Deliverability Assessment Methodology Straw Proposal Paper

Deliverability Assessment Methodology Straw Proposal Paper Stakeholder Meeting

August 5, 2019

Agenda

Time	Item
9:00-9:30	Welcome and introduction
9:30-10:30	Proposed revisions to the on-peak deliverability assessment methodology
10:30-11:00	Responses to stakeholder comments on the previously proposed revisions to the deliverability assessment methodology
11:00-12:30	Proposed revisions to the off-peak deliverability assessment methodology
12:30-12:45	Scheduling priority associated with the off-peak deliverability status
12:45-1:00	Next steps

Introduction

Neil Millar
Executive Director, Infrastructure Development

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

Issue Paper – May 2, 2019 Stakeholder Call

- The CAISO posted an issue paper and discussed it with stakeholders on May 2, 2019 to garner additional stakeholder input needed to develop a straw proposal that addresses the comments provided on the proposed on-peak generation deliverability methodology revisions

- In response to the Issue Paper, stakeholders agreed that the deliverability methodology needs to be changed and with the ISO's reasoning on why it needs to be changed

- The majority of stakeholders raised concerns with increased curtailment that would result from the revisions in the deliverability methodology focused on addressing resource adequacy needs

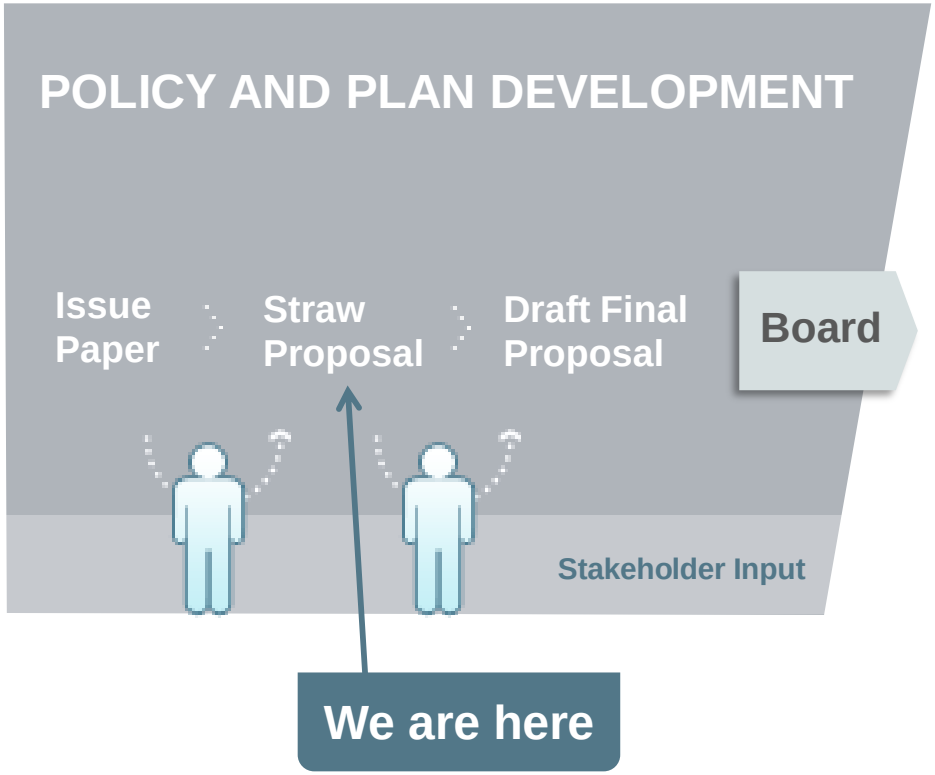
Straw Proposal

- The CAISO continues to recommend the revisions to the deliverability methodology that were proposed in 2018 with some adjustments

- We also recommend that an additional assessment be included in the interconnection studies to address excessive curtailment risks

- This is a balance between ratepayer and generator concerns, and needs to be considered in concert, as opposed to two separate proposals

CAISO Policy Initiative Stakeholder Process



Objectives for today

- Proposed revisions to the On-Peak Deliverability Assessment methodology
- Responses to stakeholder comments on the previously proposed revisions to the Deliverability Assessment methodology
- Proposed revisions to the Off-Peak Deliverability Assessment methodology – which would be the additional assessment referred to earlier

Proposed Revisions to the On-Peak Deliverability Assessment Methodology

Songzhe Zhu

Sr. Advisor Regional Transmission Engineer

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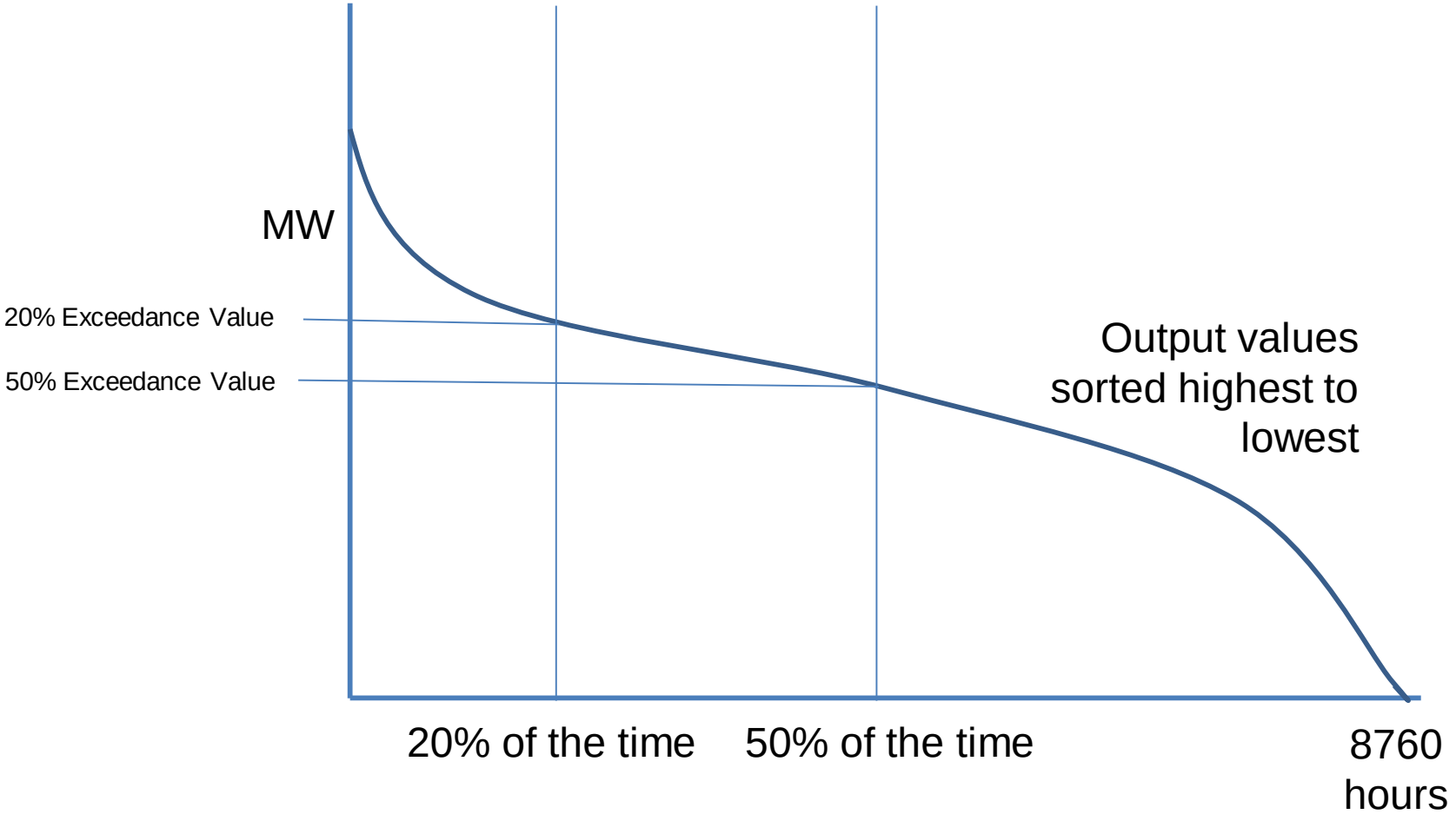
Current On-Peak Deliverability Methodology

- 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 study amount 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)

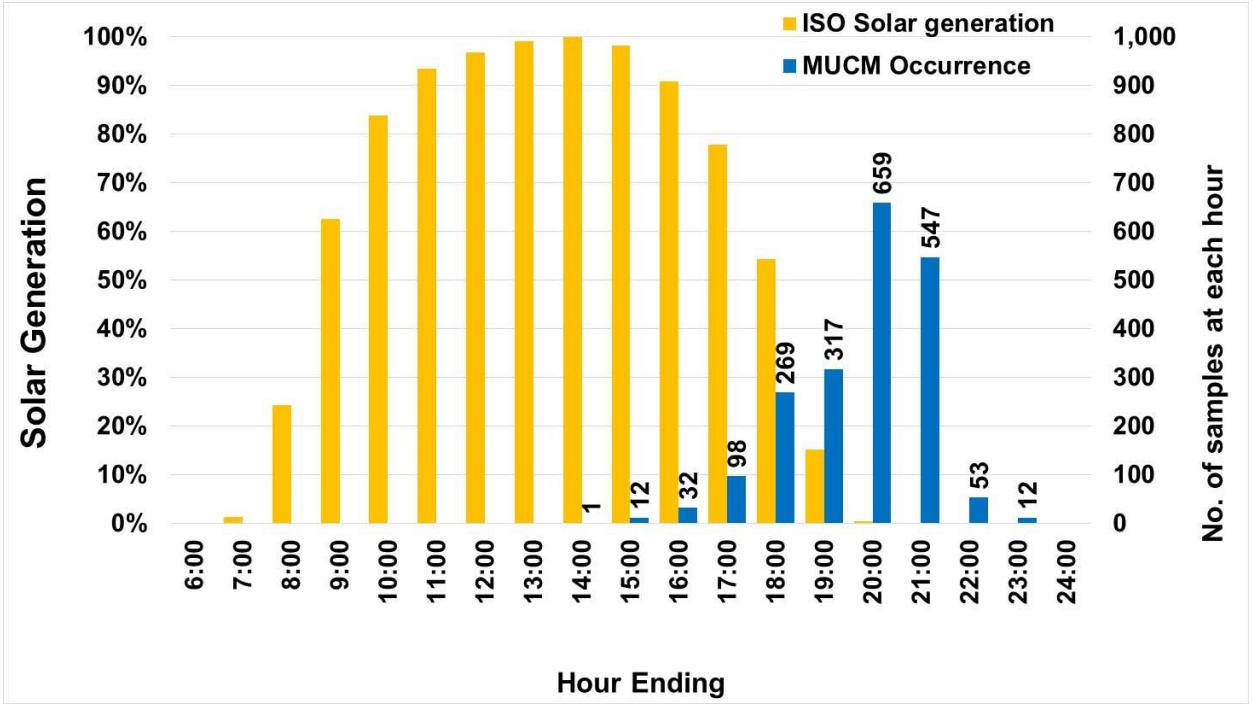
- Reliability impacts of the wind or solar resources are compared to the reliability impacts of “perfect” capacity
  - Calibrate the CAISO system to weighted average LOLE = 0.1
  - Remove the solar or wind resources and replace with perfect capacity
  - Adjust perfect capacity until LOLE = 0.1
  - ELCC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

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%	-

SCE

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%	-

PG&E Valley

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), but no lower than the average QC ELCC factor during the summer months
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 on-peak 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) and in additional interconnection studies for local upgrades

Responses to Stakeholder Comments on the Previously Proposed Revisions to the Deliverability Assessment Methodology

Robert Sparks
Sr. Manager, Regional Transmission - South

Deliverability Assessment Methodology Straw Proposal Paper Stakeholder Meeting

August 5, 2019

Impacts of the Deliverability Methodology Revisions Proposed in 2018

Stakeholder raised the following concerns:

- Revising the Deliverability Assessment methodology without additional changes to keep curtailment at reasonable levels, as the current deliverability methodology has done to date
- If the consequences of increased curtailment are not managed up front, developers may experience years of severe curtailment before a transmission solution is developed

CAISO response:

- Most of the concerns were around renewable curtailment risks during system conditions when resource adequacy was not the primary concern.
- We recommend that an additional assessment be included in the interconnection studies to address excessive curtailment risks

Addressing the Increased Risk of Renewable Generation Curtailment

- The majority of stakeholders preliminarily responded that additional studies should be included in the interconnection study process, and that the upgrades should not be required to obtain FCDS

CAISO response:

- The additional study should focus on system conditions when renewable curtailment would not occur due to oversupply of resources
- In addition, the upgrades identified as needed in the additional study should not be required for the resource to obtain FCDS
- The CAISO considered several options to address the curtailment concern
- All the options involve revising the existing off-peak deliverability assessment methodology.

Options Considered to Address Curtailment Concern within the GIP

- Option 1: Informational off-peak deliverability assessment
  - Not recommended. Although we would expand this study to apply to all renewable areas, it would not facilitate the development of low cost upgrades needed to address excessive curtailment
- Option 2: Off-Peak deliverability assessment with mandatory upgrades to obtain FCDS
  - Not recommended. The majority of stakeholders were opposed to this option
- Option 3: Off-Peak deliverability assessment with optional upgrades
  - Not for FCDS
  - Optional for the IC to fund without repayment; eligible to receive CRRs
  - Lack of incentive for the IC to fund

Option 4: Off-Peak Deliverability Assessment with Optional local upgrades and partial refunding

- Provide an opportunity for interconnection customers to trigger upgrades relieving local curtailment through GIP
  1. Avoid costly delays associated with the TPP/IRP
  2. Limited to local upgrades to avoid excessive curtailment beyond oversupply curtailment
  3. Need cost cap for the opportunity to be viable for the ICs
  4. Set reimbursement cap to protect rate-payers and motivate prudent decision by the ICs
  5. Upgrades would be optional and not associated with deliverability status
  6. The upgrade costs would be partially reimbursed and the remainder refunded with CRRs

Option 5: Off-Peak Deliverability Assessment with Mandatory Local Upgrades to Obtain Off-Peak Deliverability Status

- Provide an opportunity for interconnection customers to obtain a curtailment priority for relieving local curtailment through GIP
  1. Same as Option 4 bullets 1, 2, and 3
  2. Create new Off-Peak Deliverability Status (OPDS) interconnection service
  3. For new generators requesting OPDS upgrades would be mandatory, but costs would be reimbursed
  4. Existing FCDS and PDS generators would also receive an OPDS designation
  5. OPDS generators would receive market scheduling priority

Proposed Revisions to the Off-Peak Deliverability Assessment Methodology

Songzhe Zhu

Sr. Advisor Regional Transmission Engineer

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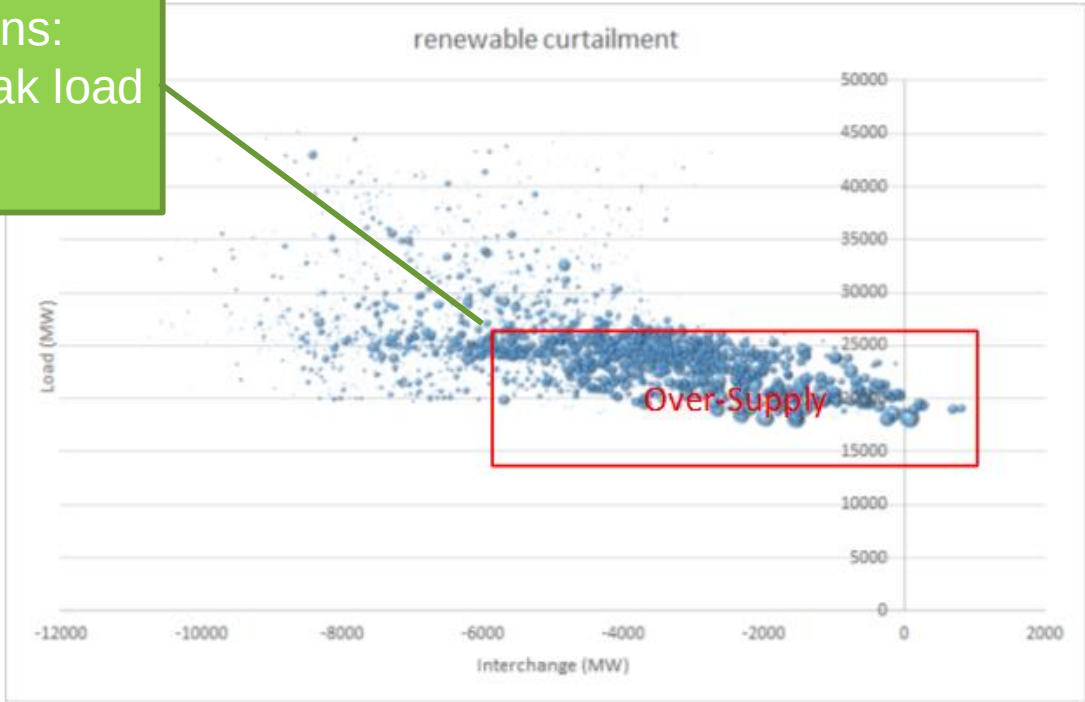
Principles of Off-Peak Deliverability Assessment

- Identify transmission bottlenecks that would cause excessive renewable curtailment.
- Identify transmission upgrades for local constraints that tend to be less expensive.
- Rely on the TPP framework to approve transmission upgrades for area constraints that tend to be expensive.
- The study should consider both full capacity and energy only generators.

Establish the System Conditions

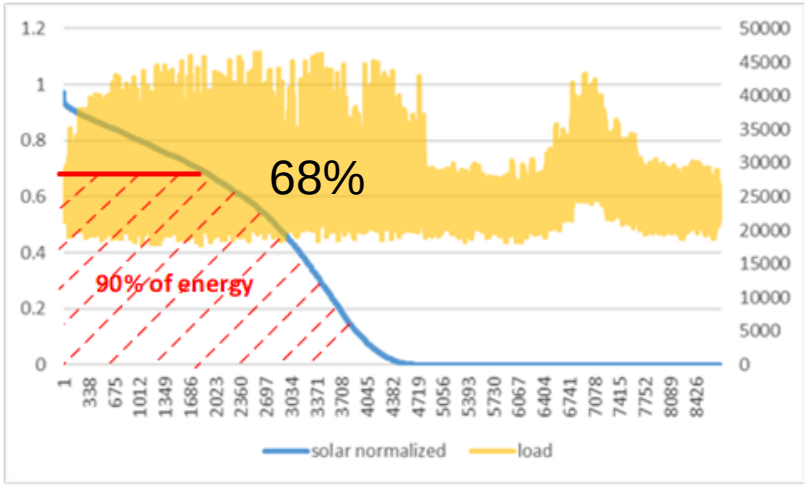
- Capture reasonable load and import conditions that stress the transmission system with high wind/solar output

Selected Conditions:
55% ~ 60% of peak load
6000 MW imports

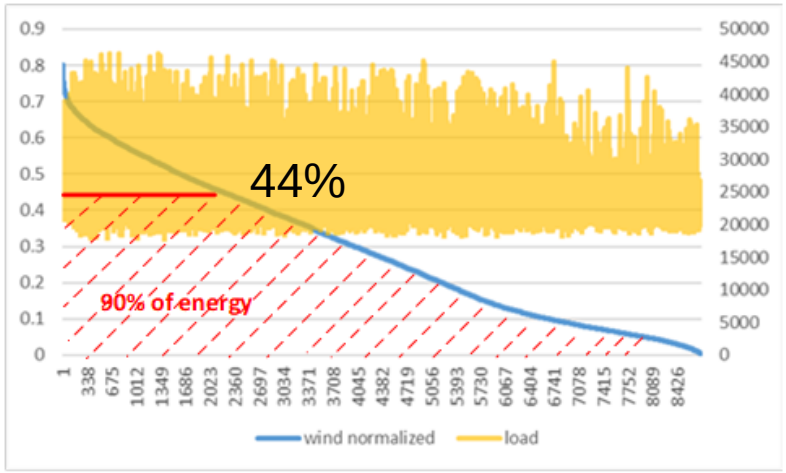


System-Wide Wind/Solar Output Assumptions

- Under the selected load and import condition, renewable outputs vary over a wide range.
- Avoid *excessive* curtailment: select output level corresponding to 90% energy production



Normalized Solar Output Duration Curve



Normalized Wind Output Duration Curve

Summary of Proposed System-Wide Study Assumptions

Load	55% ~ 60% of summer peak load
Imports	~6000 MW total
Generator Dispatch Level	
Wind	44%
Solar	68%
Energy Storage	0
Hydro	30%
Thermal	15%

Increase Local Area Renewable Generation

- After balancing load and resource under the system-wide conditions, the renewable generation in a local area is increased to identify transmission constraints.
- General local study areas include
  - PG&E : North, Fresno and Kern
  - SCE/VEA/GWL/DCRT: Northern, North of Lugo, East of Pisgah, Eastern
  - SDGE: Inland and East
- Off-peak deliverability assessment is performed for each study area separately.

Study Area Wind/Solar Dispatch Assumptions

- The study area wind/solar dispatch assumptions are based on the 90% energy production level of existing generators inside the study area.
- If more than 70% of the study area capacity is wind, then the study area is deemed a wind area; otherwise it is treated as a solar area.

Wind/Solar Dispatch Assumptions in Wind Area

	Wind	Solar
SDG&E	69%	68%
SCE	64%	
PG&E	63%	

Wind/Solar Dispatch Assumptions in Solar Area

	Solar	Wind
SDG&E	79%	44%
SCE	77%	
PG&E	79%	

Re-dispatch Order to Balance Increase of Wind/Solar Generation in the Study Area

- Reduce new generation outside the study area with a limitation of Path 26 4,000 MW north to south or 3,000 MW south to north.
- Reduce thermal generation inside the study area.
- Reduce import.
- Reduce thermal generation outside the study area.

Off-Peak Deliverability Power Flow Study

- A contingency analysis is performed under the normal and contingency conditions:
  - Normal conditions (P0)
  - Single contingency of transmission circuit (P1.2), transformer (P1.3), single pole of DC lines (P1.5) and two poles of PDCI if impacting the study area
  - Multiple contingency of two adjacent circuits on common structure (P7.1) and loss of a bipolar DC line (P7.2).
  - Two adjacent transmission circuit according to WECC's Project Coordination, Path Rating and Progress Report Processes.

Steps to Mitigate Overloads

1. Re-dispatch available resources to relieve the overloads
   - Dispatch existing energy storage resources to full four hour charging capacity
   - Turn off thermal generators contributing to the overloads
   - Reduce imports contributing to the overloads to the level required to support out-of-state renewables in the RPS portfolios
2. If the overloads are not fully mitigated, categorize the overloads to local or area constraints
3. Identify local and area network upgrades to fully mitigate all overloads

Treatment of Off-Peak Area Network Upgrades

- The area upgrades are for information only.
- Provide estimated scope and cost.
- Provide information on generation curtailment needed to mitigate the overloads.

Treatment of Off-Peak Local Network Upgrades

- An opportunity for the wind/solar interconnection customers to fund off-peak local network upgrades through the generation interconnection process
- A separate cost category – not impacting cost responsibility for DNUs and RNUs
- If the off-peak upgrades are identified, upsized or reconfigured in a subsequent TPP cycle, the upgrade requirement and cost responsibility will be removed from the interconnect customers
- Several options on cost treatment of the upgrades

Option 4 - Optional Off-Peak Local Network Upgrades with Reimbursement Cap

- Upgrades are assigned to interconnection requests with 5% or more impacts on the constraint.
- At Phase I interconnection study, full upgrade costs are assigned to each interconnection requests.
- The interconnection customer (IC) elects whether to fund the upgrades – Yes or No
- At Phase II interconnection study, the upgrade costs are allocated among the interconnection requests electing Yes
- The lower cost between Phase I and Phase II studies become the cost cap

Option 4 - Optional Off-Peak Local Network Upgrades with Reimbursement Limit (Cont'd)

- In the annual reassessment, the upgrade costs are re-allocated to the still active interconnection requests with the total cost responsibility not exceeding the cost cap from Phase II.
- The IC must make interconnection security posting for the upgrades in order to move forward in the interconnection process.
- The upgrade costs are reimbursable with a reimbursement limit.
- The IC receive Merchant Transmission CRRs for upgrade costs beyond the reimbursement limit.

Option 5 – Optional Off-Peak Deliverability Status with Mandatory Local Off-Peak Network Upgrades

- The IC elects Off-Peak Deliverability Status (OPDS) when submitting the interconnection request
- The OPDS provides a higher scheduling priority in the market.
- Upgrade costs are allocated among interconnection requests electing OPDS.
- The lower allocated cost between Phase I and Phase II sets the cost cap.

Option 5 – Optional Off-Peak Deliverability Status with Mandatory Local Off-Peak Network Upgrades (Cont'd)

- In annual reassessment, the upgrade costs are re-allocated to the still active interconnection requests with the total cost responsibility not exceeding the cost cap from Phase II.
- The IC must make interconnection security posting for the upgrades in order to move forward in the interconnection process.
- The upgrade costs are reimbursable.

Scheduling Priority Associated with the Off-Peak Deliverability Status

Guillermo Bautista Alderete
Director, Market Analysis & Forecasting

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Treatment of OPDS scheduling in the market

- Self schedules are currently considered with certain priorities in the market clearing process
- OPDS self schedules can be assigned a higher priority than the priority assigned to non-OPDS resources
- OPDS condition can only ensure a relative priority in the sequencing of curtailing self schedules among all types of self schedules
- OPDS self schedules may still be curtailed when market conditions exist

Next Steps

Robert Sparks
Sr. Manager, Regional Transmission - South

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Next Steps Pertaining to Deliverability Assessment Methodology

- Seek feedback from the stakeholders on the Straw Paper
- Consider stakeholder feed back and prepare a Draft Final Proposal Paper

Comments

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