Deliverability Assessment Methodology Issue Paper

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Generation Deliverability Assessment Methodology Issue Paper Stakeholder Call

May 2, 2019

Introduction

California ISO

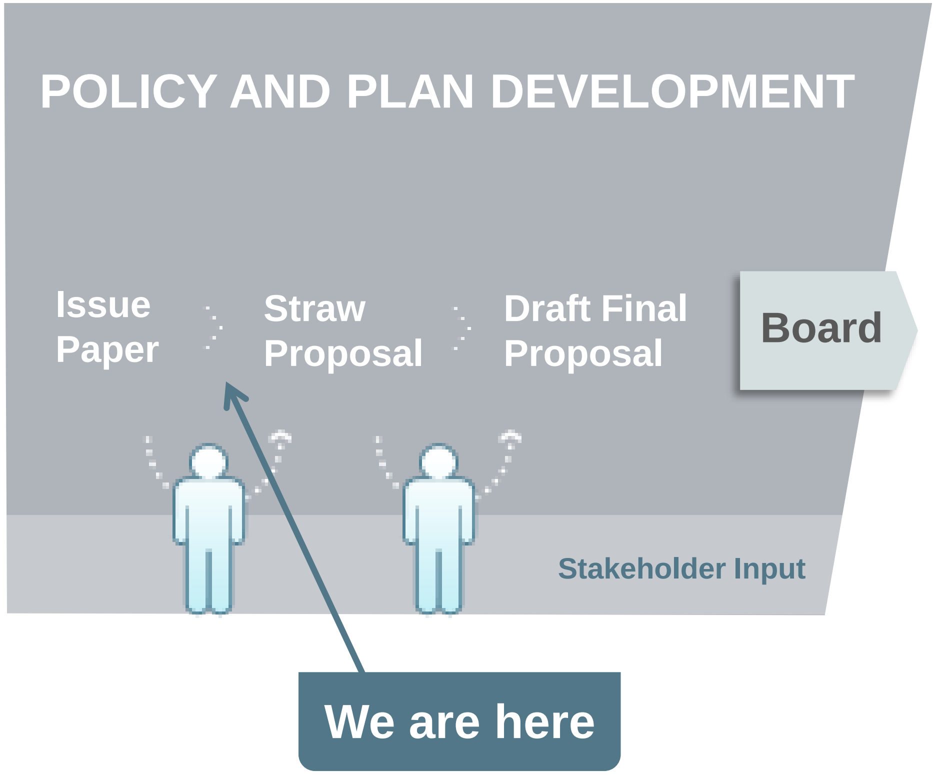
Why is there a need to change the study scenarios for assessing deliverability?

- The need for study changes are driven by the evolving shape of the “net sales” load shape to peaking later in the day, and increasing levels of intermittent resources
- This necessitates more deliberate study of the output of intermittent resources to serve load matched with the load level at the time of output
- The same factors have essentially led the CPUC to move towards an “effective load carrying capability” or ELCC basis for considering “qualifying capacity” values in resource adequacy processes
- As a probabilistic approach is not viable for deliverability assessments, the solution for deliverability is to study specific scenarios matching load with intermittent generation output

Preliminary Outreach - December 18, 2018 Stakeholder Call

- The ISO held a stakeholder call to offer a more in-depth review of the proposed revisions to the on-peak generation deliverability assessment methodology than initially presented at an earlier transmission planning stakeholder session
- Stakeholder's written comments were generally supportive of the proposed changes,
  - but raised various concerns regarding impacts to other processes and existing generation, and,
  - recommended that the ISO take more time to address these concerns.
- The ISO considered those comments and decided to undertake a separate stakeholder initiative in 2019 to review the issue more comprehensively and address stakeholder concerns

CAISO Policy Initiative Stakeholder Process



Objectives for today

- Review changing system conditions driving the need for revisions to the methodology
- Provide a summary of the previously proposed revisions
- Provide a summary of the comments provided by stakeholders in the 2018-2019 transmission planning process
- Discuss options for addressing these comments.

Summary of the Previously Proposed Revisions

Songzhe Zhu
Sr. Advisor Regional Transmission Engineer

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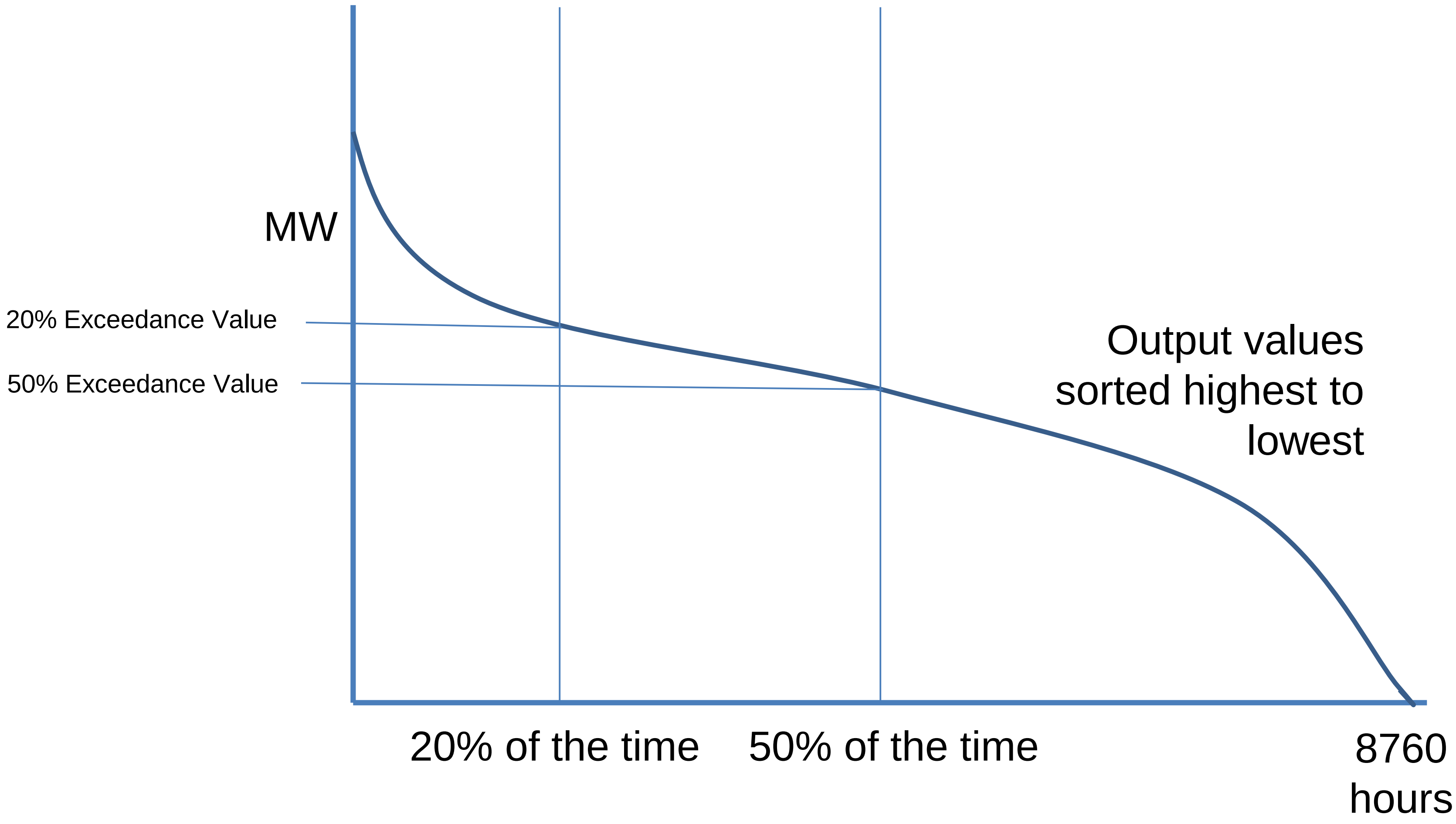
Current On-Peak Deliverability Methodology

- Power flow analysis tests deliverability under a system condition when the generation capacity is needed the most assuming 1-in-5 ISO peak load conditions
- Specific levels of intermittent generation output are studied: 50% exceedance values (a lower MW amount) or 20% exceedance values (a higher MW amount) from 1 PM to 6 PM during summer months.
- Deliverability is tested by:
  – Identifying potential gen pockets from which delivery of generation to the ISO grid may be constrained by transmission
  – Increasing generators in the gen pocket to 100% of the <u>study amount</u> and reducing generation outside the gen pocket
  – Conducting the power flow analysis

Explanation of Exceedance Values



Changes Affecting On-Peak Deliverability Assessment

- When the capacity resources are needed the most:
  - The time of highest need is moving from the peak consumption hours (Hours 16:00 to 17:00) to peak sales hours (Hour 18:00) due to increased behind-the-meter solar PV distributed generation

- The need to more properly account for the evolving contribution of growing volumes of intermittent resources on resource adequacy across the whole year
  - For CPUC, moving from exceedance value to effective load carrying capacity (ELCC) approach

CPUC moving to ELCC Based Qualifying Capacity Calculation for Wind and Solar Resources

- QC = ELCC (%) * Pmax (MW)

- Probabilistic reliability model
  - 8760-hour simulation for a study year
  - Each study consists of many separate cases representing different combinations of load shape and weather-influenced generation profiles
  - Each case is run with multiple iterations of random draws of variables such as generator outages

CPUC ELCC Based Qualifying Capacity Calculation for Wind and Solar Resources (continued)

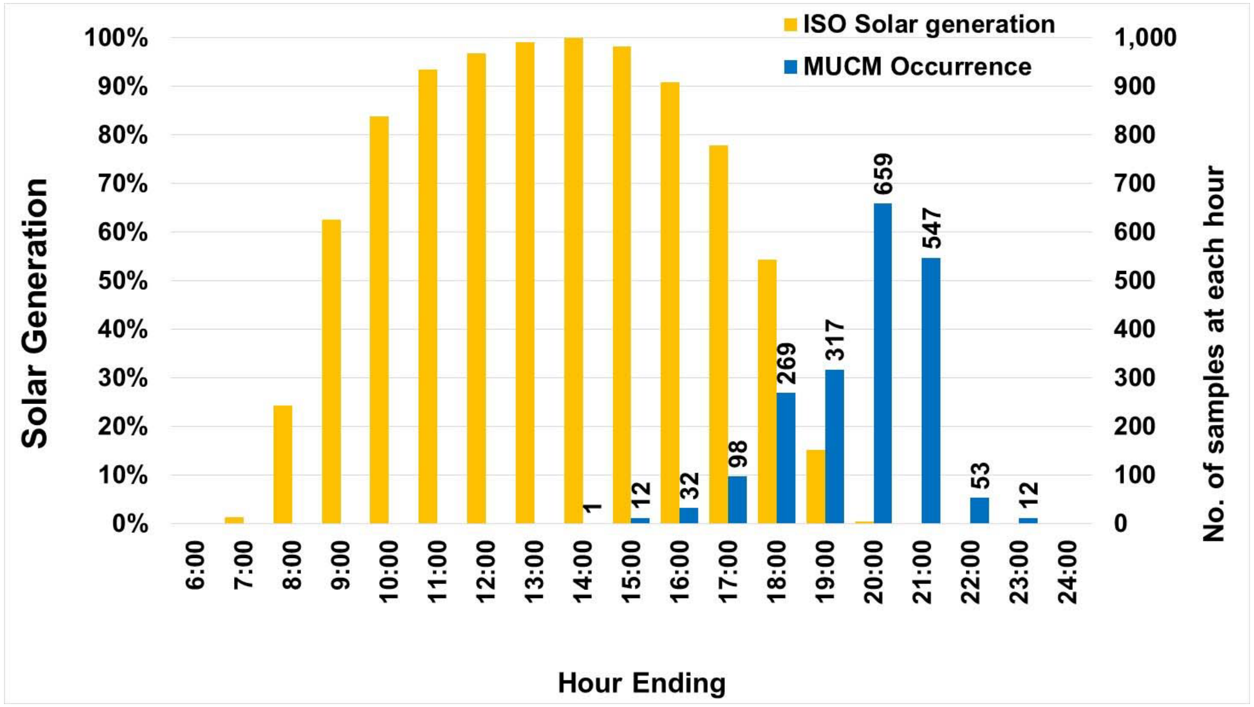
- Reliability impacts of the wind or solar resources are compared to the reliability impacts of “perfect” capacity
  - Calibrate the CAISO system to weighted average LOLE = 0.1
  - Remove the solar or wind resources and replace with perfect capacity
  - Adjust perfect capacity until LOLE = 0.1
  - ELCC (%) = removed solar or wind resources / perfect capacity

- Aggregated by technology and region

Expanding the Selection of System Conditions

- The on-peak deliverability test itself is not changing, but;
- We need to expand study scenarios to capture a broader range of combinations of modeling quantities – load, generation and imports
- At a minimum, the deliverability analysis should test multiple critical system conditions
- Data sources for identifying critical system conditions:
  - CAISO summer assessment
  - CPUC ELCC data (http://www.cpuc.ca.gov/General.aspx?id=6442451973)
    - CPUC unified RA and IRP Modeling Datasets
    - Latest CPUC output data from QC calculation for wind and solar resources

Critical Conditions per Review of Minimum Unloaded Capacity Margin Hours from 2018 Summer Assessment



Source: http://www.caiso.com/Documents/2018SummerLoadsandResourcesAssessment.pdf

Critical Conditions per Review of Loss of Load Hours from CPUC Monthly LOLE Summary

- For summer peak days, loss of load events occur in HE16 – HE21

SCE

Day/Hour	June	July	August	September
Peak Day - Hour 17	-	1.66%	0.24%	-
Peak Day - Hour 18	-	1.12%	0.26%	0.08%
Peak Day - Hour 19	0.55%	4.34%	2.56%	3.66%
Peak Day - Hour 20	4.11%	7.02%	1.86%	0.29%
Peak Day - Hour 21	1.99%	0.12%	0.03%	-

PG&E Valley

Day/Hour	June	July	August	September
Peak Day - Hour 16	0.02%	-	-	-
Peak Day - Hour 17	0.08%	1.21%	0.06%	-
Peak Day - Hour 18	0.02%	1.18%	0.04%	0.08%
Peak Day - Hour 19	0.83%	2.87%	1.02%	2.68%
Peak Day - Hour 20	3.37%	3.35%	2.09%	0.02%
Peak Day - Hour 21	1.01%	0.07%	0.04%	-

Critical System Conditions which were derived from these sources:

- Highest system need scenario (peak sale)
  - HE18 ~ HE22 in the summer

- Secondary system need scenario (peak consumption)
  - HE15 ~ HE17 in the summer

- These are the two critical system conditions the ISO selected in which generation will be tested for deliverability

Highest System Need (HSN) Scenario – Study Assumptions

Load	1-in-5 peak sale forecast by CEC
Non-Intermittent Generators	Pmax set to QC
Intermittent Generators	Pmax set to 20% exceedance level during the selected hours (high net sale and high likelihood of resource shortage)
Import	MIC data with expansion approved in TPP*

* The Maximum Import Capability is calculated from the highest imports during the summer hours when the load is above 90% of the annual peak load. In the last five years, the highest import hours are between HE18 and HE21.

HSN Scenario – Basis for Assumptions for Intermittent Generation

- Time window of high likelihood of capacity shortage
  - High net sale
  - Low solar output
  - Unloaded Capacity Margin < 6% or Loss of Load hours
- 20% exceedance level to ensure higher certainty of wind and solar being deliverable when capacity shortage risk is highest

Wind and Solar Output Percentile for HE18~22 & UCM<6% Hours

Exceedance		50%	40%	30%	20%	10%
wind	SDG&E	11.1%	16.3%	23.0%	33.7%	45.5%
	SCE	27.6%	36.9%	46.3%	55.7%	65.6%
	PG&E	29.8%	38.2%	52.5%	66.5%	78.2%
solar	SDG&E	0.0%	0.1%	1.7%	3.0%	7.6%
	SCE	1.9%	3.9%	7.0%	10.6%	14.8%
	PG&E	0.9%	4.1%	6.8%	10.0%	13.7%

Secondary System Need (SSN) Scenario – Assumptions

Load	1-in-5 peak sales forecast by CEC adjusted by the ratio of highest consumption to highest sale
Non-Intermittent Generators	Pmax set to QC
Intermittent Generators	Pmax set to 50% exceedance level during the selected hours (high gross load and likely of resource shortage)
Import	Import schedules for the selected hours

SSN Scenario – Basis for Assumptions for Intermittent Generation

- Time window of high gross load and high solar output
  - High gross load
  - High solar output
  - UCM < 6% or LOL hours
- 50% exceedance level due to mild risk of capacity shortage

Wind and Solar Output Percentile for HE15~17 & UCM<6% Hours

Exceedance		50%	40%	30%	20%	10%
wind	SDG&E	11.2%	16.6%	26.5%	40.8%	47.9%
	SCE	20.8%	24.8%	34.9%	57.4%	64.8%
	PG&E	16.3%	21.4%	44.7%	69.7%	76.8%
solar	SDG&E	35.9%	44.7%	58.0%	72.1%	75.4%
	SCE	42.7%	49.6%	51.8%	61.9%	86.3%
	PG&E	55.6%	61.6%	63.2%	74.6%	75.9%

Comparing to past results using Current Methodology

The new methodology results in the following upgrades identified using the current methodology in QC10 Phase I reports not be needed, and no new requirements:

PG&E South area	SCE-VEA-GWT area	SDG&E area
LDNU: Warnerville-Wilson 230 kV	RNU: Lugo – Victorville RAS expansion	RNU: Sycamore-Penasquitos 230 kV RAS
LDNU: Borden-Wilson Corridor 230 kV OLs	RNU: Bob RAS	RNU: Mission-San Luis Rey 230 kV RAS
LDNU: ElCapitan-Wilson 115 kV	RNU: Innovation RAS	
LDNU: Panoche-Mendota 115 kV Line	ADNU: Desert Area Deliverability Constraint substantially alleviated	LDNU: Silvergate-Bay Boulevard 230 kV series reactor
LDNU: GWF-Kingsburg 115 kV line	ADNU: North of Lugo Area Deliverability Constraint substantially alleviated	ADNU: East of Miguel Area Deliverability Constraint (IV – Valley 500 kV line)
LDNU: Helm-Crescent SW Station 70 kV line	ADNU: Barre-Lewis 230 kV Area Deliverability Constraint (Talega-Santiago 230 kV line)	
RNU: 4 RAS (3 in Fresno and 1 in Kern) not needed		

Summary of Previously Proposed Deliverability Assessment Methodology Revisions – What would Remain the Same:

- Methodology would remain fundamentally the same, but study scenarios would align load levels with intermittent generation output
- What would remain the same:
  - TPP policy study would assess deliverability of the renewable portfolio
  - GIP study would assess deliverability of the generation projects seeking FCDS
  - Energy-only generators would be off-line in the study unless needed to balance load

Summary of Proposed On-Peak Deliverability Assessment Methodology Revisions – What would Change:

- System conditions selected to test deliverability:
  - Highest system need scenario (peak sale)
  - Secondary system need scenario (peak consumption)

- Delivery network upgrades and NQC determination:
  - TPP to approve upgrades to mitigate portfolio amounts for peak sale deliverability constraints;
  - TPP to approve upgrades based on portfolio amounts (or not) for peak consumption constraints if the need is also identified in the policy/reliability or economic studies
  - TPP no-upgrade determination means MWs up to the portfolio amount is deemed deliverable for the peak consumption constraint in TPD allocation and annual NQC determination
  - GIP may identify LDNU/ADNUs in the primary system need scenario and ADNUs in the secondary system need scenario

Expected Impacts of the Previously Proposed Methodology

- More deliverability available in the TPD allocation on the basis of installed MW due to declining QC values stemming from CPUC ELCC methodology
- Fewer transmission upgrades required for the generators to achieve FCDS
- Fewer transmission upgrades identified from the deliverability assessment in both the generation interconnection study process and TPP process
- Renewable curtailments due to transmission constraints may increase, and would need to be addressed in the transmission planning process as policy-driven or economic-driven upgrades (aligned with TEAM)

Summary of the Stakeholder Comments

Robert Sparks

Sr. Manager, Regional Transmission - South

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With fewer transmission upgrades needed to achieve deliverability, and the increased risk of renewable generation curtailment, stakeholders raised concerns about:

- The CAISO Transmission Economic Evaluation Assessment (TEAM) methodology, and specifically about the valuation of renewable energy curtailments;
- The curtailment impacts on existing resources;
- The timing of upgrades that would be approved in the TPP; and,
- The potential financial harm to generation projects from delays in the development of needed transmission upgrades was also a concern.
- TEAM will be discussed in the TPP stakeholder meetings
- Renewable curtailment concerns will be further discussed in this process

The proposed solar and wind output assumptions for the revised on-peak deliverability assessment are different than the ELCC based QC values

- Some stakeholders suggested that the ISO should just study the ELCC based QC value of wind and solar
- The ELCC value tends to be the average value of a resource's production during resource shortage conditions – but above-average levels need to be delivered to offset below-average hours
- For example:
  - Hours 1 and 2 are resource shortage hours and the resource is producing 0 and 100 MW in those hours respectively
  - The QC value would be approximately 50 MW
  - If only 50 MW were deliverable then the resource would actually produce 0 and 50 MW in those hours respectively and the dependable capacity would be more like 25 MW.

Hybrid Solar-Storage Facilities

- Stakeholders commented that the on-peak deliverability study methodology should address how hybrid solar-storage facilities would be modeled in the assessment
  - The CAISO agrees that storage projects can complement the output profiles of intermittent resources,
  - and that it is reasonable to expect that storage facilities would be discharging at full output during resource shortage conditions.
- For a typical hybrid project, we assume the storage would be controlled to supplement the solar PV output
  - a project with 100 MW of solar and 100 MW of storage, and a combined total output capability of 100 MW would be modeled with 100 MW of combined total output in both the “highest system need scenario” and the “secondary system need scenario

Transition Issues: transfers of deliverability

- Some stakeholders also asked about how transfers of deliverability during repowering or to new behind the meter resources with different fuel types would be impacted by the new methodology.

- Once the revisions to the methodology are finalized, then the details on how transfers of deliverability would be impacted can be addressed

Transition Issues: postponement of financial postings

- Some stakeholders proposed postponing the posting of financial security for upgrades required by the generation interconnection process until after a new methodology is adopted.
- With the decision to delay the implementation of any changes to the methodology,
  - it is not known which postings would be impacted until the revisions to the methodology are finalized, and,
  - the ISO needs to apply our tariff fairly and consistently, so,
  - postponement of security postings is not possible

MITIGATION OPTIONS FOR THE INCREASED RISK OF RENEWABLE GENERATION CURTAILMENT

California ISO

Previously proposed revisions would reasonably identify fewer transmission upgrades

- The objective of the on-peak deliverability study methodology has been to ensure that resources are deliverable during a resource shortage condition
  - The objective has not been to ensure that resources can be delivered when there is not a resource shortage condition
  - However, the transition to ELCC methodologies for determining qualifying capacity levels implies that the deliverability methodology needs to consider the transmission system’s capabilities to enable the resources to contribute to overall load carrying capability at the times the resource is making its contributions to reliability, not necessarily when it is needed the most
- The previously proposed revisions would generally meet this objective but would result in identifying fewer transmission delivery network upgrades

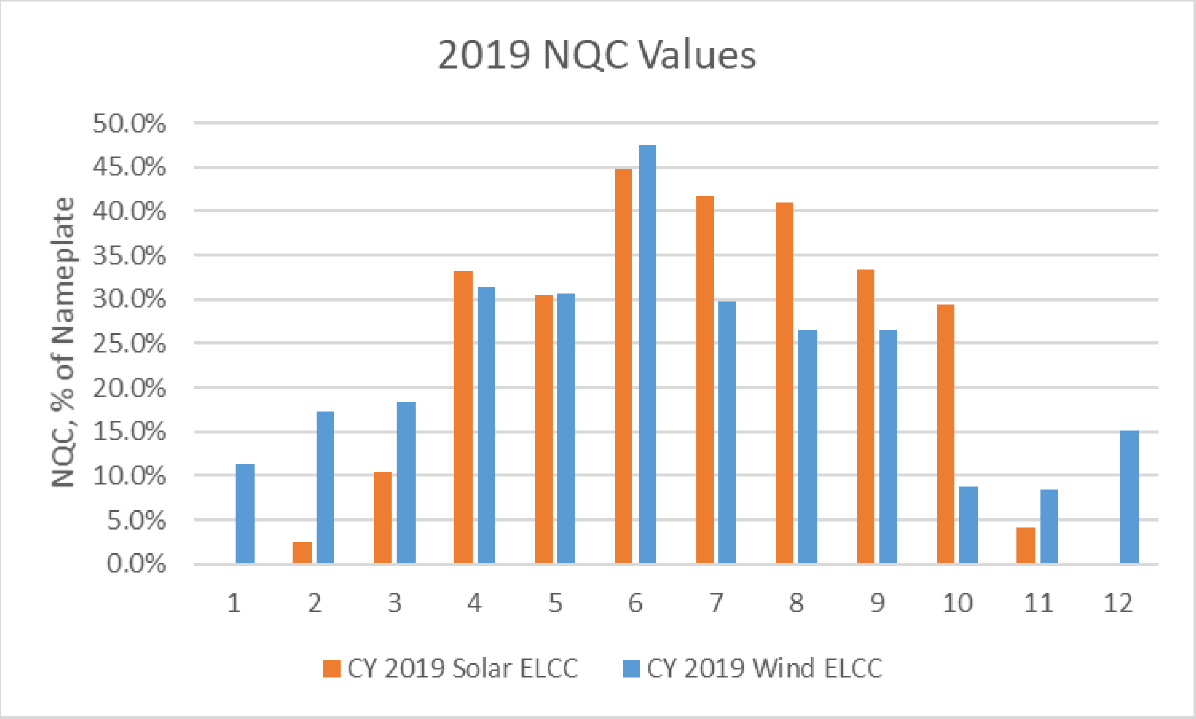
With the previously proposed revisions, renewable generation curtailments would increase:

- With a reduced amount of network upgrades there would be an expectation that deliverability-driven transmission costs would decrease, but renewable generation curtailments would increase

- The CAISO initially proposed to address this increase in curtailments by identifying needed policy and economic driven transmission upgrades in the TPP
  - One weakness of relying on the TPP is that delivery network upgrades needed for specific generation interconnection projects could not be approved until there was a high degree of certainty that the generation projects would proceed

Reliability Impacts of Transmission Related Curtailment during the Off-Peak period

- 65% of the NQC value is during the peak months of May-September (the sum of the monthly QC values over those 5 months)
- 35% of the NQC value is during the off-peak months of January-April and October-December (the sum of the monthly QC values over those 7 months)



Potential additional studies

- The CAISO proposes to explore additional studies that can be performed as part of the interconnection study process to meet the objective of avoiding excessive curtailment
- The CAISO welcomes comments on what data would be most helpful to developers in making decisions to proceed with a project,
- and what delivery network upgrade requirements should be placed on new generators requesting FCDS to avoid excessive transmission constraints on both the new and existing generators

The need for additional studies

- Should additional studies be added to the interconnection study process to meet the objective of avoiding excessive curtailment?

- If such studies are performed in the interconnection study process, then should the identified delivery network upgrades be required to be funded by the generator owner for its generation project to obtain FCDS?

Next Steps Pertaining to Deliverability Assessment Methodology

- Seek feedback from the stakeholders on the Issue Paper
- Consider stakeholder feed back and prepare a Straw Proposal Paper
- Stakeholder meeting to discuss the Straw Proposal Paper
- Consider stakeholder feed back and prepare a Draft Final Proposal Paper

Comments

- Stakeholder comments should be submitted to regionaltransmission@caiso.com by May 16, 2019