



# Renewables and Exceedance – A Primer

Slice of Day: Structural Elements Technical Workshop

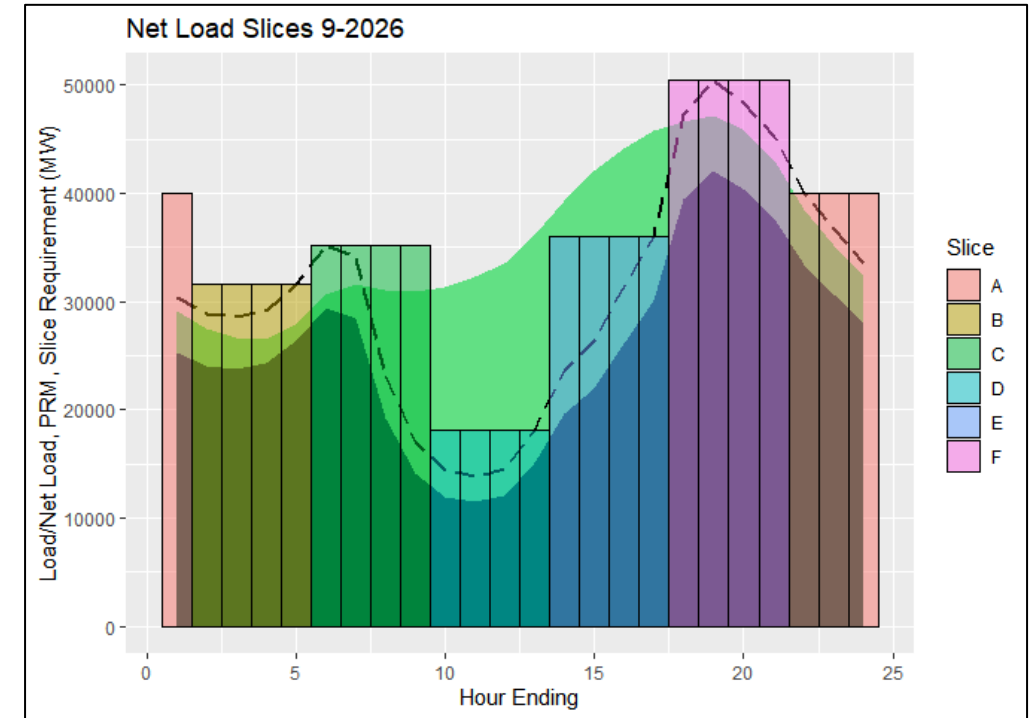
September 22, 2021



# Overview: Exceedance within Slice of Day

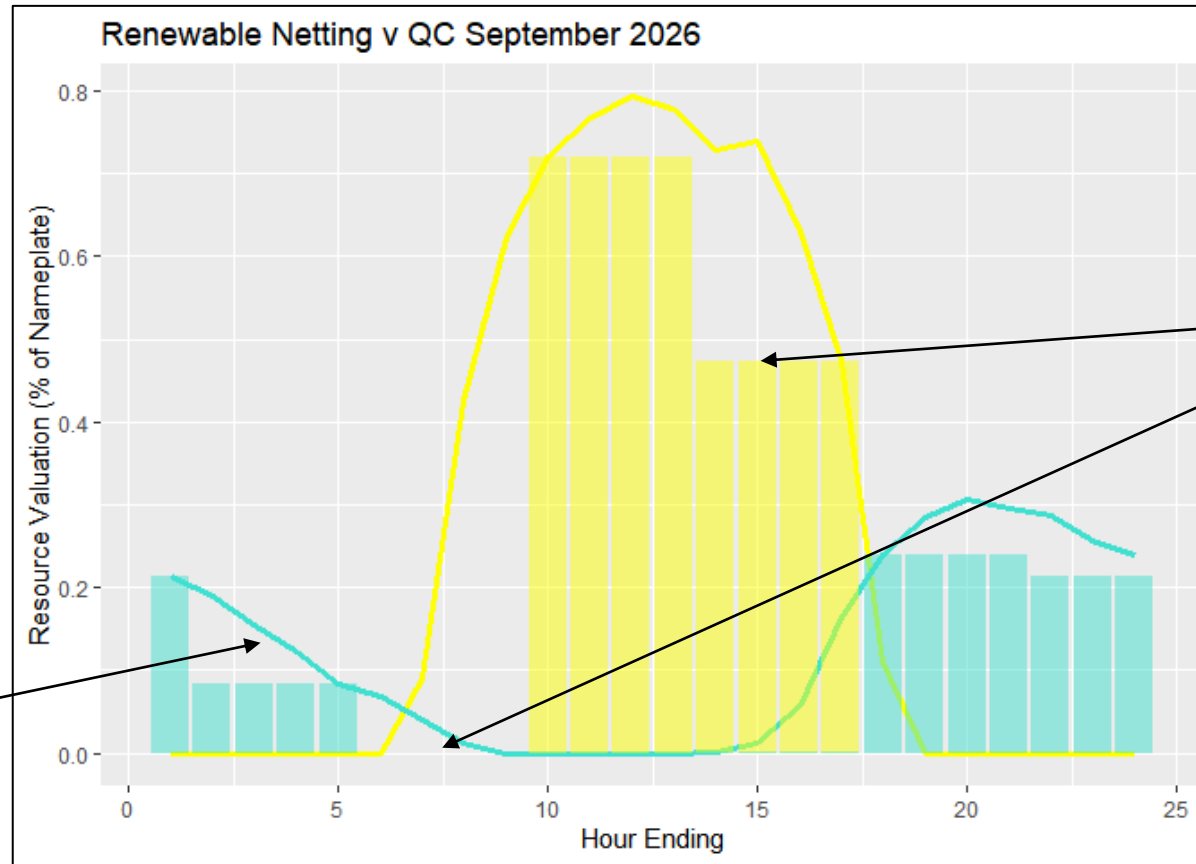
## Overview

- Growing penetrations of variable renewable resources require a more granular look at hourly resource availability for reliability planning
- “Exceedance” is a statistical approach which indicates the amount of generation one can expect from a resource a given percentage of the time
- An exceedance analysis for slice-of-day RA would likely produce month-hour pairs, e.g.:
  - At 12pm in September, we expect at least 0.87MW of solar per installed megawatt on 75% of days.
  - At 8pm in August, we expect at least 0.45MW of wind per installed megawatt on 75% of days.
- Unlike Effective Load Carrying Capability (ELCC), exceedance provides hourly estimates by month, avoids methodological debates like “average/marginal”, and requires no specialized modeling tools



**Above:** Illustrative slice requirements after netting of 45GW of solar and wind (light green) using an exceedance methodology; September 2026 forecast.

# Why Netting? Netting Vs Slice QC

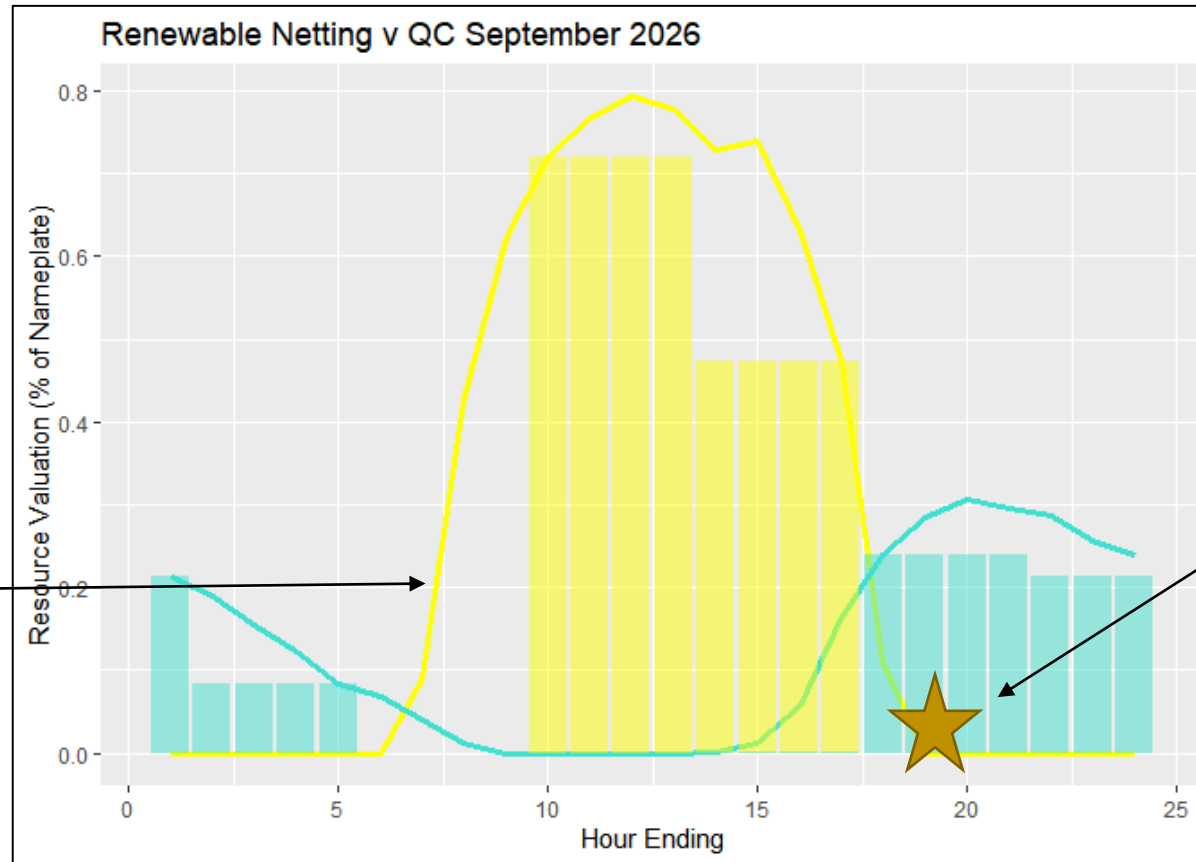


**Exceedance + Netting** contributions, however small, are captured in every viable hour.

**Slice QC**  
Binning of hours results in “weakest link” reductions for shoulder slices.

*Attempting to establish a multi-hour QC for variable renewable resources is... problematic. By necessity, QC for an entire slice cannot exceed the expected availability in any given hour within the slice, driving value to zero for shoulder slices.*

# Why Exceedance? Exceedance Vs ELCC

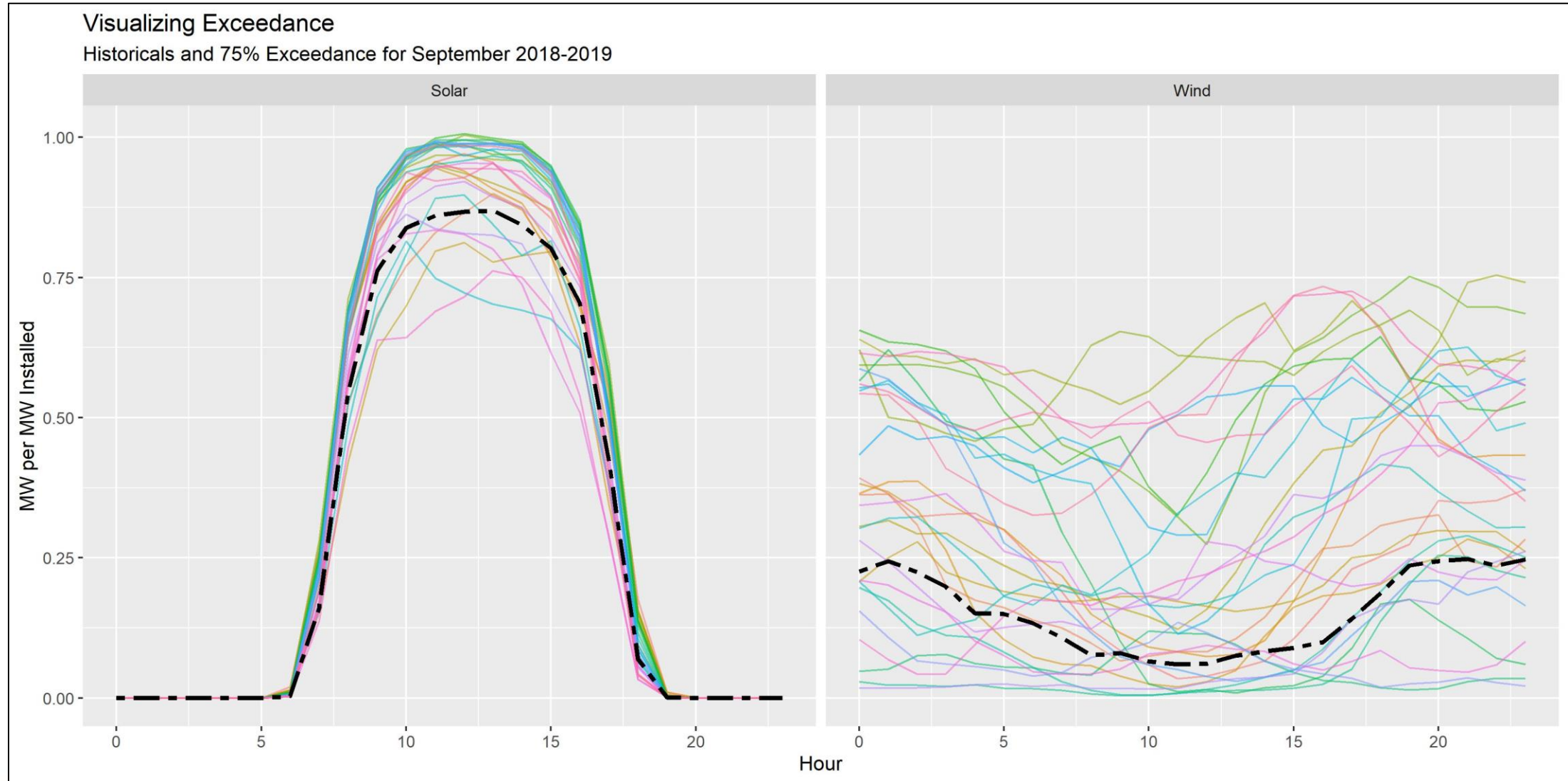


**Exceedance + Netting**  
Realistic value observed throughout the day.

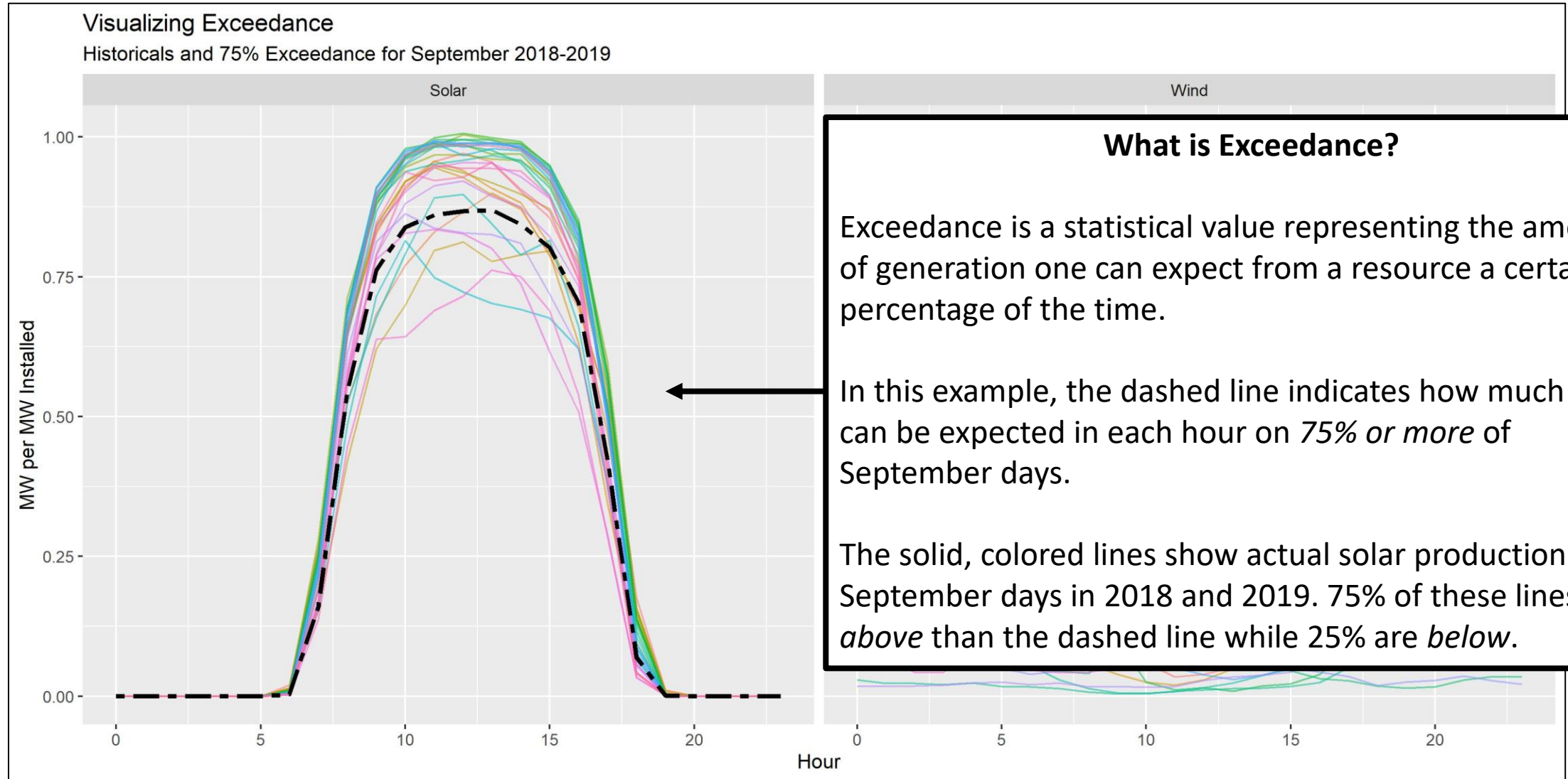
**ELCC**  
Single point value intended to compare resource to CCGT (unrealistic comparison).

*ELCC estimates a resource's ability to replace CCGT resources on the margin using a sophisticated LOLE counterfactual comparison. While it may have been appropriate on the margin ten years ago, it is not appropriate for the high-renewables era.*

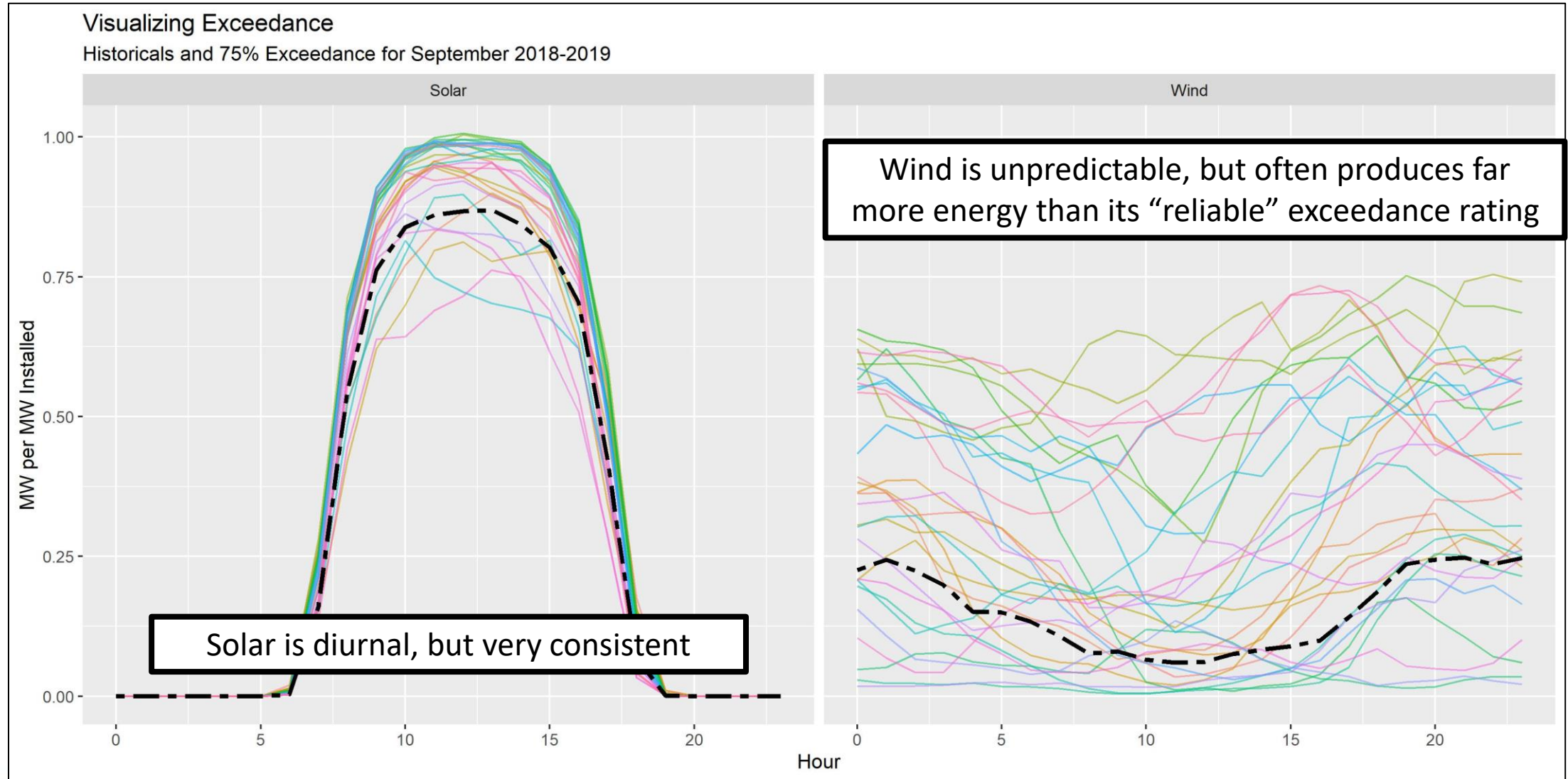
# Refresher: What is Exceedance?



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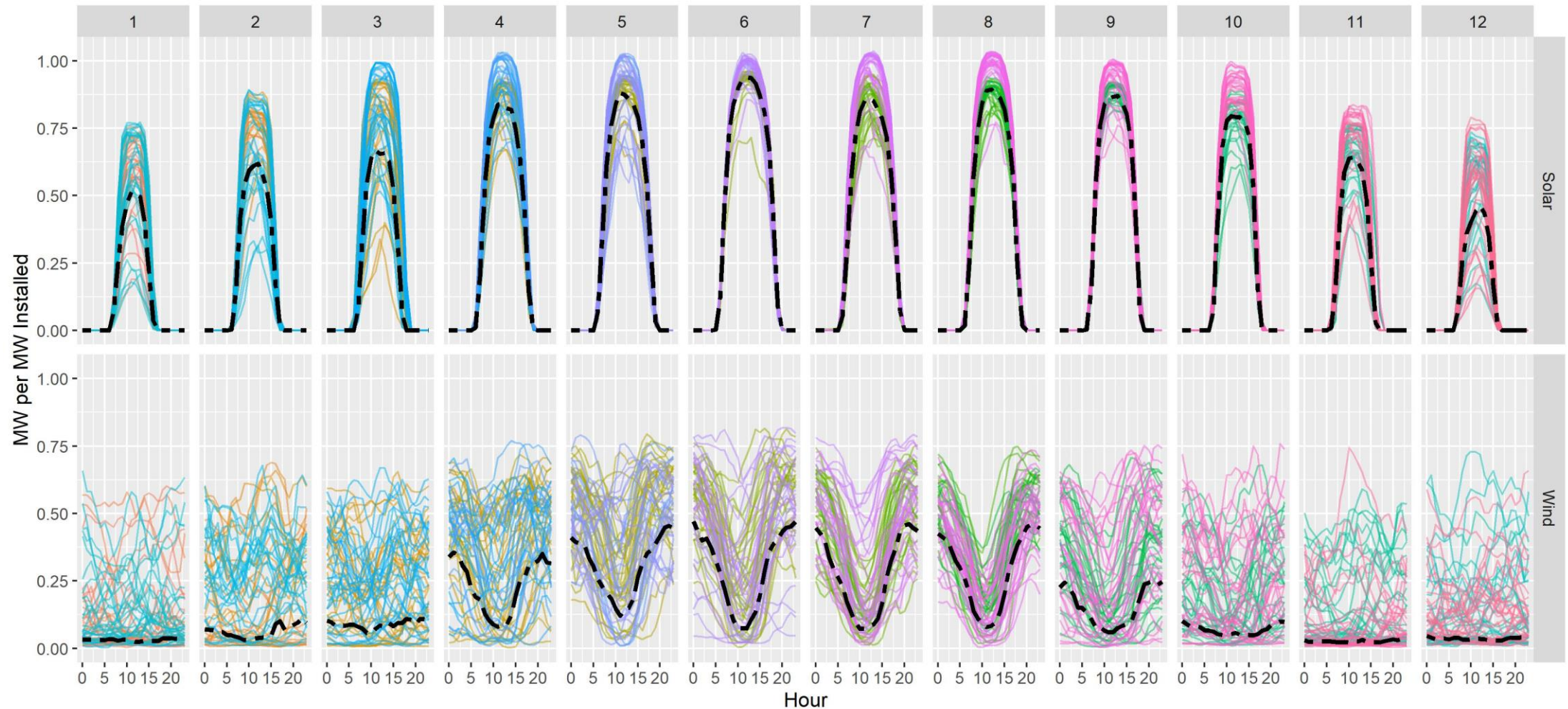


# Refresher: What is Exceedance?



## Visualizing Exceedance

Historicals and 75% Exceedance for September 2018-2019

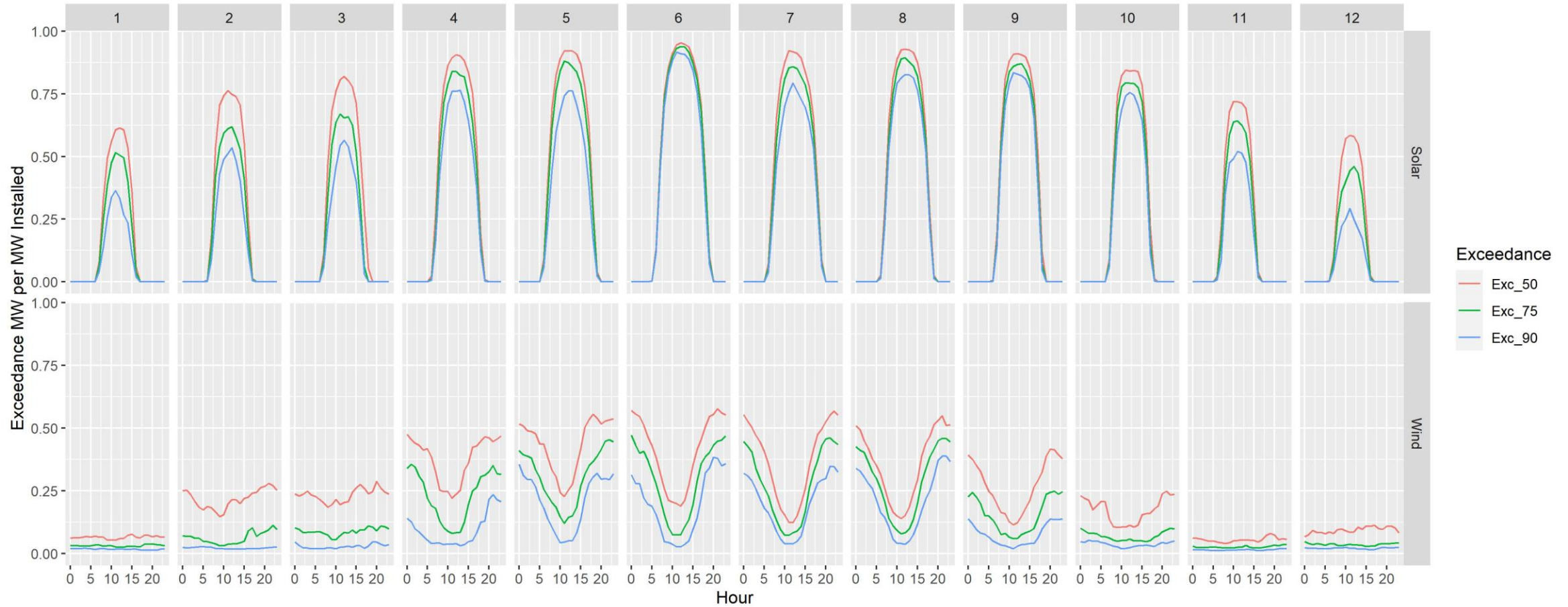


*“Capacity exceedance” may need to be differentiated from “energy exceedance.” Wind, in particular, offers substantially more energy on a daily, monthly, and seasonal basis than implied by its “reliable capacity” in any given hour.*



## Solar and Wind Exceedance Values, 2018-2019 CAISO Historicals

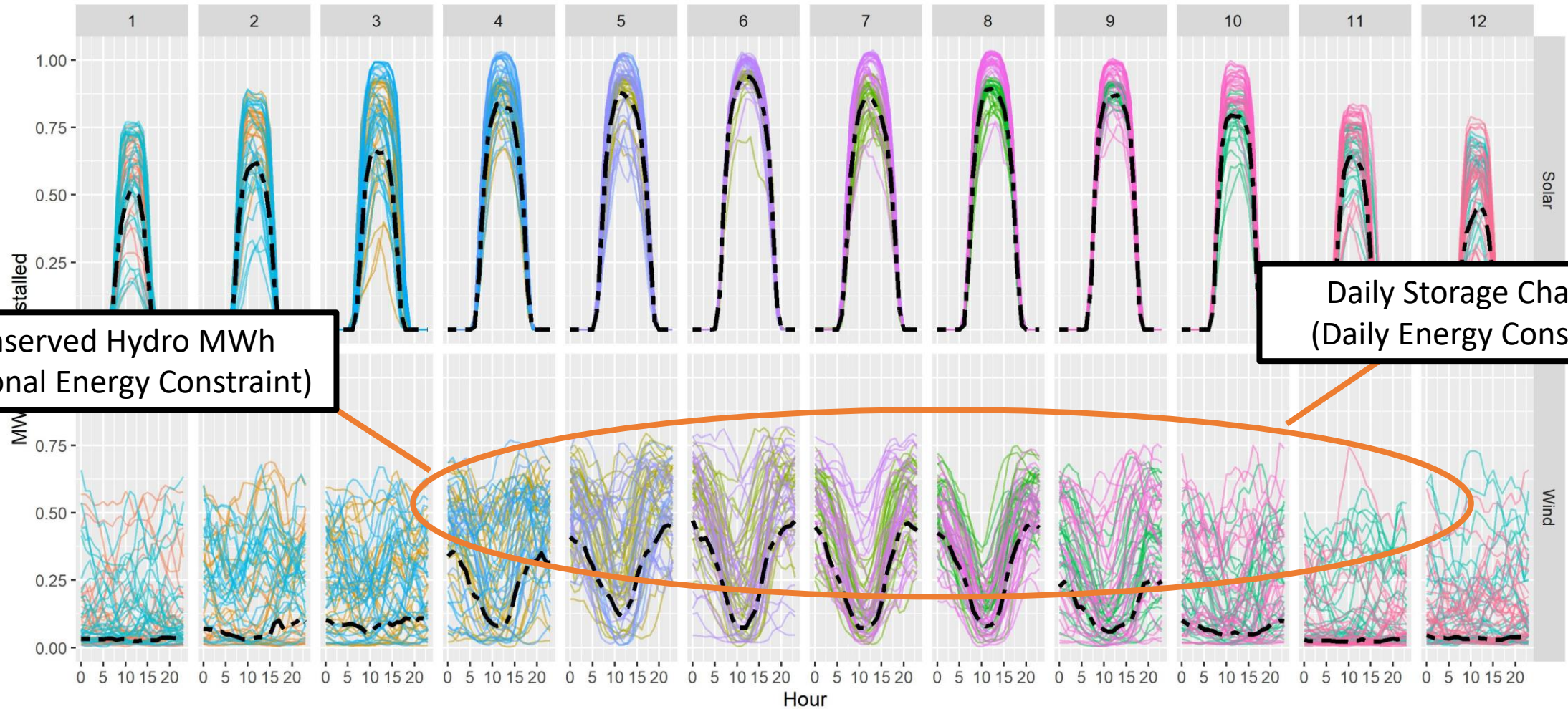
Source: 5-Minute CAISO RTD; Installed Solar: 10,483MW, Installed Wind: 5,550MW



*Parameters matters: determining an appropriate exceedance parameter and a correspondingly appropriate planning reserve margin parameter will be critical.*

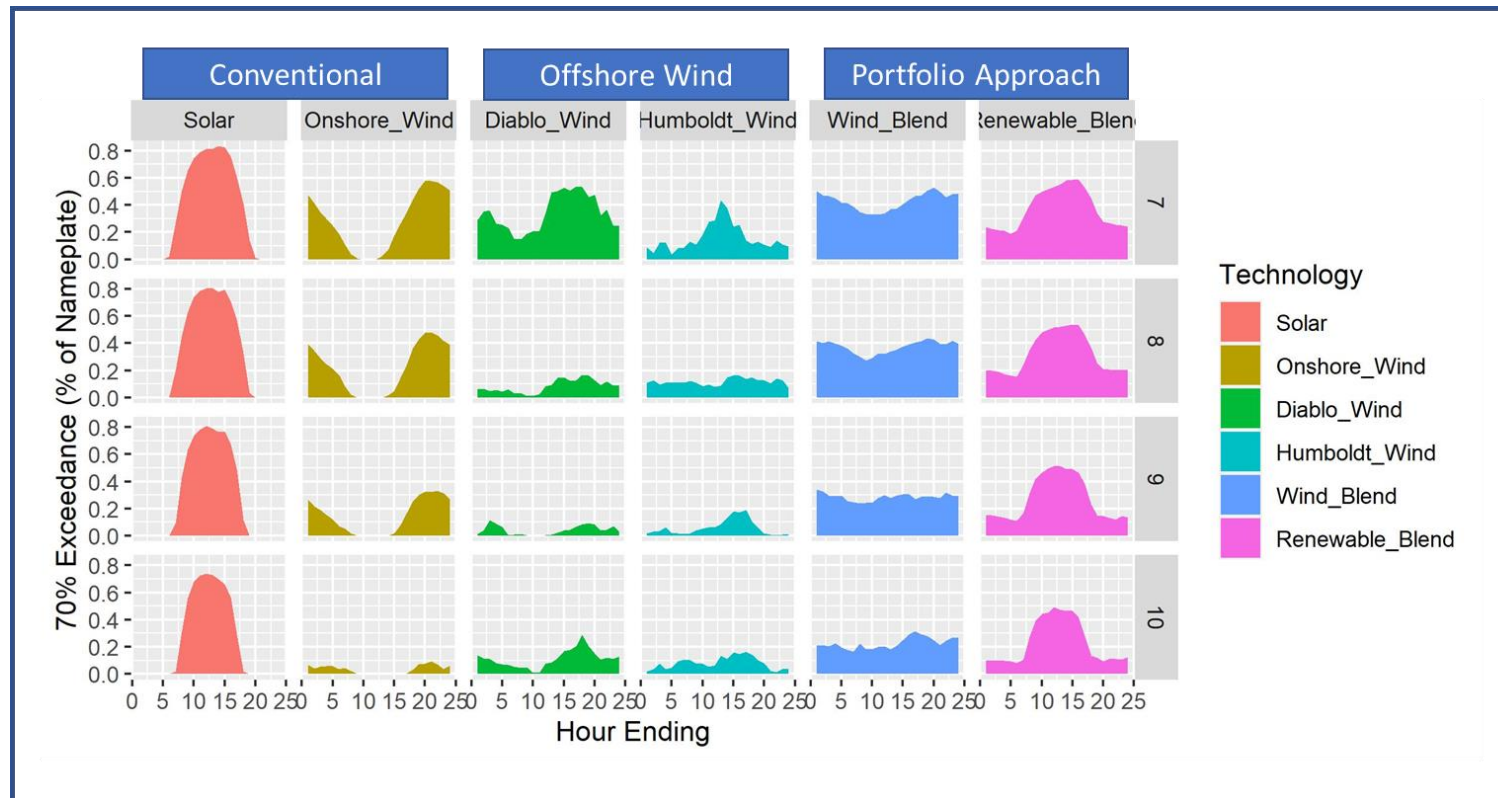
### Visualizing Exceedance

Historicals and 75% Exceedance for September 2018-2019



*Hour-to-hour capacity is necessary, but not sufficient – variable energy resources offer energy benefits which are more difficult to quantify, such as supporting hydro conservation (seasonally) and charging storage resources (daily).*

# Blended Portfolio: “Diversity Benefit”



“The wind is always blowing somewhere.” Looking at exceedance on a blended portfolio basis can provide substantial “diversity benefits” when considering the different profiles across wind regions, on-shore / off-shore, etc.

- Wind Blend = 33% Onshore, 33% Diablo Offshore, 33% Humboldt Offshore
- Renewable Blend = 50% Solar, 25% Onshore Wind, 12.5% Diablo, 12.5% Humboldt Offshore

**Note:** Illustrative only; IRP Clean System Power profiles used for lack of historical data.

# Exceedance Questions for Future Workshops

- Should alternatives to exceedance be considered?
  - Slice-based QC? ELCC?
  - Weather “archetypes” – e.g. plan for each month’s extreme weather events?
  - Other options?
- What degree of technological and locational differentiation should be supported?
  - What data should be utilized?
  - Should blended portfolios be given diversity benefit consideration?
  - Should ITC hybrid / collocated resource constraints be incorporated?
- Can or should capacity and energy exceedance values be measured separately?
  - Capacity = “Reliably expectable” capacity per hour
  - Energy = “Reliable expectable” energy per slice
- How much specialization is feasible / desirable?
  - What degree of specialization and “fancy math” can be supported in regulatory guidance and standardized templates?
  - Do the benefits of avoided overprocurement and precision outweigh administrative impact?

# QUESTIONS AND DISCUSSION

## Slice of Day: Structural Elements *Renewables and Exceedance*



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# Appendix: Data Sources

- **Solar and Wind Profiles:**
  - Slides 5-10: CAISO Historicals 2018-2019
    - Installed wind 5,550MW
    - Installed solar 10,483MW
  - Slides 3-4, 11: IRP CSP Profiles, June 2020 Version
- **Demand:** IEPR 1-in-2 CAISO Load 2020-2030
- **Future Resources (Needs Refinement):**
  - NQC List
  - RSP (Solar and Wind)
  - IRP Mandate (Storage, Geothermal, LDES)
  - Planned Retirements