



Resource Adequacy Reforms: Structure & Counting Issues for Solar

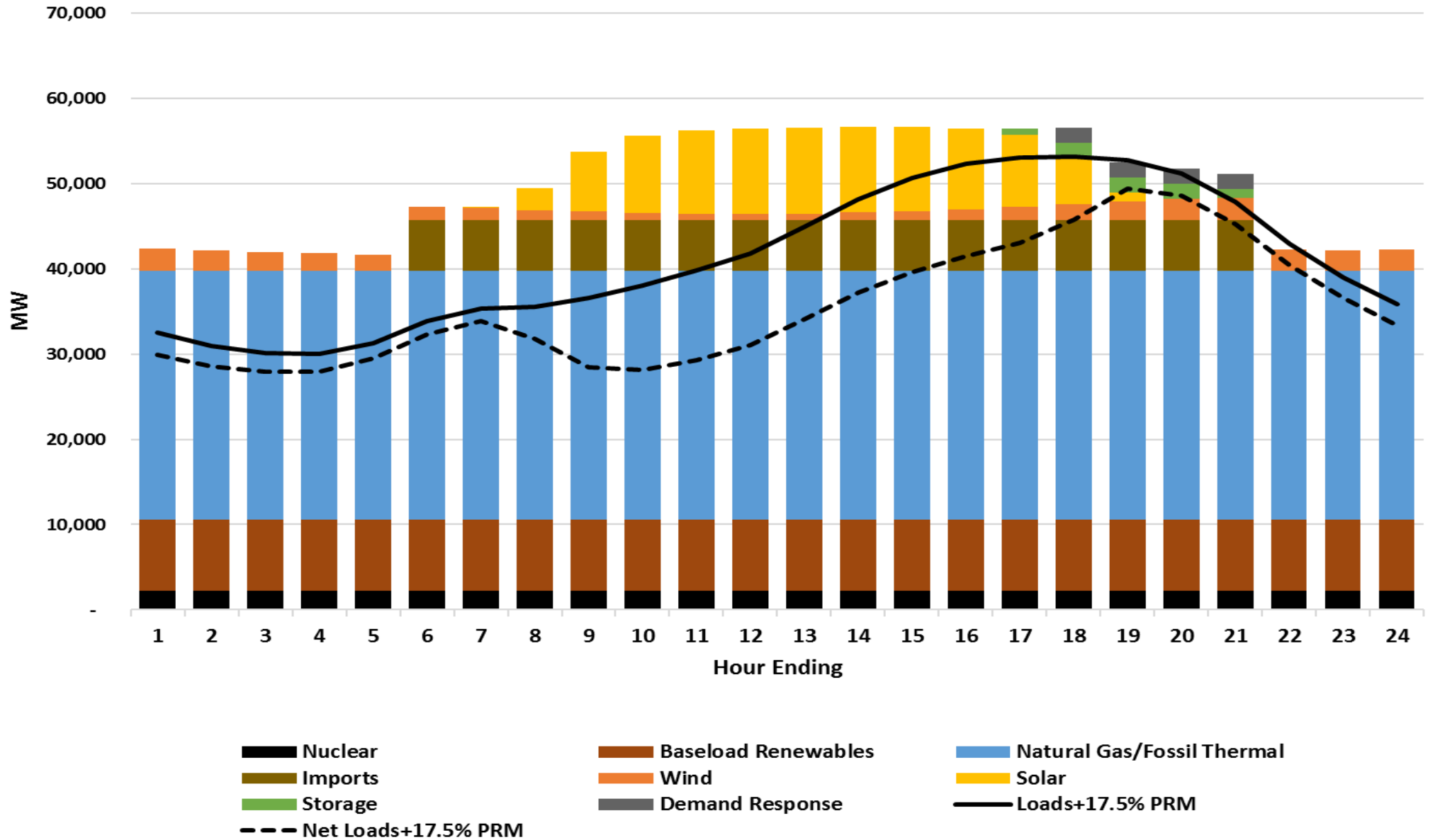
Presentation from SEIA – LSA – Vote Solar

CPUC Docket R. 19-11-009 / R. 21-10-002

Tom Beach
Crossborder Energy

November 3, 2021

CAISO September 2021 RA Market in Hourly Slices



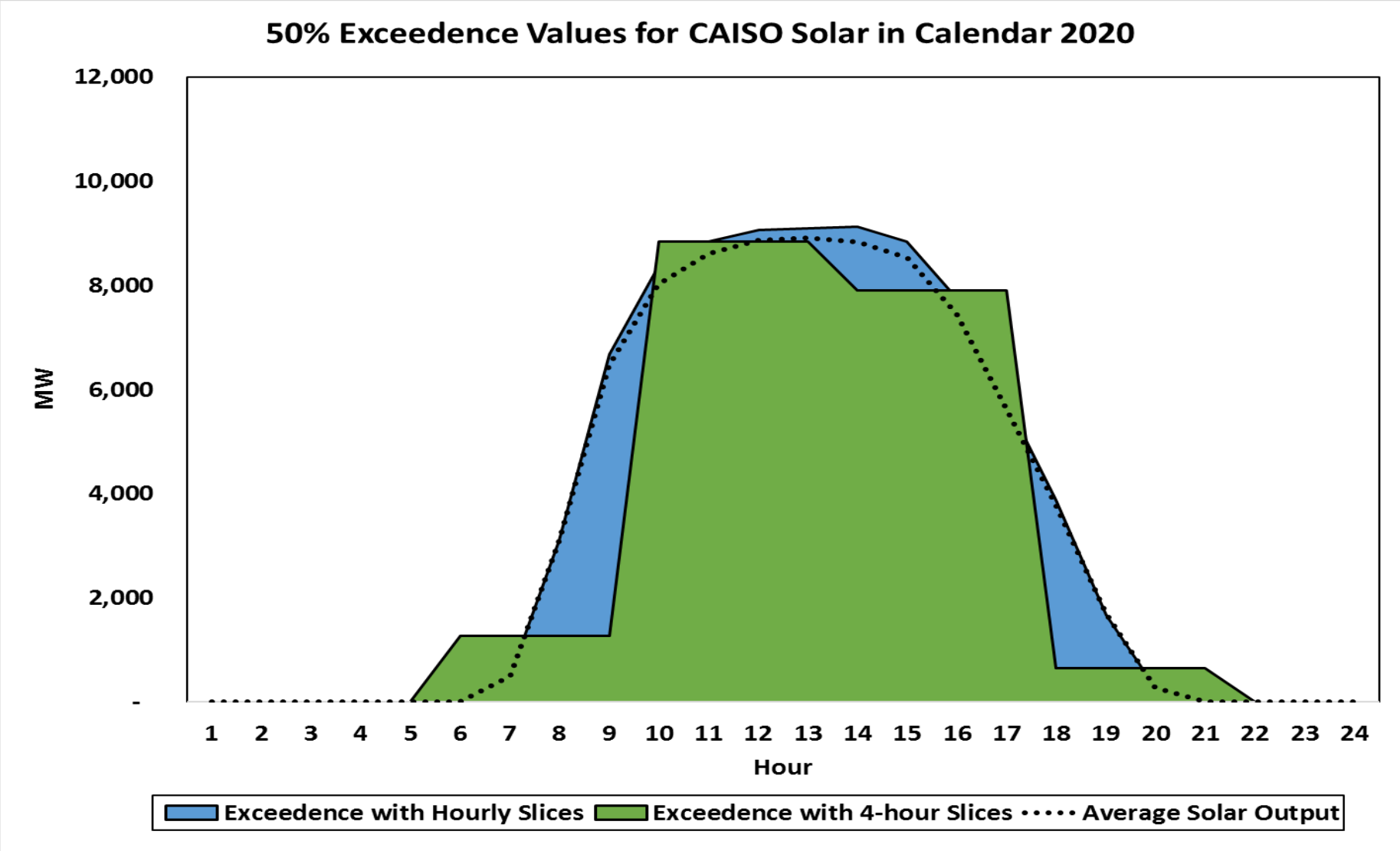
The Resource Adequacy Values of Solar

1. Energy: low-cost, clean source of energy to fill storage
 - Added energy for storage from DC-coupled hybrids
2. Capacity: output in the solar “tail” from 5p-9p
 - Especially in the summer months (June-Sept)
 - These are the hours with almost all of the positive LOLP/EUE.
3. Intrinsic value: net load peak < gross load peak, due to solar
4. Portfolio effects
 - Narrow net load peak can be served with shorter-duration storage
 - More wind generation and exports at the later net load peak
 - Midday solar avoids the need to run gas plants until late afternoon

RA Proposal from SEIA – LSA – Vote Solar

- Adopt hourly slices, monthly showings
- Use 50% exceedance solar output in each slice, in all hours
 - On-peak: 5p to 9p
 - Off-peak: all other hours
- Benchmark the exceedance for on-peak hours to the ELCC
 - Current average solar ELCC supports a 50% exceedance for solar in these hours
- Counting rule for hybrids – build on the current “additive” approach
 - Storage component
 - Energy – the MWh that can be stored each day, including losses
 - Capacity – flexible up to the max hourly discharge capacity, limited by the energy stored
 - Solar component
 - Solar output less the amount needed to fill storage (including losses)
 - Use DC output for DC-coupled storage, adjusted for inverter losses

Slice size: Impact on Solar of 4-hour vs. 1-hour Slices



Slice size: Impact on Solar of 4-hour vs. 1-hour Slices (3)

Solar Receiving RA Credit, as a Percentage of Average Hourly Solar Output

| Period | Slice Size | Exceedance | |
|-------------|------------|------------|-----|
| | | 50% | 75% |
| 2020 Annual | 1 – hour | 103% | 91% |
| | 4 – hour | 93% | 71% |
| 2020 August | 1 – hour | 101% | 89% |
| | 4 – hour | 89% | 72% |
| 2021 August | 1 – hour | 102% | 94% |
| | 4 – hour | 91% | 75% |

Exceedance for Energy

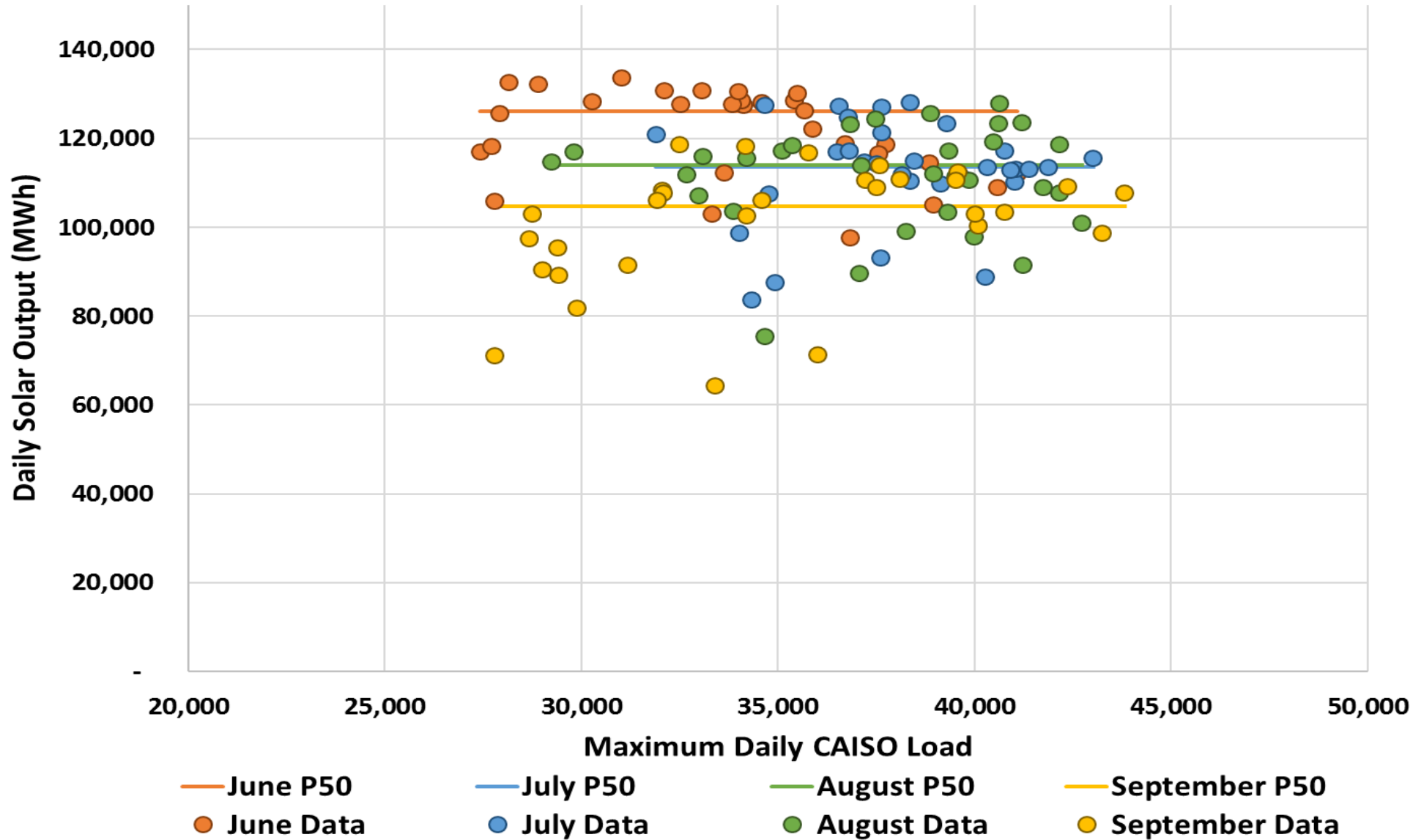
- SEIA/LSA/VS propose use of P50 (50% exceedance) for solar
- Little difference in P50 and P25 (75% exceedance) for solar
 - Especially in the summer months (June-September).
- Substantial excess midday capacity
 - 250,000 MWh above load forecast in September 2021
 - Storage charging < 10,000 MWh per day today
 - Variation in daily solar energy from P50 (50% exceedance) is no more than 20,000 MWh on high-demand summer days.
- All hours except net load peak hours of 5p-9p
- 50% exceedance avoids the portfolio/diversity issues raised by higher exceedance values.

Range of CAISO Solar Output Based on 50%/75% Exceedance

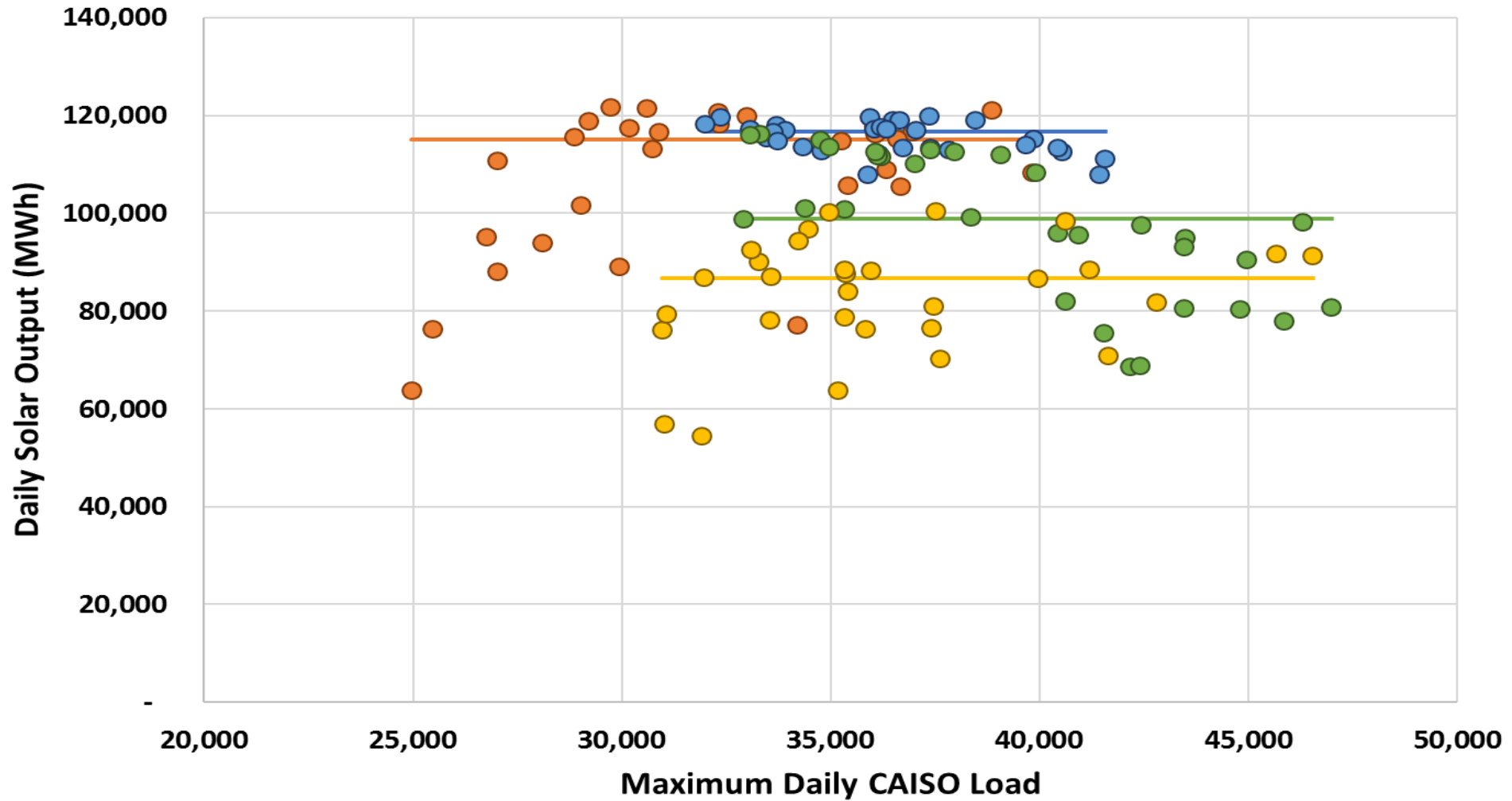
- PG&E modeling of 2018-2019 CAISO data

| CAISO Solar Output at 75% Exceedance as a Percentage of Solar Output at 50% Exceedance (Median) | | | | | | | | | | | | |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| HE | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
| 7 | | 8% | | 40% | 78% | 92% | 80% | 74% | 50% | | 45% | |
| 8 | 76% | 72% | 65% | 75% | 89% | 94% | 82% | 92% | 82% | 71% | 77% | 70% |
| 9 | 78% | 80% | 77% | 88% | 85% | 96% | 84% | 88% | 92% | 87% | 80% | 75% |
| 10 | 81% | 78% | 80% | 86% | 85% | 98% | 90% | 93% | 95% | 90% | 88% | 71% |
| 11 | 86% | 84% | 85% | 88% | 88% | 98% | 91% | 95% | 96% | 89% | 88% | 72% |
| 12 | 84% | 85% | 83% | 90% | 88% | 98% | 93% | 96% | 94% | 93% | 90% | 79% |
| 13 | 82% | 82% | 85% | 90% | 88% | 98% | 91% | 96% | 94% | 92% | 87% | 78% |
| 14 | 82% | 80% | 84% | 89% | 86% | 98% | 92% | 95% | 94% | 91% | 84% | 81% |
| 15 | 72% | 80% | 78% | 87% | 87% | 97% | 93% | 94% | 93% | 89% | 77% | 69% |
| 16 | 58% | 72% | 70% | 84% | 87% | 97% | 92% | 92% | 94% | 90% | 72% | 64% |
| 17 | 55% | 67% | 64% | 86% | 87% | 95% | 90% | 90% | 90% | 88% | 62% | 52% |
| 18 | | 61% | 26% | 81% | 87% | 94% | 88% | 89% | 77% | 70% | | |
| 19 | | | 1% | 75% | 84% | 90% | 83% | 85% | 60% | 10% | | |
| 20 | | | | 35% | 78% | 82% | 81% | 46% | | | | |

2021 CAISO Load vs. Daily Solar Supply

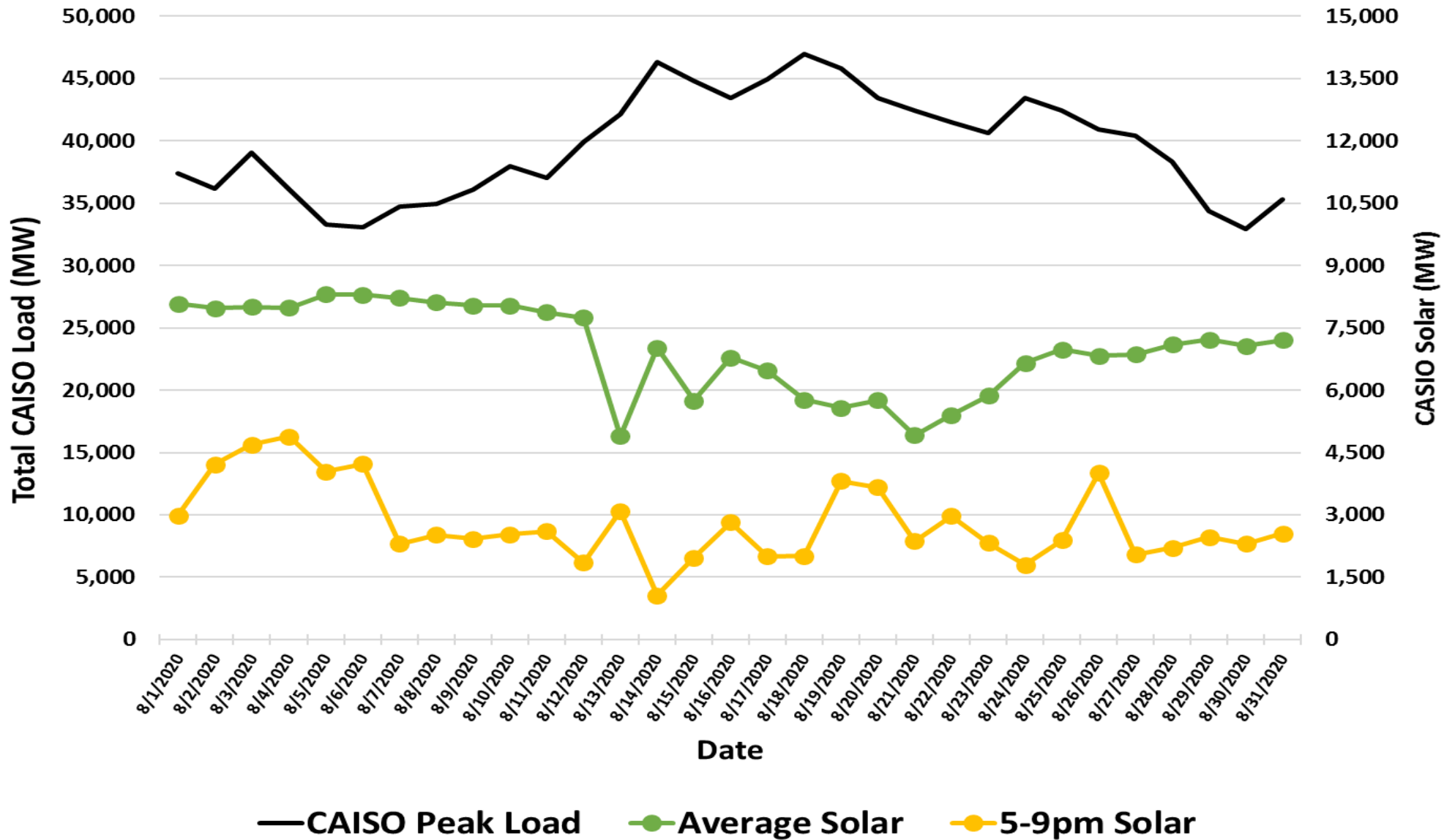


2020 CAISO Load vs. Daily Solar Supply



- June P50
- July P50
- August P50
- September P50
- June Data
- July Data
- August Data
- September Data

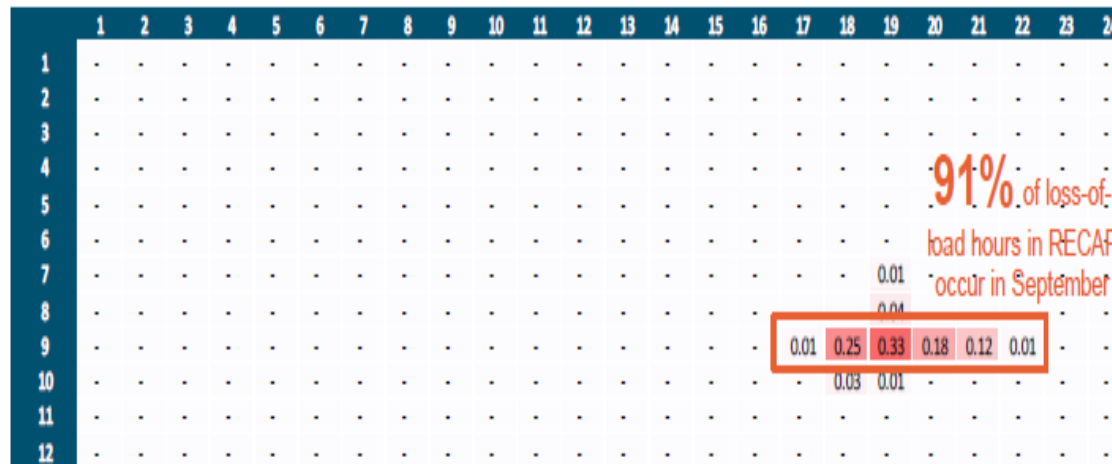
August 2020 -- Do Smoky Days Impact Solar?



Exceedance for Net Load On-Peak Hours (5p-9p)

- 5p-9p are the hours with virtually all of the LOLH/EUE
 - From E3 RECAP results, 2022 ACC Workshop slides, at Slide 25.

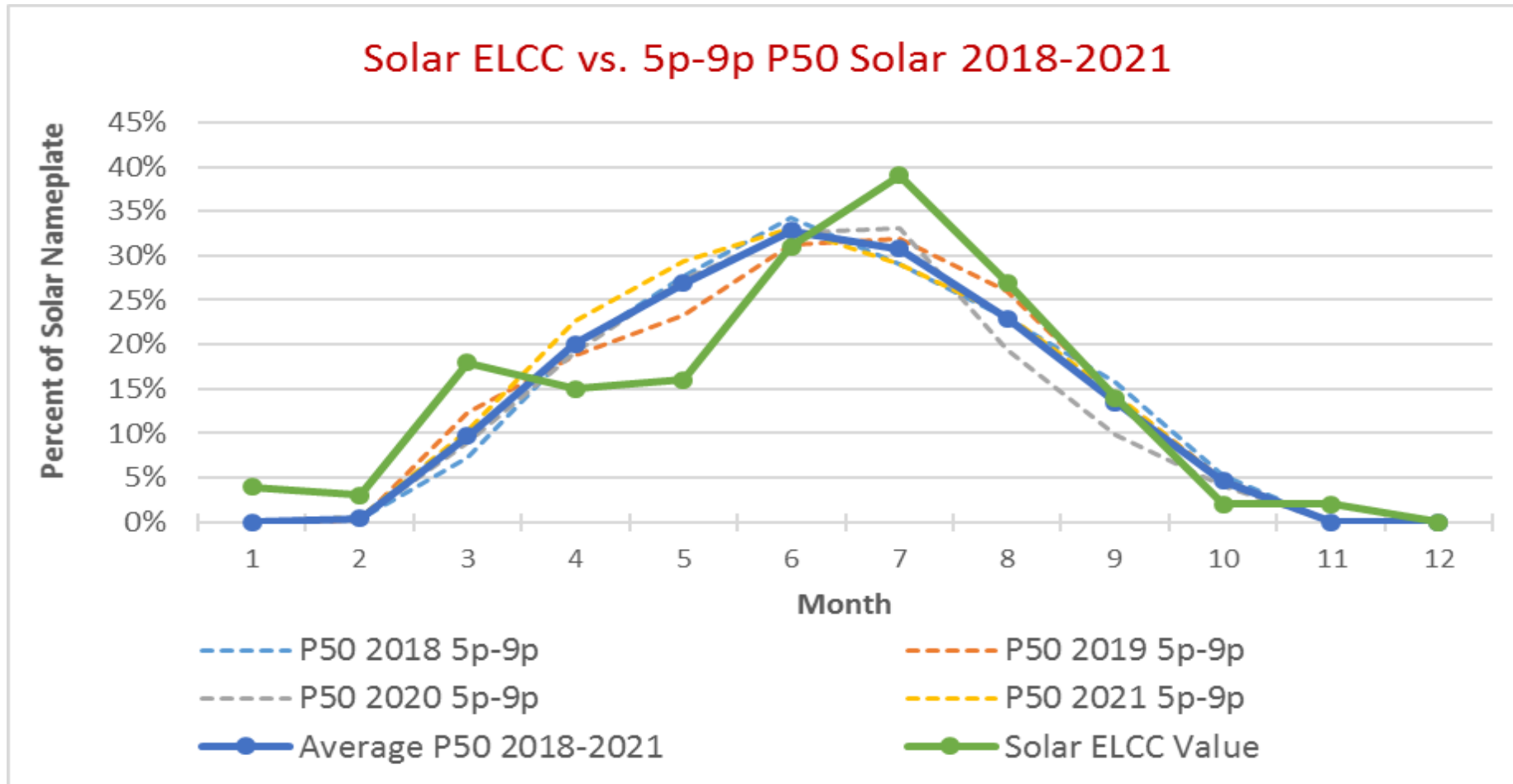
Heat Map of LOLH Based on California, 2019



- Principle: use an exceedance % benchmarked to the average ELCC

Exceedance for Net Load Peak Hours (5p-9p) - Solar

- SEIA/LSA/VS propose use of P50 (50% exceedance) for solar



Counting rule for hybrids

- Build on “additive” approach adopted in D. 20-06-03 I
- Storage component
 - Energy – determine the MWh that can be stored each day, including losses, by two hours before the net load peak. Use DC output for DC-coupled storage.
 - Counting rule: flexible up to the maximum hourly discharge capacity, use-limited by the amount of energy stored.
- Solar component
 - Counting rule: solar output less the output needed to fill storage by two hours before the net load peak.
 - Use DC output for DC-coupled storage, adjusted for inverter losses.