreement.

CAISO Response

The CAISO proposal from the revised straw proposal regarding maximum cost responsibility and repayment remains the same. The PTO cost estimates will sum to set a single maximum cost responsibility for the interconnections customer's entire project.

The CAISO carefully considered the input of stakeholders regarding the contractual relationship among the CAISO, interconnection customer, interconnecting PTO and affected PTOs. Because the stakeholders cannot reach a consensus on this issue and CAISO does not have projects that currently require this functionality, CAISO will defer this issue to the next IPE process.

6.4 Ride-through Requirements for Inverter-based Generation

Background/Issue

The CAISO proposed modifications to the technical requirements for the interconnection of inverter based generation to the CAISO controlled grid. The CAISO proposed these new

requirements to address incorrect and undesired tripping or cessation of inverter based generation which occurred during the routine high speed clearing of bulk electric transmission lines.

Stakeholder Input

CESA, Intersect Power, LSA, Six Cities, and Wellhead had no comments at this time.

First Solar appreciated the CAISO providing the redlined draft language for Appendix H. First Solar believes that the language is a good start but would benefit from a discussion with stakeholders to ensure that it captures what the CAISO is intending and that the operators of facilities with these technologies agree that the language accomplishes what the CAISO intends. We suggest this would be best done in a workshop environment. First Solar asserts that the CAISO is not clearly expressing its intent in paragraph A(i)(3) – it seems that the facility should be required to return to its pre-event condition after the event, and the language should capture that, and then describe the ramping capability that is desired for facility's rate of return in the timeline desired. In another example, in section (iii) the point of interconnection is changed out for the "high voltage side of the substation transformer" but later in that paragraph the term "point of interconnection" is used again – Fist Solar also expresses that it is unclear what is intended with this change and whether it should be consistent.

Nextera generally supports the proposed new requirements, assuming (as stated in the last stakeholder meeting) that they would be applicable only to new generation projects and those seeking to change out inverters. However, Nextera has concerns in the two areas described below.

- Diagnostic Equipment: Continuous recording of inverter-level data on a 1 msec resolution, with 30-day storage, would be a significant data-storage requirement. The CAISO should verify with equipment manufacturers that the cost of such capability would not be significant as inverters currently do not have this capability. If the cost would be significant, the CAISO should instead consider requiring equipment (similar to fault recorders) that would only be triggered for low- and high-voltage events.
- Requirement for a PMU at every site: Nextera requests further information on the need for this requirement. Individual solar sites generally aren't large enough to have significant impacts, and the PMU sampling is too slow to capture momentary cessation and therefore may not be that useful for model verification.

PG&E is generally supportive of the CAISO's proposal to ensure that inverters don't cause momentary cessation during voltage excursions smaller than 1.2 p.u. PG&E would like the proposal to apply to not only new projects, but also to any projects going through the repower or post-COD modification.

SCE reiterated its support for the CAISO to address voltage and frequency ride-through requirements, including the requirement to continue to inject current during system fault conditions that are cleared within a prescribed time period (i.e., cycles needed for system protection to clear faulted facilities). SCE agrees with the CAISO that tripping should be based on physical equipment limitations to protect the inverter itself. Minimum technical standards for return times following transient voltage deviations and post inverter trip return time are also

appropriate to stabilize the grid following a disturbance and to not jeopardize the reliability of the network.

SDG&E noted that the written proposal doesn't specify the duration required for a generation facility to inject reactive current into the grid. This may be inconsistent with NERC inverter-based resource performance task force (IRPTC) guidelines.

TMEIC comments that the elimination of the trip due to PLL or loss of synchronism should instead be retained. TMEIC argues that removing the PLL trip will dramatically limit the control the inverter has and believes that having control and getting offline when there is no 3phase system anymore is important. TMEIC proposes a ride through either with or without reduced current injection or momentary cessation with current resumption within 500ms (assuming no loss of synch). If the ride through is long enough that inverters lose synch, then re-synch and resumption of current injection may take up to 1.5s – ramp rates should be discussed as this is most likely an unstable system and different than a LVRT event. TMEIC proposes a 15 degree phase shift and a 150ms ride through prior to tripping offline as a discussion point.

CAISO Response

First Solar made a request for a technical workshop. The CAISO has scheduled a stakeholder meeting to discuss the various technical aspects of the proposed new requirements on September 17, 2018. The CAISO agrees with First Solar that paragraph A(i)3 would benefit from clarifying verbiage. The intent of the revision is to no longer allow momentary cessation for transient voltage conditions that extend beyond the nominal 0.9 to 1.1 PU magnitude, with the possible exception of transient high voltages greater than 1.20 Per Unit. Further, the intent is to allow reactive current injection that is proportional to the voltage deviation as an acceptable replacement for the use of momentary cessation. The CAISO also agrees with First Solar that the inverter should return to its pre-event condition upon the clearing of the voltage transient. The CAISO offers additional revisions to paragraph A(i)3 of Appendix H as shown in redline below.

Nextera expressed concern in the area of cost to require the inverter to record 30 days of inverter level data. The CAISO agrees that this is beyond the normal capability of inverters available today. The intent here is for the Generator Owner and /or Operator to record and store this data, but not necessarily in the inverters themselves. The use of a central data recording system for all plant event data is acceptable to the CAISO. To add clarity to this requirement, the CAISO proposes to modify paragraph A(vi) of Appendix H as shown in redline below.

Nextera also expressed concern about the requirement to install a PMU (Phase angle Measuring Unit). The CAISO notes that many of the protective relays installed in Asynchronous Generating Facilities already have this capability, and just require a change in the relay settings to activate this capability. It will be necessary to record this data. The CAISO agrees that this requirement can be clarified, and proposes additional revisions to section A(vi) in Appendix H as shown in redline below.

PG&E is generally supportive, but requested that the proposed requirements apply not only to new projects, but also to any projects going through a repower or post COD modification. The CAISO will apply the new requirements to repowers and post COD modifications where new

inverters will be installed.

SCE's comments are supportive of the CAISO proposal and do not require any additional clarification.

SDG&E expressed concern that the proposal does not identify how long the units need to express reactive power. The CAISO's proposal focuses on implementing the recent NERC recommendation of eliminating the use of momentary cessation to the greatest extent possible. As such, the CAISO proposal addresses the use of reactive current injection during transient voltage conditions where the magnitude of the voltage transient is beyond the normal operating range of 0.9 Per Unit < V < 1.10 Per Unit. The proposed revision to paragraph A(i)3 of Appendix H, as described above, clarifies this.

TMEIC expressed concern that it is important to retain inverter tripping for loss of the Phase Lock Loop. The CAISO agrees. The intent is to have the inverter remain in service for momentary loss of synchronism, which may be due to the failure of the Phase Lock Loop to remain synchronized. The CAISO proposes to modify paragraph A(i)10 of Appendix H as shown in redline below.

Appendix H

INTERCONNECTION REQUIREMENTS FOR AN ASYNCHRONOUS GENERATING FACILITY

Appendix H sets forth interconnection requirements specific to all Asynchronous Generating Facilities. Existing individual generating units of an Asynchronous Generating Facility that are, or have been, interconnected to the CAISO Controlled Grid at the same location are exempt from the requirements of this Appendix H for the remaining life of the existing generating unit. Generating units that ~~are replaced~~repower or replace inverters during the life of the project, however, shall meet the requirements of this Appendix H.

A. Technical Requirements Applicable to Asynchronous Generating Facilities

i. Low Voltage Ride-Through (LVRT) Capability

An Asynchronous Generating Facility shall be able to remain online during voltage disturbances up to the time periods and associated voltage levels set forth in the requirements below.

1. An Asynchronous Generating Facility shall remain online for the voltage disturbance caused by any fault on the transmission grid, or within the Asynchronous Generating Facility between the Point of Interconnection and the high voltage terminals of the Asynchronous Generating Facility's step up transformer, having a duration equal to the lesser of the normal three-phase fault clearing time (4-9 cycles) or one-hundred fifty (150) milliseconds, plus any subsequent post-fault voltage recovery to the final steady-state post-fault voltage unless clearing the fault effectively disconnects the generator from the system. Clearing time shall be based on the maximum normal clearing time associated with any three-phase fault location that reduces the voltage at the Asynchronous Generating Facility's Point of Interconnection to 0.2 per-unit of nominal voltage or less, independent of any fault current contribution from the Asynchronous Generating Facility.

2. An Asynchronous Generating Facility shall remain online for any voltage disturbance caused by a single-phase fault on the transmission grid, or within the Asynchronous

Generating Facility between the Point of Interconnection and the high voltage terminals of the Asynchronous Generating Facility's step up transformer, with delayed clearing, plus any subsequent post-fault voltage recovery to the final steady-state post-fault voltage unless clearing the fault effectively disconnects the generator from the system. Clearing time shall be based on the maximum backup clearing time associated with a single point of failure (protection or breaker failure) for any single-phase fault location that reduces any phase-to-ground or phase-to-phase voltage at the Asynchronous Generating Facility's Point of Interconnection to 0.2 per-unit of nominal voltage or less, independent of any fault current contribution from the Asynchronous Generating Facility.

3. Remaining on-line shall be defined as continuous connection between the Point of Interconnection and the Asynchronous Generating Facility's units, without any mechanical isolation. ~~Asynchronous Generating Facilities may cease to inject current into the transmission grid during a fault.~~ Momentary cessation (i.e. ceasing to inject current) is no longer an acceptable mode of operation, with one exception as noted below. For transient low voltage conditions, the Asynchronous Generating Facility's units will inject reactive current. The level of this reactive current shall be directly proportional to the decrease in Per Unit voltage at the inverter AC terminals. The inverter shall produce full rating reactive current when the AC voltage at the inverter terminals drops to a level of 0.50 Per Unit. The Asynchronous Generating Facility shall absorb reactive current for transient voltages between 1.10 and 1.20 Per Unit. The Asynchronous Generating Facility's units may momentarily cease to inject current into the transmission grid for transient high voltage conditions above 1.20 PU. ~~The Asynchronous Generating Facility should continue to absorb reactive current for transient voltages between 1.10 and 1.20 PU.~~

Upon cessation of transient voltage conditions and the return of the grid to normal operating voltage (0.90 < V < 1.10 Per Unit), the Asynchronous Generating Facility's units shall automatically ~~connect to the grid within a maximum of 0.10 seconds (if momentary cessation was used for transient high voltage), and~~ transition to normal active (real power) current injection. The Asynchronous Generating Facility's units shall ramp up to inject active (real power) current with a minimum ramp rate – from no output to full output – of at least 100% per second. A ramp rate of 200% per second is preferred. The entire time to complete the transition from reactive current injection or absorption (or momentary cessation if used for voltages above 1.20 Per Unit) shall be one second or less.

Inverter protective functions should use a filtered, fundamental frequency voltage input for overvoltage protection to avoid spurious tripping on transient high voltages.

4. An Asynchronous Generating Facility unit trip is defined as the opening of the unit's AC circuit breaker or otherwise electrical isolation of the unit from the grid. Following the unit trip, the unit will make at least one attempt to resynchronize and connect back to the grid. The time delay to accomplish this will be adjustable to between 2 and 5 minutes. The default time shall be 2 ½ minutes. An attempt to resynchronize and connect back to the grid is not required if the unit trip was initiated due to a fatal fault code, as determined by the original equipment manufacturer.

5. The Asynchronous Generating Facility is not required to remain on line during multi-phased faults exceeding the duration described in Section A.i.1 of this Appendix H or single-phase faults exceeding the duration described in Section A.i.2 of this Appendix H.

6. The requirements of this Section A.i of this Appendix H do not apply to faults that occur between the Asynchronous Generating Facility's terminals and the high side of the step-up transformer to the high-voltage transmission system.

7. Asynchronous Generating Facilities may be tripped after the fault period if this action is intended as part of a special protection system.

8. Asynchronous Generating Facilities may meet the requirements of this Section A.i of this Appendix H through the performance of the generating units or by installing additional equipment within the Asynchronous Generating Facility, or by a combination of generating unit performance and additional equipment.

9. The provisions of this Section A.i of this Appendix H apply only if the voltage at the Point of Interconnection has remained within the range of 0.9 and 1.10 per-unit of nominal voltage for the preceding two seconds, excluding any sub-cycle transient deviations.

10. Asynchronous Generating Facility units shall not trip or cease to inject current for ~~loss of the Phase Lock Loop (PLL)~~ momentary loss of synchronism. As a minimum, the Asynchronous Generating Facility's unit controls may lock the PLL to the last synchronized point and continue to inject current into the grid at that last calculated phase until the PLL can regain synchronism ~~upon voltage recovery (e.g. the transmission system fault clears).~~ The ~~reactive~~ current injection may be limited to protect the inverter. The inverter may trip if the PLL is unable to regain synchronism after 150 mSec.

11. Inverter restoration following transient voltage conditions must not be impeded by plant level controllers. If the Asynchronous Generating Facility uses a plant level controller, it must be coordinated to allow the individual inverters to rapidly respond following transient voltage recovery, before resuming overall control of the individual plant inverters.

~~The requirements of this Section A.i in this Appendix H shall not apply to any Asynchronous Generating Facility that can demonstrate to the CAISO a binding commitment, as of July 3, 2010, to purchase inverters for thirty (30) percent or more of the Generating Facility's maximum Generating Facility Capacity that are incapable of complying with the requirements of this Section A.i in this Appendix H. The Interconnection Customer must include a statement from the inverter manufacturer confirming the inability to comply with this requirement in addition to any information requested by the CAISO to determine the applicability of this exemption.~~[1]

ii. Frequency Disturbance Ride-Through Capability

An Asynchronous Generating Facility shall comply with the off nominal frequency requirements set forth in the ~~WECC Under Frequency Load Shedding Relay Application Guide or successor requirements as they may be amended from time to time.~~ NERC Standard PRC-024, Western Variance.

iii. Power Factor Design Criteria (Reactive Power)

An Asynchronous Generating Facility not studied under the Independent Study Process, as set forth in Section 4 of Appendix DD, shall operate within a power factor within the range of 0.95 leading to 0.95 lagging, measured at the high voltage side of the substation transformer ~~Point of Interconnection~~ as defined in this LGIA in order to maintain a specified voltage schedule, if the Phase II Interconnection Study shows that such a requirement is necessary to ensure safety or reliability. An Asynchronous Generating Facility studied under the Independent Study Process, as set forth in Section 4 of Appendix DD, shall operate within a power factor within the range of

[1] New policy aside, the CAISO may remove this paragraph as anachronistic. The CAISO will move this language into the BPM for those generators for which this applied.

0.95 leading to 0.95 lagging, measured at the ~~Point of Interconnection~~ high voltage side of the substation transformer as defined in this LGIA in order to maintain a specified voltage schedule. The power factor range standards set forth in this section can be met by using, for example, power electronics designed to supply this level of reactive capability (taking into account any limitations due to voltage level, real power output, etc.) or fixed and switched capacitors, or a combination of the two, if agreed to by the Participating TO and CAISO. The Interconnection Customer shall not disable power factor equipment while the Asynchronous Generating Facility is in operation. Asynchronous Generating Facilities shall also be able to provide sufficient dynamic voltage support in lieu of the power system stabilizer and automatic voltage regulation at the generator excitation system if the Phase II Interconnection Study shows this to be required for system safety or reliability.

iv. Supervisory Control and Data Acquisition (SCADA) Capability

An Asynchronous Generating Facility shall provide SCADA capability to transmit data and receive instructions from the Participating TO and CAISO to protect system reliability. The Participating TO and CAISO and the Asynchronous Generating Facility Interconnection Customer shall determine what SCADA information is essential for the proposed Asynchronous Generating Facility, taking into account the size of the plant and its characteristics, location, and importance in maintaining generation resource adequacy and transmission system reliability.

v. Power System Stabilizers (PSS)

Power system stabilizers are not required for Asynchronous Generating Facilities.

vi. Diagnostic Equipment

An asynchronous Generating Facility shall monitor and record ~~the following~~ data in real time. The data may be recorded and stored in a central plant control system. These requirements shall pertain to all Generators with a net export to the CAISO of 20 MW or greater. The following data in real time shall be recorded:

Plant Level

(1) Plant three phase voltage, current and power factor
(2) Status of ancillary reactive devices
(3) Status of all plant circuit breakers
(4) Status of plant controller
(5) Plant control set points
(6) Status of main plant transformer no load taps
(7) Status of main plant transformer tap changer (if applicable)
(8) Protective relay trips (relay target data)

Inverter Level Data

(1) High and low frequency ride through events
(2) High and low voltage ride through events
(3) Momentary cessation for transient high voltage events
(4) Reactive current injection for transient low voltage events
(5) Phase Lock Loop (PLL) status
(6) Inverter status
(7) AC and DC current

(8) AC and DC voltage

The data shall be time synchronized to a one millisecond level of resolution. The Asynchronous Generating Facility shall store this data for a minimum of 30 calendar days. The Asynchronous Generating Facility, upon request from the CAISO or the PTO, shall make this data available within 10 calendar days of the request.
The Asynchronous Generating Facility shall install and maintain a PMU (Phase angle Measuring Unit) or functional equivalent normally provided by protective relays at the service entrance to the facility. The PMU shall have a resolution of at least 30 samples per second. The Asynchronous Generating Facility, upon request from the CAISO or the PTO, shall make this data available within 10 calendar days. The CAISO does not require real time telemetry of the PMU data to the CAISO.

7 Interconnection Financial Security and Cost Responsibility

7.1 Maximum Cost Responsibility for Network Upgrades and Potential Network Upgrades

Background/Issue

Currently, an interconnection customers' maximum cost responsibility is established from its phase I and phase II study reports. The combined costs for all network upgrades in the phase I and phase II study reports are compared, and the lower cost sets the maximum cost responsibility for network upgrades for the project. An interconnection customer's current cost responsibility is then used to calculate its required interconnection financial security (IFS), which can change as the result of, *inter alia*, customers withdrawing from the queue. The CAISO is aware that the reassessment-related cost responsibility changes and the increased appearance of potential (fka contingent) network upgrade costs in project's study reports has created confusion around how the maximum cost responsibility plays out in practice. The CAISO also has observed that there is confusion regarding when and how an upgrade impacts the maximum cost responsibility and/or the current cost responsibility.

Following the straw and revised straw proposal, it became clear that the CAISO was placing too much uncertainty on the cost responsibilities to Interconnection Customers associated with potential network upgrades. The CAISO has adjusted its proposal in this paper such that the addition of new and clarified cost responsibility definitions should clarify how potential network upgrades from prior clusters—where GIAs have and have not been executed—affect cost responsibility.

Please note that due to the FERC definition of contingent upgrades in Order No. 845, the CAISO is converting the use of *contingent* network upgrades to *potential* network upgrades.

Stakeholder Input

EDF-R suggests that the execution of a GIA is a sufficient milestone for defining the shift in cost responsibility for upgrades if that project withdraws. EDF-R notes that PTOs have not demonstrated an undue burden and projects must make their first and second postings prior to signing a GIA.

First Solar suggests additional processes are needed and suggests the CAISO schedule a workshop in an effort to achieve balance between cost and timing certainty.

Intersect Power, LSA, NextEra suggests that placing 100% of each contingent (potential) upgrade in a projects maximum cost exposure is inconsistent with the current GIDAP provisions.

PG&E, SCE, and SDG&E continue to have concerns associated with the protections provided by contingent (potential) network upgrades, and appreciates the additional definitions and clarifications provided in the revised straw proposal. PG&E and SCE suggest that in the place of the execution of the GIA as the trigger for the removal of contingent (potential) network upgrades, the trigger be changed to the execution of the GIA and submission of final security postings.

Six Cities is requesting clarification on maximum cost exposure and how the maximum cost responsibility can change over time.

Wellhead suggests the CAISO remove contingent (potential) network upgrades such that they represent a liability that could cause a project to become non-financeable.

SCE noted that the CAISO did not specifically address their concern and suggests confirmation is needed from the CAISO that plan of service RNUs will be treated differently versus other RNUs as pertaining to the provisions of Section 14.2.2 of the GIDAP and the backstop financing responsibility of PTOs in that Section. SCE believes that a PTO must not be exposed to additional financing risk just because it allowed multiple interconnection customers to share a plan of service RNU that serves no other purpose than to terminate an interconnection customer –owned generation tie line.

CAISO Response and Proposal

Upon review of stakeholder comments, the CAISO is further revising its proposal and looks forward to the upcoming in-person stakeholder discussion on this topic. In this revised proposal, the CAISO attempts to balance the concerns of providing cost certainty and responsibility to interconnection customers and at the same time limit cost risks to a PTO. The CAISO believes the following revised proposal provides the right balance for maintaining consistency with current tariff policy (by allocating potential network upgrade costs in a consistent manner as cost allocations for directly assigned network upgrades), providing interconnection customers more definitive cost certainty, and providing PTOs reasonable and manageable cost risk associated with potential upgrades and maximum cost responsibility.

The CAISO understands and appreciates the PTOs' concerns that PTOs become responsible for the cost of network upgrades upon the execution of a GIA when the upgrade is still needed by future clusters. However, with the proposed implementation of the ranking groups for the allocation of transmission plan deliverability, and proposed changes to cost responsibility herein, the CAISO maintains the transfer of responsibility at the time a GIA is executed is still appropriate. Except for projects that receive a transmission plan deliverability allocation, GIAs are being tendered such that they should be executed near or upon the start of construction of a project's assigned network upgrades. As such, PTOs should be requiring final postings at or near the execution of the GIA. This process helps mitigate the risk to PTOs of GIAs being executed by projects sooner than needed and at a time when the project is less certain. Projects

that do receive a transmission plan deliverability allocation must execute a GIA to retain the allocation, but now will have demonstrated they have a power purchase agreement (PPA), are on a shortlist for a PPA, or state the projects will proceed to commercial operation without a PPA. These are the projects with the lowest likelihood of withdrawing of all projects in the queue.

The CAISO's revised proposal is a framework for overall cost responsibility as well as proposed definitions around upgrades and cost responsibilities. They are:

Proposed Definitions:

Potential Network Upgrade: *Reliability and/or Local Deliverability Network Upgrades where the cost responsibility for which was already assigned to one or more prior clusters, but which may fall to the interconnection customer because none of the prior-cluster Interconnection Customers have executed a Generator Interconnection Agreement pursuant to Section 14.2.2 of Appendix DD.*

Directly Assigned Network Upgrade: *Reliability and/or Local Deliverability Network Upgrades identified in the Interconnection Customer's Interconnection Study or annual reassessment, and for which the Interconnection Customer has a direct financial responsibility, exclusive of Potential Network Upgrades that could become Directly Assigned Network Upgrades.*

Interconnection Service Upgrades: *Reliability Network Upgrades at the Point of Interconnection to accomplish the physical interconnection of the generator project to the CAISO controlled grid. Interconnection Service Upgrades can be Potential Network Upgrades and/or Directly Assigned Network Upgrades.*

Precursor Network Upgrades: *Network Upgrades that are required by a project for its selected level of service, including (1) the cost responsibility for which is assigned to one or more prior cluster that has executed a Generator Interconnection Agreement, and/or (2) upgrades approved in the CAISO Transmission Plan.*

Current Cost Responsibility: *The sum of the Interconnection Customer's current allocated costs for Directly Assigned Network Upgrades. This cost is used to calculate the Interconnection Financial Security requirement, not to exceed the Maximum Cost Responsibility.*

Maximum Cost Responsibility: *The sum of the Interconnection Customer's assigned Direct Network Upgrades plus the Interconnection Customer's assigned Potential Network Upgrades identified in its Interconnection Studies. Where the Interconnection Customer has received a Phase I and a Phase II Interconnection Study Report, the lower sum of the above from the Phase I and the Phase II Interconnection Study Reports will establish the Interconnection Customer's Maximum Cost Responsibility.*

Revised proposal for upgraded assignment and cost responsibility structure:

The CAISO proposes the following modified approach to the assignment and cost allocation of network upgrades:

1. An interconnection customer is assigned upgrades and associated cost responsibility of

the following two components in their Phase I and Phase II study reports:

a. Directly assigned network upgrades

b. Potential network upgrades

2. Cost allocation of directly assigned network upgrades will follow the current provisions in tariff Appendix DD, Section 8.3 for RNUs and 8.4 for LDNUs[2], with the following exception:

   The allocation of cost responsibility for interconnection service upgrades will be:

   a. For maximum cost responsibility – fully allocated (100% cost responsibility) to each generation project that requires the upgrades to interconnect. [3]

   b. For current cost responsibility – the project's current cost allocation associated with the phase I, phase II, or latest reassessment study report, as applicable. Projects within a cluster requiring the same interconnection service upgrade will share the cost for the upgrade(s) equally.

3. Cost allocation of potential network upgrades will follow the current provisions in tariff Appendix DD, Section 8.3 for RNUs and 8.4 for LDNUs and:

   a. The allocation of cost responsibility for interconnection service upgrades will be fully allocated (100% cost responsibility) to the maximum cost responsibility of each generation project that requires the upgrades to interconnect.

4. The interconnection customer's maximum cost responsibility equals the sum of the following two components:

   a. Directly assigned network upgrades (as describe in #2 above); and

   b. Potential network upgrade (as described in #3 above)

   Where the interconnection customer has received a Phase I and a Phase II interconnection study report, the lower sum of (a) and (b) above from the Phase I and the Phase II interconnection study reports will establish the interconnection customer's maximum cost responsibility.

5. The interconnection customer only posts IFS for directly assigned network upgrades (current cost responsibility). Interconnection customers will not post IFS for the cost of potential network upgrades unless and until they become directly assigned network upgrades for those interconnection customers. If the interconnection customer wishes to achieve commercial operation before its potential network upgrades are completed by the

---

[2] http://www.caiso.com/Documents/AppendixDD_GeneratorInterconnection_DeliverabiltyAllocationProcess_asof_Mar11_2018.pdf

[3] SCE's comments raised a concern with "plan of service" RNUs, stating, confirmation is needed from the CAISO that plan of service RNUs will be treated differently versus other RNUs. The ISO believes that by fully allocating (100% cost responsibility) into each generation project's maximum cost responsibility that requires the "interconnection service" upgrades to interconnect achieves what SCE seeks to accomplish.

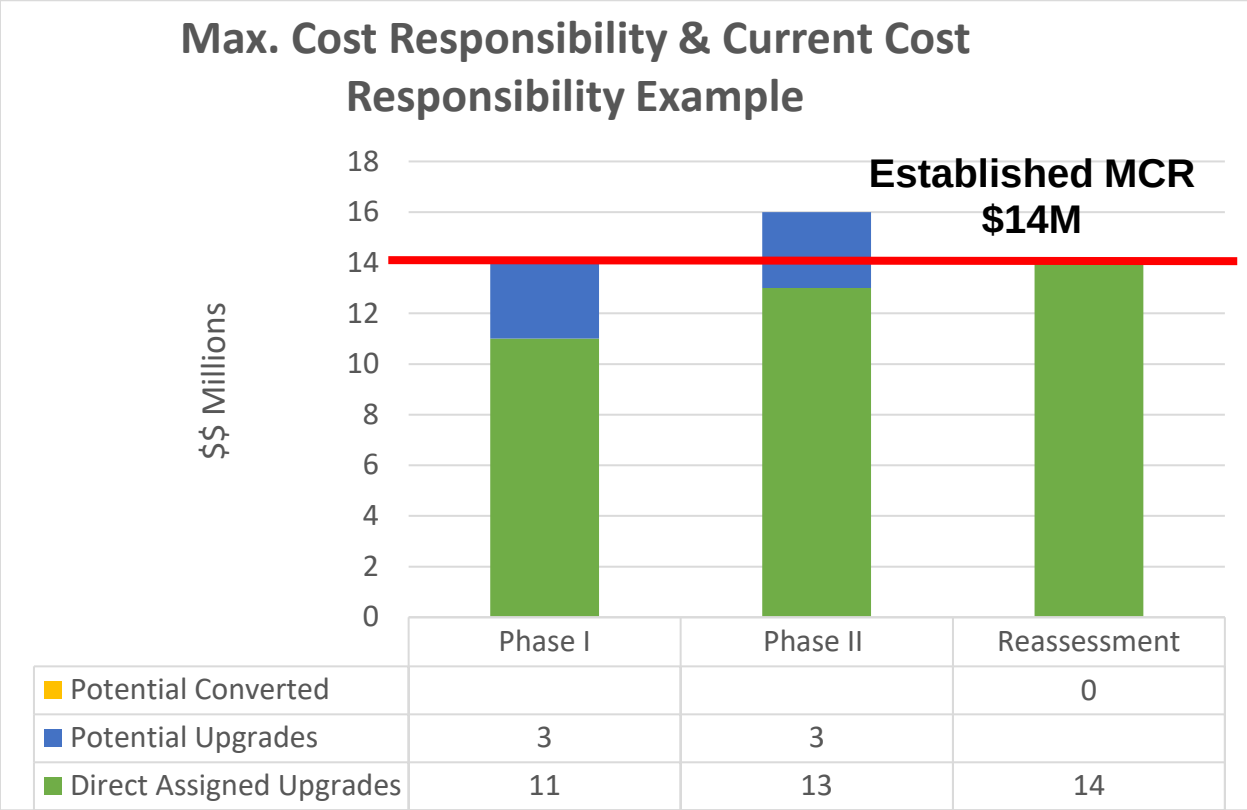
cluster/project that is currently funding such upgrades, that interconnection customer must post and fund the potential reliability network upgrades in lieu of the earlier-queued cluster. If the potential network upgrades are DNUs and the interconnection customer wants to achieve commercial operation before their anticipated completion, the interconnection customer also could elect to (1) post and fund the potential DNUs, or (2) achieve commercial operation but forego its final deliverability status until they are complete. The CAISO notes that interconnection customers have only desired to achieve commercial operation ahead of such precursor or potential upgrades in very few circumstances, and there the CAISO and PTO worked to find case-by-case solutions, including the construction of new and/or temporary network upgrades on a merchant basis. The CAISO anticipates that if this situation arises again, other options may be available, and the CAISO and PTO would work with the interconnection customer to identify potential solutions in addition to those identified above.

A potential network upgrade stops being a potential network upgrade and becomes a directly assigned network upgrade when all prior cluster projects assigned a cost responsibility allocation (direct or potential) for the network upgrade withdraw without having executed a GIA. For example, if cluster 5 triggered an upgrade, it is considered a potential upgrade for cluster 6, cluster 7, and cluster 8 if no projects in cluster 5 requiring the upgrade has executed a GIA. When all applicable cluster 5 projects withdraw, the upgrade becomes direct for cluster 6, but remains potential for cluster 7 and cluster 8. In this example, the cluster 6 projects will become responsible for the costs of the potential network upgrade and such costs will be included in the project's current cost responsibility for network upgrades based on the amount allocated to the project (as described above), up to the project's maximum cost responsibility.

A potential network upgrade stops being a potential network upgrade and becomes a precursor network upgrade (as defined above) when at least one of the prior cluster projects executes a GIA that contains a the network upgrade as a direct upgrade. The later cluster project(s) will no longer have cost responsibility for that network upgrade.

For clarification purposes, at any time a potential network upgrade is removed from a project's maximum cost responsibility, it may provide headroom within the maximum cost responsibility for increasing cost allocations of a project's other directly assigned network upgrades through the reassessment study process. Eligibility for adjustments to the maximum cost responsibility will follow Section 7.4 of Tariff appendix DD.

The following charts depict two scenarios: 1) a potential network upgrade is removed from the project's obligation. The removal of the potential network upgrade provided headroom for the reallocation of the direct assigned network upgrades already assigned to the project, and 2) a potential network upgrade becomes a direct assigned network upgrade and the current cost responsibility of the project. This example shows the interconnection customer's maximum cost responsibility is maintained.


Max. Cost Responsibility & Current Cost Responsibility Example
Established MCR $14M
$$ Millions
18
16
14
12
10
8
6
4
2
0
Phase I
Phase II
Reassessment
Potential Converted
Potential Upgrades
Direct Assigned Upgrades
0
3
3
11
13
14


Max. Cost Responsibility & Current Cost Responsibility Example
Established MCR $14M
$$ Millions
18
16
14
12
10
8
6
4
2
0
Phase I
Phase II
Reassessment
Potential Converted
Potential Upgrades
Direct Assigned Upgrades
3
3
11
13
12

7.7 Reliability Network Upgrade Reimbursement Cap

Background/Issue

Section 14.3.2.1 of the GIDAP provides that PTOs will reimburse an interconnection customer's cost responsibility for RNUs only up to $60,000 per MW of the interconnection customer's generating capacity, as specified in its GIA.[4] This policy was designed to ensure that ratepayers only incur costs for RNUs commensurate with the benefits they receive from the new generator. The repayment limit of $60,000 per MW for RNUs assigned to a project was determined to result in full cash repayment for RNUs for the vast majority of projects, and provides an incentive for interconnection customers to avoid siting projects in locations where the costs of RNUs needed to support the interconnections would be inappropriately high.

The CAISO has found that the $60,000 per MW maximum reimbursement amount for an RNU for funds advanced for network upgrades has the potential to be circumvented in instances where earlier-queued projects withdraw from the queue but the upgrades are still needed. To demonstrate this potential issue, consider the following example; Assume a 100 MW project in Cluster 8 with an executed GIA has a required RNU whose cost exceeds the $60,000 per MW limit. Also assume a Cluster 10 project, also 100 MW, requires the same RNU as the Cluster 8 project to interconnect. If the Cluster 8 project that triggered the RNU withdraws, the PTO must fund the construction costs of the RNU for the Cluster 10 project.[5] In this example the PTO is responsible for funding the entire cost of the RNU, including the portion over $60,000 per MW, and will include the entire cost of the RNU into its Transmission Revenue Requirement and ratepayers will ultimately have to pay for the entire cost of the RNU.

Stakeholder Input

EDF-R, LSA, NextEra, oppose all three options suggested by the CAISO and believe that the issue of projects that have upgrades that exceed the RNU reimbursement is rare and those projects with such upgrades rarely execute GIAs. The stakeholders also raise the issue of cost escalation of the $60,000 per MW value, noting that the value was established in 2012 and per-unit costs have increased with an annual escalation, and suggest that the CAISO consider applying escalation factor to the currently established $60,000 per MW value.

First Solar is concerned with this proposal and three suggested solutions and suggests the CAISO reevaluate the reimbursement cap based on more recent cluster studies. Further, First Solar is concerned about the categorization of deliverability and reliability network upgrades and requests clarification of how RNUs and DNUs are categorized.

Intersect Power raises issues with the three suggested solutions and suggest the CAISO delay this topic to ensure stakeholders can adequately address the issue and determine an amenable solution.

PG&E supports the CAISO's proposal for the RNU Reimbursement Cap that closes the loophole

[4] Reimbursement beyond the cost cap would come in the form of Merchant Transmission Congestion Revenue Rights.

[5] *See* Section 14.2.2 of Appendix DD to the CAISO tariff.

of Interconnection Customers with projects in different clusters that need the same Network Upgrades could ultimately require ratepayers to pay the entire cost of the network upgrades, and not just the $60,000 per MW limit on reimbursement, by withdrawing their project after GIA execution

SCE, SDG&E, and Six Cities support the CAISO continuing to seek a mechanism to require a project that ultimately benefits from the RNU to pay the cost component in excess of the $60,000/MW cap directly related to their project.

Wellhead supports options three provided in the revised straw proposal.

CAISO Response

While the CAISO believes a potential issue remains with this policy as established, based on stakeholder feedback and that the CAISO has not identified an actual instance where the $60K/mw cap has been circumvented to the detriment of ratepayers, the CAISO will not proceed with this topic in this 2018 IPE. The CAISO will, however, continue to monitor its concerns for the foreseeable future to ensure there is no adverse impact to ratepayers, interconnection customers, or the PTOs as a result of misuse of the intent or spirit of the policy.

However, the ISO agrees with stakeholder comments that the $60,000 per MW cap for RNU reimbursement should be escalated by an industry-based escalation factor. The ISO proposes to work with the PTOs to determine an appropriate index to determine the escalation factor. Because this $60,000 cap was established in 2012, the CAISO proposes to revise its tariff to specify that the 2012, $60,000 figure will be used as the baseline and be escalated on an annual basis thereafter. The annual escalation rate and the resulting RNU reimbursement cost cap will be developed in coordination with the PTOs and included in the annual per unit cost update process.[6] Each project's reimbursement cap value will be determined based on the date in which the RNU is placed into service. Forecasts of future year escalation rates will be provided with the historical escalation rates. The table below illustrates the process and serves as an example of the escalated value to date. The final values will be developed through the annual per unit cost update process.

Year	2012	2013	2014	2015	2016	2017	2018
Actual Escalation Rates		1.20%	1.90%	1.80%	2.10%	2.10%	1.80%
Escalation Factors	1.0000	1.0120	1.0312	1.0498	1.0718	1.0943	1.1140
Escalated RNU Cost Cap	**$60,000**	**$60,720**	**$61,874**	**$62,987**	**$64,310**	**$65,661**	**$66,843**

[6] Link to the "Participating transmission owner per unit costs" (at bottom of the page).

http://www.caiso.com/planning/Pages/GeneratorInterconnection/InterconnectionStudy/Default.aspx