Reform of the CAISO Deliverability Test:
Joint Proposed Framework for Discussion

Jointly proposed by:
Bay Area Municipal Transmission Group (BAMx), California Energy Storage Alliance (CESA),
and the California Wind Energy Association (CalWEA)

June 22, 2023

The above-referenced stakeholders recommend that CAISO and the parties discuss reform of the CAISO's deliverability test based on the following proposed framework, which will foster development of a common understanding of each specific issue and various possible reforms that aim to address CAISO's stated concerns.

Proposed Tenets for Discussion

1. ***The purpose of the deliverability test is to qualify resources for the CPUC's RA Program at a level up to their Qualifying Capacity (QC) levels established by the applicable local regulatory authority.***[1]

    a. Each LRA's Resource Adequacy (RA) Program sets QC counting rules for various resource types and an overall QC procurement requirement, including a Planning Reserve Margin (PRM). The overall requirement is allocated across the LRA's load-serving entities and is expected to ensure sufficient reliability resources will be procured and made available to the CAISO. QC resources must be deliverable to load, as determined by the CAISO. Thus, the purpose of the deliverability test is to ensure the availability of sufficient resources to serve the system load under stressed system conditions.

2. ***The CAISO has various means of addressing system reliability apart from the deliverability test.***

    a. System reliability is currently addressed by LRA RA Programs, as well as the CAISO Transmission Planning Process (TPP), and the Generation Interconnection Process (GIP) reliability studies, and *not from the CAISO deliverability test*. If additional reliability concerns remain with the generation interconnection process, additional reliability test scenarios could be added to the generation interconnection study process.

[1] The California Public Utilities Commission (CPUC) establishes QC rules applicable to approximately 90% of the CAISO load. The remainder is determined by local, state or federal entities. CAISO awards Net QC (NQC) depending on available deliverability capacity. If a resource is fully deliverable, then there is no difference between QC and NQC.

b. Reforming the deliverability test will create widespread additional deliverability capacity that will enable storage resources to obtain deliverability status, qualify for the CPUC's RA Program, and absorb renewable energy that would otherwise be curtailed, substantially and simultaneously mitigating curtailment concerns.

3. ***The deliverability test should assume stressed, but not extreme, system conditions. Otherwise, new capacity will be blocked from helping to address stressed conditions.***[2]

a. There are no NERC standards for deliverability tests.[3]

b. Reliability studies, governed by NERC standards, should use generation dispatch similar to the levels used in the CAISO's TPP reliability studies, including the re-dispatch of resources.[4]

c. PJM and MISO effectively use resources' Effective Load Carrying Capability (ELCC)-based QC levels for generation capacity designation studies (which is equivalent to the CAISO generation deliverability test) of Variable Energy Resources.[5]

---

[2] The most common stressed conditions – as experienced during the rolling blackouts in August 2020 and the extended stress conditions in September 2022 – is when there is a shortage of resources available in high-demand hours (i.e., the evening net peak), exacerbated by extreme weather. Had there been more generation resources available during those events, more loads could have been served with the existing transmission system. During the August 2020 event, while some imports were not available due to derates of the California-Oregon Intertie (COI), CAISO's deliverability assessment methodology does not directly apply the N-2 criteria to CAISO interties, instead relying on historical import levels that actually occurred across a branch group during high load hours. This is much less stringent than testing all N-2 conditions that might materialize. During the other events, transmission limitations were not the key drivers of the stressed conditions. **Source:** CAISO Root Cause Analysis, Mid-August 2020 Extreme Heat Wave, January 31, 2021, pp. 8, 22 ,48, and 88.

[3] The TPL-001 standard is one of NERC's Transmission System Planning Performance Requirements and does not apply to generation deliverability studies. CAISO referenced FAC-002-3 during the June 8, 2023 stakeholder meeting; that standard mandates adherence to applicable NERC Reliability Standards; regional and Transmission Owner planning criteria; and Facility Interconnection requirements; and studies of system conditions under normal and contingency conditions. The TPL requirements are not mandated to be met via a generation deliverability assessment process, and CAISO already ensures those are met as part of the TPP and GIP. Including the N-2 contingencies within the deliverability studies does not itself guarantee that the TPL requirements can be met, merely that an amount of load equal to the modeled generation in a subset of the system could be served if the assumed generation is available; however, the levels of generation included in the deliverability studies may be significantly higher than the amounts of generation that reasonably could be expected from the generation resources during the most stressed system conditions.

[4] CAISO 2023-2024 Transmission Planning Process Draft Study Plan, February 21, 2023, p.11, and APPENDIX B: Reliability Assessment of the CAISO ISO 2022-2023 Transmission Plan May 18, 2023, pp. B-18:B-24.

[5] For the purpose capacity designation studies, both MISO and PJM allow the project to select the desired capacity up to their peak capacity and study the project based on the selected capacity. However, since Variable Energy Resources cannot claim more than their ELCC for RA capacity, VERs are effectively studied at their ELCC.

d. For assumed transmission system performance, neither MISO nor PJM uses an *N-2* contingency scenario,[6] which is a very rare occurrence, for their generation capacity deliverability designation studies.[7,8]

e. The HSN test is appropriately focused on the times of highest system reliability risk (e.g., HE 18-21) during summer months, when it is necessary for all RA resources to be deliverable to load (at their QC levels).

f. The SSN test focuses mainly on the local curtailment of supply resources, which does not translate to a lack of system reliability from an RA capacity standpoint since other system resources are available to meet the demand plus PRM. In fact, PJM and MISO use only one test, equivalent to HSN, aimed at the high system need period when testing for generation capacity designation for RA.

g. The stakeholders represented herein support the CAISO's proposal to allow for the assignment of interim deliverability status to assets awaiting the finalization of upgrades related to meeting N-2 requirements. We believe, however, that this change should apply to CAISO's standard long-term deliverability eligibility criteria, consistent with the tenets above.

h. Reform will enable existing transmission and new upgrades that have been approved by CAISO to accommodate more generation and storage capacity that will be needed to meet state reliability and clean energy goals.

---

[6] An *N-2* condition is the unexpected failure or outage of two major system components, such as a generator, transmission line, circuit breaker, switch or other electrical element. CAISO studies common mode (i.e., two circuits on the same tower) contingencies in its generation deliverability assessment methodology.

[7] MISO's BPM states: "Contingency files for deliverability studies should only contain P1 and P0 contingencies." See MISO Generation Interconnection Business Practices Manual BPM-015-r25, Effective Date: MAR-01-2023, Appendix C MISO Generation Deliverability Study Method, p. 121.

[8] PJM Manual 14B, Appendix C (on Generation Deliverability) Revision: 52 Effective Date: April 10, 2023, on Page 85 says: "Deliverability, from the perspective of individual generator resources, ensures that, under normal system conditions, if **Capacity Resources** are available and called on, their ability to provide energy to the system will not be limited by the dispatch of other certified Capacity Resources. This test does not guarantee that a given resource will be chosen to produce energy at any given system load condition. Rather, its purpose is to demonstrate that the installed capacity in any electrical area can be run simultaneously, and that the excess energy above load in that electrical area can be exported to the remainder of PJM, **subject to the same single contingency testing** used when examining deliverability from the load perspective." The text is bolded to emphasize that, although PJM's deliverability test includes both single and common mode (N-2) contingencies, the capacity designation part of the generator deliverability test only includes the single contingencies.

Proposed Reform Elements for Discussion

1. ***Stressed, but not extreme, conditions should be assumed in deliverability test studies.***

    a. Assumed dispatch levels & QC values

    Each proposed new variable energy generator's dispatch should be set at, rather than above, its LRA-determined QC value (i.e., the value that the LRA's RA Program is counting on). (Any production above that level can be curtailed in actual operations.) All existing Variable Energy Resources (VER) should be dispatched in the studies according to their already-assigned NQC levels.[9] A reasonable way to revise the storage dispatch assumptions within the SSN test, if retained, would be to use the average dispatch value interval being studied.[10] (Appendix A demonstrates how a new storage generator fails the current deliverability test due to unreasonable dispatch assumptions made under the current CAISO deliverability test.)

    For RA Year 2023, the CPUC's QC values for VERs are statistical expectations for production from VERs achieved over many hours, not necessarily during times of potential resource shortfalls. However, the CPUC has adopted new QC methodologies in the future for its new 24-hourly RA framework that will reflect expected generation levels during each hour. The CPUC plans to apply the new 24-hour Slice-of-Day framework in 2024 as a test run. It would be reasonable for CAISO to adopt the CPUC's new QC values for CPUC-jurisdictional LSEs at the earliest possible time. Finally, the deliverability test should only apply to those time slices during which there is a distinct possibility of loss of load.

    b. Assumed transmission system performance

    Deliverability studies should assume only *normal (N-0)* and *N-1* contingency conditions.

[9] Currently, CAISO assumes that all existing, previously studied Variable Energy Resources (VERs) in the study area are assumed to operate at levels higher than their NQC levels granted by the CAISO, and all VERs requesting deliverability in the study area are assumed to operate at levels higher than the QC levels set by the LRAs.

[10] The Issue Paper notes that CAISO currently assumes a resource output of 50% for storage resources in the SSN test. The ISO argues that this is reasonable since the assumptions are based on recent historical performance. The ISO's reasoning, however, conflicts with the data observed during the September 2022 events where storage dispatch levels throughout the SSN window ranged between 10-46%. The CAISO argues that the storage assets are dispatchable and uses that as a justification for using their values in the later hours of the SSN timeframe, given their highest need at that time. (CAISO Issue Paper at p. 24.)

c. Study area

We recommend that CAISO consider the same flow impact levels being used by PJM for determining the generation circle behind constrained deliverability flowgates. PJM uses 5% DFAX for all constrained transmission lines up to 500 kV and 10% DFAX for all constrained transmission lines at 500 kV and above.[11]

2. *Reliability and Curtailment Concerns should be addressed separately*

a. Reliability upgrades that currently come out of GIP are limited as they are based on a very limited set of reliability studies. To address any concerns about reliability not currently addressed in the Generator Interconnection Process, an additional reliability test with an expanded scope could be added to the GIP.[12] Such reliability studies should use generation dispatch similar to the one used in TPP reliability studies, including re-dispatch of resources.[13]

b. To address any concerns that additional curtailment will unduly shift economic upgrade needs to the TPP, the curtailment impacts of a reformed deliverability test (i.e., whether storage enabled by reform will offset additional curtailments) can be tested in a production simulation study in the GIP.

3. *Local deliverability test*

We understand that CAISO intends to deal with the issue of local versus system deliverability designation as part of a separate stakeholder process on RA capacity. We support that decision. We, however, believe that many of the technical criteria for determining local deliverability designation should be addressed as part of this initiative due to its highly technical content that is dependent on transmission-related studies.

[11] PJM Manual 14B, Appendix C, Section 3.1 on Generator Deliverability Procedure.

[12] Any resulting reliability upgrades are required to be financed by the developer, with refundability.

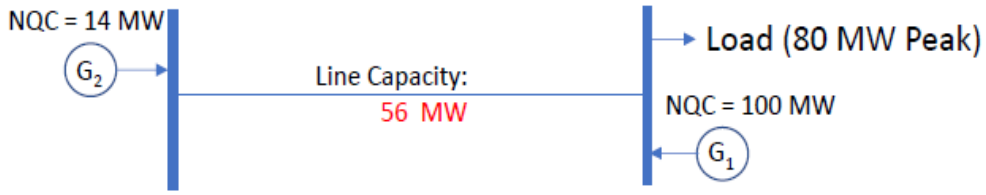
[13] NERC reliability studies typically assume historical production or Security-Constrained Economic Dispatch (SCED) dispatch levels.

Appendix A

Modeling VER Capacity at Levels Above QC Leads to Under-Utilization of Transmission Assets

Example 1.

Consider the very simple 2-bus network with the load and resources shown below:



G_1: existing 100 MW dispatchable resource (FCDS)
G_2: existing 100 MW wind resource in SCE (FCDS)

In this very simple network, both the existing dispatchable resource and the wind resource have Full Capacity Deliverability Status (FCDS). The NQCs of these resources, based on their LRA-awarded QCs, are noted in the diagram. The line capacity at 56 MW is also noted.

Now, assume a new 30-MW storage resource (S_{new}) wishes to connect at the same bus as the wind resource (G_2), as shown below:

S_{new}: new 30 MW storage resource at the same bus as G_2

If the new 30-MW storage resource (with a QC of 30 MW) requests deliverability status, CAISO's deliverability test methodology would apply the following two tests to see whether the new storage unit can get deliverability:

HSN Test:

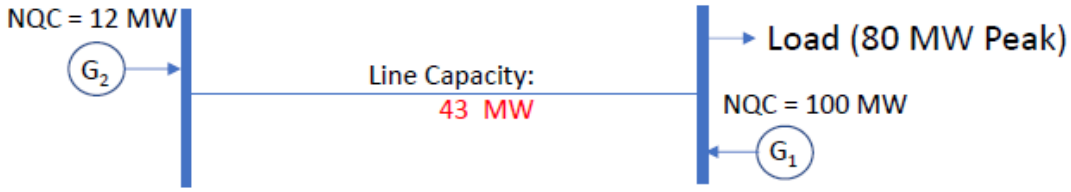
In this test, CAISO dispatches the wind generation (G_2) at its exceedance-based HSN level which, as determined by CAISO, is 56 MW:

The result is that G_2, whose maximum RA contribution is its QC of 14 MW, uses the entire 56 MW of TPD capacity of the line, leaving no TPD capacity for the storage resource, which will be deemed Energy Only (EO). In other words, 56 MW of line TPD capacity is set aside for a resource whose maximum RA contribution is only 14 MW.

The outcome of this situation is that the storage resource will not be able to provide RA capacity, even though the line can readily handle the QCs of both the storage resource (30 MW) and the wind resource (14 MW). If, as a result of its EO status, the storage resource withdraws from the queue, which has normally been the case, the system will be deprived of a source of RA capacity that could have also absorbed the output of the wind resource when its output exceeds 56 MW.

SSN Test:
This test will not be needed as the storage resource has already failed the HSN test.

Example 2.
Consider another very simple 2-bus network with load and resources shown below:



G_1: existing 100 MW dispatchable resource (FCDS)
G_2: existing 100 MW solar resource in SCE (FCDS)

In this very simple network, both the existing dispatchable resource and the solar resource have Full Capacity Deliverability Status (FCDS). The NQCs of these resources, based on their LRA-awarded QCs, are noted in the diagram. The line capacity at 43 MW is also noted.

Now, assume a new 20-MW storage resource (S_{new}) wishes to connect at the same bus as the solar resource (G_2), as shown below:

S_{new}: new 20 MW storage resource at the same bus as G_2

If the new 20-MW storage resource (with a QC of 20 MW) requests deliverability status, CAISO's deliverability test methodology would apply the following two tests to see whether it can get deliverability:

HSN Test:

In this test, CAISO dispatches the solar resource (G_2) at its exceedance-based HSN level which, as determined by the CAISO, is 10.6 MW:

As one notes in this simple example, G_2, whose maximum RA contribution is its QC of 12 MW, uses only 10.6 MW capacity of the line in this deliverability test leaving plenty of capacity for the storage resource to get TPD allocation and deliverability capacity. As a result, the storage unit is deemed FCDS based on the HSN test.

SSN Test:

In this test, CAISO dispatches the solar resource (G_2) at its CAISO-determined, exceedance-based SSN level of 43 MW:

The result is that G_2, whose maximum RA contribution is its QC of 12 MW, uses the entire 43 MW of TPD capacity, leaving no TPD capacity allocation for the storage resource, which will be deemed EO. In other words, 43 MW of line TPD capacity is set aside for a resource whose maximum RA contribution is only 12 MW.

The outcome of this situation is that the storage resource will not be able to provide RA capacity, even though the line can readily handle the QC of both the storage resource (20 MW) and the solar resource (12 MW). If, as a result of its EO status, the storage resource withdraws from the queue, which has normally been the case, the system will be deprived of an RA capacity resource that could have also absorbed the output of the solar resource when its output exceeds 43 MW.