Net Load Reduction (NLR) QC Counting for Wind and Solar Resources

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Stating the "Obvious"

- **Current reliability paradigm relying on annual/monthly-based RA values has been misleading for a long time but we have been getting away with it due to a resource mix dominated by dispatchable resources**
  - Relying on RA contribution of variable energy resources (VERs) (wind and solar) based on a single QC number per month makes reliability prediction easier but very misleading
    - Single QC value for the whole month, even when ELCC-based, does not correctly predict the capacity contribution of VERs in critical capacity hours (for evening hours, it overstates the capacity contribution of solar resources and can understate that of wind resources)
- **PG&E's Slice of Day proposal goes a long way to address this fundamental flaw by, among other reasons, replacing a single monthly QC contribution with an RA contribution for a single slice where the capacity contribution of VERs can be more reliably predicted**
  - The major question even in this "superior" paradigm is still how to predict VERs' QCs

Why Not Stick with ELCC for SoD?

- **ELCC remains the best approach for determining the QC of VERs, however:**
  - For each slice, VERs' ELCC-based QCs will be a single number and may not reflect the capacity contribution during the one hour when the capacity shortfall is most critical
  - ELCC calculations are complex, non-transparent and subject to "miscalculation" – e.g., significant difference between IOU- and CPUC-calculated ELCCs for the same VERs and similar time-periods

Table ES1. 2022 Study Results (expressed as a percentage of assumed interconnection capability)

Technology	BTM PV	Fixed PV	Tracking PV	Wind
PGE Valley	5.9%	8.6%	11.0%	17.2%
PGE Bay	5.5%	8.5%	10.9%	24.4%
SCE	6.4%	8.9%	11.2%	11.8%
SDGE	5.9%	8.7%	11.0%	11.8%
AZ APS	N/A	5.0%	6.8%	16.1%
NM EPE	N/A	5.0%	6.8%	14.8%
BPA	N/A	N/A	N/A	16.0%
CAISO	5.9%	8.7%	11.0%	16.3%

Source: Joint Utility ELCC Submission to CPUC – 6/1/21

Table 6. Incremental ELCCs by MTR Tranche

	Tranche 1 2,000 MW 2023	Tranche 2 6,000 MW 2024	Tranche 3 1,500 MW 2025	Tranche 4 2,000 MW 2026
4-Hour Battery	96.3%	90.7%	74.2%	69.0%
6-Hour Battery*	98.0%	93.4%	79.6%	75.1%
8-Hour Battery*	98.2%	94.3%	82.2%	78.2%
8-Hour Pumped Storage Hydro	N/A	N/A	N/A	76.8%
12-Hour Pumped Storage Hydro	N/A	N/A	N/A	80.8%
Solar - Utility Scale and BTM PV	7.8%	6.6%	6.7%	5.7%
Wind CA	13.9%	16.5%	22.6%	21.6%
Wind WY	28.9%	28.1%	26.7%	31.6%
Wind NM	31.1%	31.0%	34.5%	34.2%
Wind Offshore	N/A	N/A	N/A	36.4%

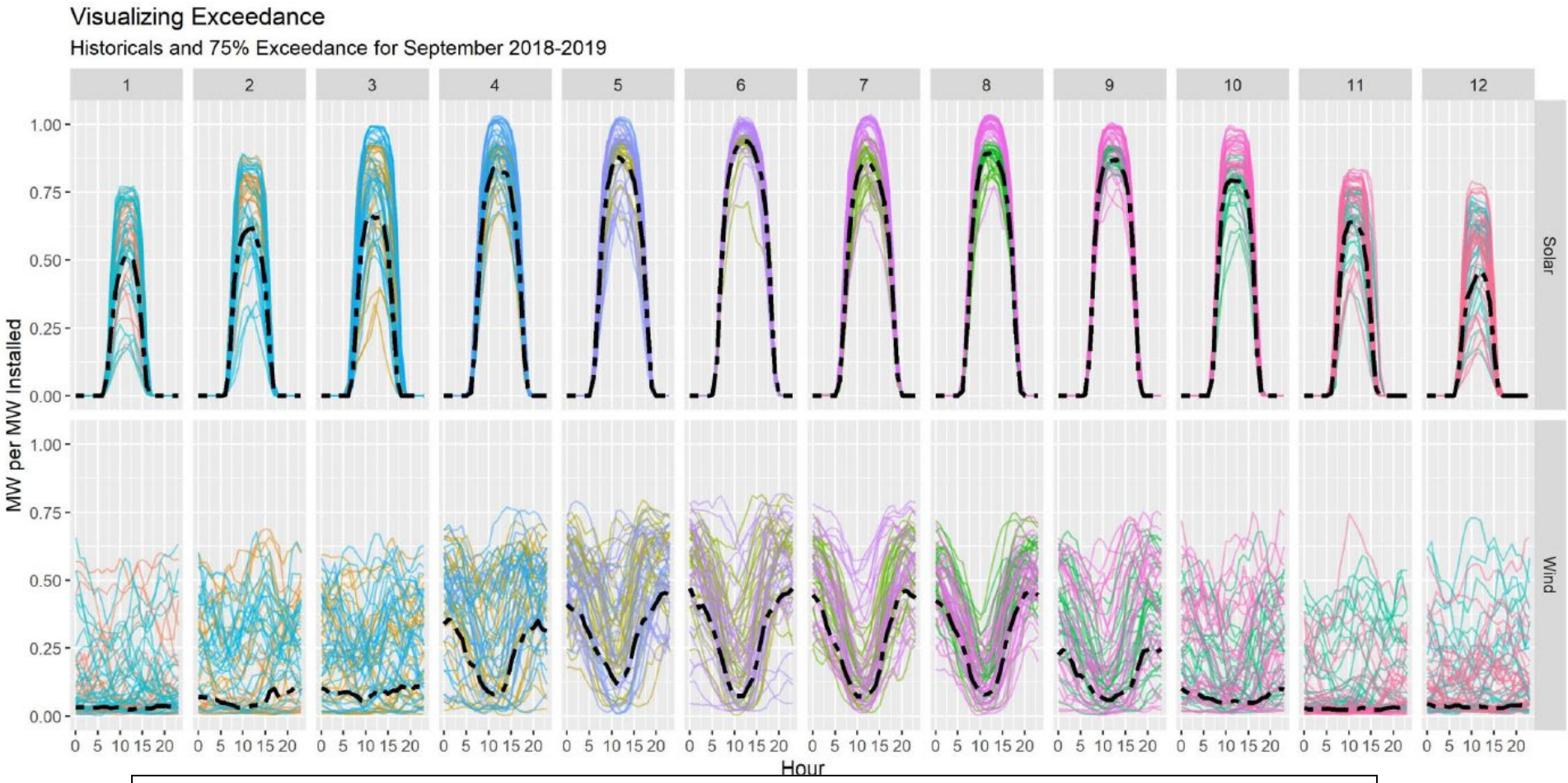
* *The 6 and 8 hour battery rows were each simulated with one tranche of 6 or 8 hour. The underlying tranches are assumed to be comprised of only 4-hour batteries. For example, tranche 3 for the 6 hour battery row is comprised of 8 GW of incremental effective capacity from 4-hour batteries with an additional 1.5 GW of 6-hour battery capacity.*

Source: CPUC E3-Astrape MTR ELCC Study – 10/22/21

What Is Wrong with Exceedance?

- **The better question: What is NOT wrong with exceedance-based QC calculation for VERs?**
  - Crapshoot – at best, one could look at GENERAL historical correlation between an VER output and actual load to guess an exceedance number
  - A bigger crapshoot to distinguish based on technology or even location
  - Can be readily "miscalculated" – as was the case for several years in CA before ELCC was eventually introduced
- **On the positive side, exceedance-based QCs will be easy to "calculate" – arbitrarily grab a number and stick to it!**

What Is Wrong with Exceedance?



Source: NP Energy's Renewables and Exceedance – A Primer (a presentation at the 2021 RA reform workshops)

CalWEA's Proposal: Net-Load-Reduction-Based QC Calculation

Net Load Reduction (NLR) methodology for VERs' QC calculation is intended to PERFECTLY capture the correlation between load and VERs' output:

- For every historical hour, the amount of **actual** wind/solar output is netted against **actual** gross load to calculate the **actual** net load for that hour

  1. Hourly actual net load calculated for all VERs
  2. Wind (or solar) NLR for an hour calculated by ignoring the wind (or solar) output for that hour, repeating the hourly netting, and calculating the increase in the actual net load for that hour
  3. NLR Factor for wind (or solar) for any hour is calculated by dividing wind NLR by the total wind interconnection capacity (not necessarily installed capacity) for that hour
  4. NLR-based QCs for any slice could be calculated based on the average NLR Factors for the hours within the slice. Other derivations could be considered when calculating the QC for wind/solar (e.g., only consider averaging NLR Factors for the most critical hour within the slice)

- NLR-based QC evaluation can be done for a resource type (wind/solar) per total output, per zone output, per technology output, or even per-project output as needed

NLR-Based QC Example Calculation

- **Wind Interconnection Capacity: 5,000 MW**
- **Solar Interconnection Capacity: 10,000 MW**

Year	Hour	Date & Time	Gross Load (MW)	Wind Output (MW)	Solar Output (MW)	Net Load (MW)	NLR Factor for Wind	NLR Factor for Solar
20XX	5669	August 28 at 20:00	42,000	1,000	500	39,500	20% (1GW/5GW)	5% (0.5 GW/10 GW)

- **Process is as simple as shown above**
- **Uses actual historical data that is readily available**

CalWEA's Recommendation on Other Structural Elements

- **Need determination**
  - **Top-down on system-wide basis by slice**
- **Allocation of need to LSEs**
  - **Bottom-up by slice – LSE-specific RA shortfalls**
    - Based on gross load minus all RA capacity (existing and contracted)

Both using the more accurate NLR method for QC/RA capacity for VERs