DR Education and Review

A Summary of Education to Date and Implications for Next Steps
Market Implementation Committee
9/11/2024

Presented by DR Coalition

DR Coalition Sponsors

- Advanced Energy Management Alliance
  - Most members are PJM members
  - Voltus is AEMA member
- PJM Industrial Customer Coalition
- CPower
- Enel
- NRG Curtailment Solutions, LLC

Agenda

- Two Categories of Stranded DR in Winter
- Changes Required to Access Winter DR
- How we got to this point
  - Summary of educational presentations to date
  - Recap of Key Takeaways from educational sessions
  - PJM ELCC Modeling of DR

Two Categories of Stranded DR in Winter

Two Sources of “Stranded” Winter DR

1. **Stranded by requirement to use lesser of summer & winter ICAP**

   With CIFP, reliability risk shifted from summer (95% +) to winter (~90%) with no change in DR construct.

   - There is a legacy Summer DR option – excess DR is summer has value.
   - There is no Winter DR option – excess DR capability in winter has no value.
   - Result – winter DR capability is not captured.

2. **Stranded by Availability Hours**

   With CIFP, winter risk is spread over more hours of the day.

   - The legacy winter availability window ignores DR capability available in more than 20% of high-risk hours.

Stranded Winter DR Increases Costs to Load

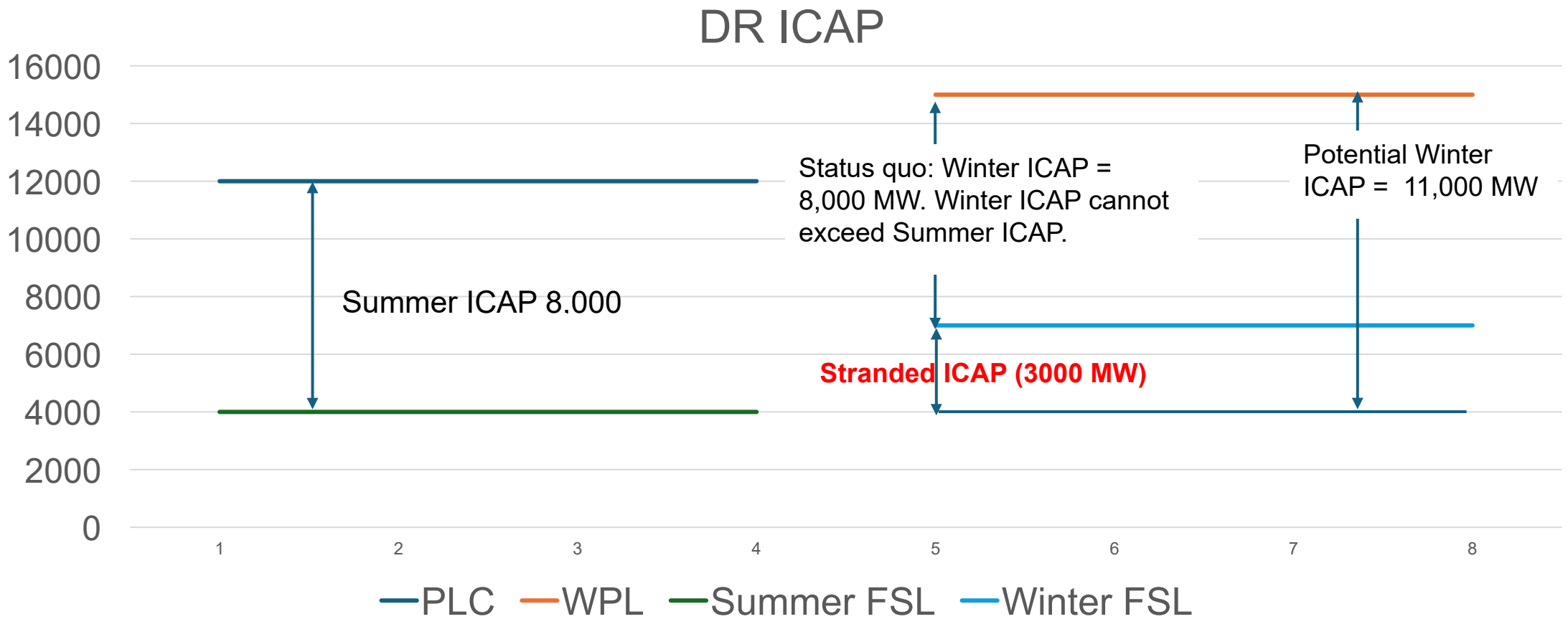
- At the August MRC PJM indicated that for 25/26 BRA Excess Capacity was reduced by 2,682 MW due to the CIFP changes. At least half of this appears to be DR.

- Including 1300 MW of DR would have moved the clearing price down to approximately $210/MWd

- **Removing 1300 MW of DR increased cost for load by $2.96B**
  - Calculated as follows: $60/MWd x 135,000MW x 365 = $2.96B

DR Stranded by Summer ICAP Limitation

Key takeaway - Capping ICAP at the lesser of Summer and Winter capability results in stranded energy capability in winter.



PJM Data Shows Excess Winter ICAP

Data Element	2021/22	2022/23	2023/24	2024/25
Summer Peak Load Contribution (PLC)	14,909	15,918	15,242	13,973
Summer Firm Service Level (FSL)	7,290	7,406	7,355	6,591
Summer Nominated Value	7,314	8,174	7,568	7,053
Winter Peak Load (WPL)	16,206	15,517	15,888	14,012
Winter Firm Service Level (WFSL)	9,433	8,870	8,845	8,132
Winter Nominated Value	8,832	9,073	8,202	7,414
Winter excess Nominated ICAP	1,518	899	634	361

The Winter excess Nominated Value <u>understates</u> the potential value because under the status quo CSPs have no incentive to offer more.

Changes Required to Access Stranded Winter DR

Opportunities to Access Winter DR

- Expand the Availability window

- Revise approach to winter DR energy drop estimates to address stranded energy drop created by summer ICAP limit
  - Option 1:
    - Review WPL methods along with winter FSL
  - Option 2:
    - Provide for winter ICAP accreditation, separate from summer ICAP limit

How We Got to This Point

PJM ELCC modeling

A key element of PJM ELCC modeling is to estimate the load that must be met by generation after DR is dispatched. ELCC modeling for DR credits DR with the estimated *energy drop* available from dispatched DR. The DR ELCC is the ratio of modeled *energy drop* to the registered ICAP. The approach can be boiled down to 4 steps.

- **Step one** – Forecast overall PJM Load.
- **Step two** - Estimate how much of any hour's load forecast consists of DR registrations (DR Load). Today, PJM estimates this as a ratio of expected load to the summer 50/50 peak forecast times the DR PLC/WPL, i.e. scaled DR Load.
- **Step three** – Subtract the FSL from the scaled DR Load to determine the energy drop.
  - In Summer, risk hour loads are higher than the 50/50 forecast, This results in energy drops higher than ICAP and is reflected in the historical outcome of DR UCAP > DR ICAP.
  - In winter, risk hour loads are lower than the 50/50 forecast. This results in energy drops less than ICAP.
  - *With most risk now in winter, this results in an ELCC less than 1.0.*
  - The aggregated hourly ratio of energy drops to ICAP is the ELCC.
- **Step four** - The aggregate DR hourly *energy drop* is subtracted from the hourly load forecast to determine the load to be served by generation.

Summary of Educational Sessions to Date

There Have Been Four Key Educational Sessions

- 2/16/2024 PC ELCC Education – PJM ELCC Presentation
  - Showed how PJM models ELCC for all, including DR
- 6/5 MIC – PJM presentation:
  - Showed data on Winter Peak Load (WPL), aggregate DR load data from WPL days, and (limited?) energy settlement data from Winter Storm Elliot
- 7/10 MIC – Voltus presentation:
  - Showed aggregate metered load data available outside winter Availability Hours
  - Showed representative summer and winter DR load and impact of peak load shaving on summer and winter ICAP
- 8/7 MIC – PJM presentation:
  - Showed ”metered DR” available for dispatch compared to PJM’s prediction on selected winter days

Risk Has Shifted From Summer to Winter & PJM Needs DR in Shoulder Hours

(2/16/24 PJM ELCC education presentation)

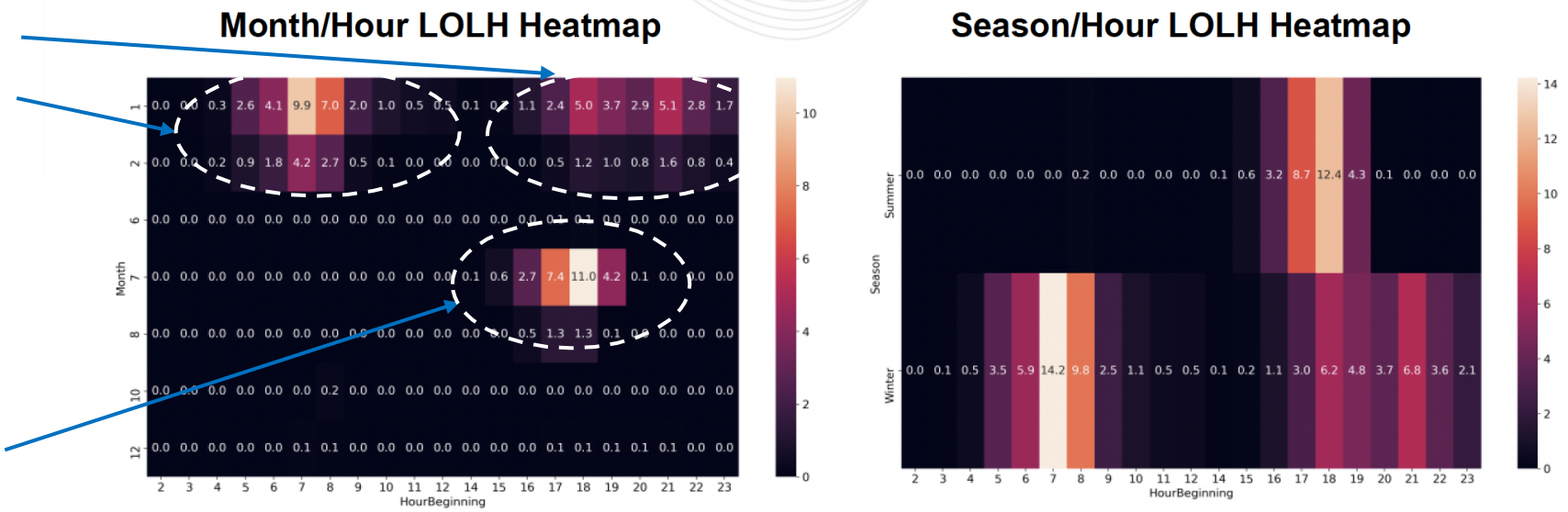
Feb. 2024 Results: LOLH Heatmaps

Key Points:

- DR is needed in winter and in shoulder hours

- Winter risk hours = 5 – 9 AM and 5 – 11 PM

- DR was designed to relieve summer peak



How PJM Models DR in ELCC Models

(2/16/24 PJM presentation to MIC)

Key Points:

- DR availability is assumed to be zero in winter outside the PJM defined performance windows

- DR availability is modeled proportionate to PJM load and DR ICAP

DR ICAP calculation:

Summer ICAP = PLC – (FSL*Loss Factor)

Winter ICAP = WPL - (FSL*Loss Factor)

Annual ICAP = lesser of winter & summer, no greater than summer

Demand Resource Dispatch

- Demand Resources (DR) have performance windows depending on the season

	Capacity Performance DR	Summer-Period DR
Summer Months	10:00AM to 10:00PM EPT	10:00AM to 10:00PM EPT
Winter Months	6:00AM to 9:00PM EPT	NA

- DR is dispatched prior to limited duration resources, when available during the relevant performance window

- DR availability during performance window is modeled to be scaled proportional to system load.

$$\frac{Simulated\ HourlyLoad_i}{50/50\ Simulated\ Peak\ Load\ Forecast} \times Nominated\ ICAP\ of\ DR$$

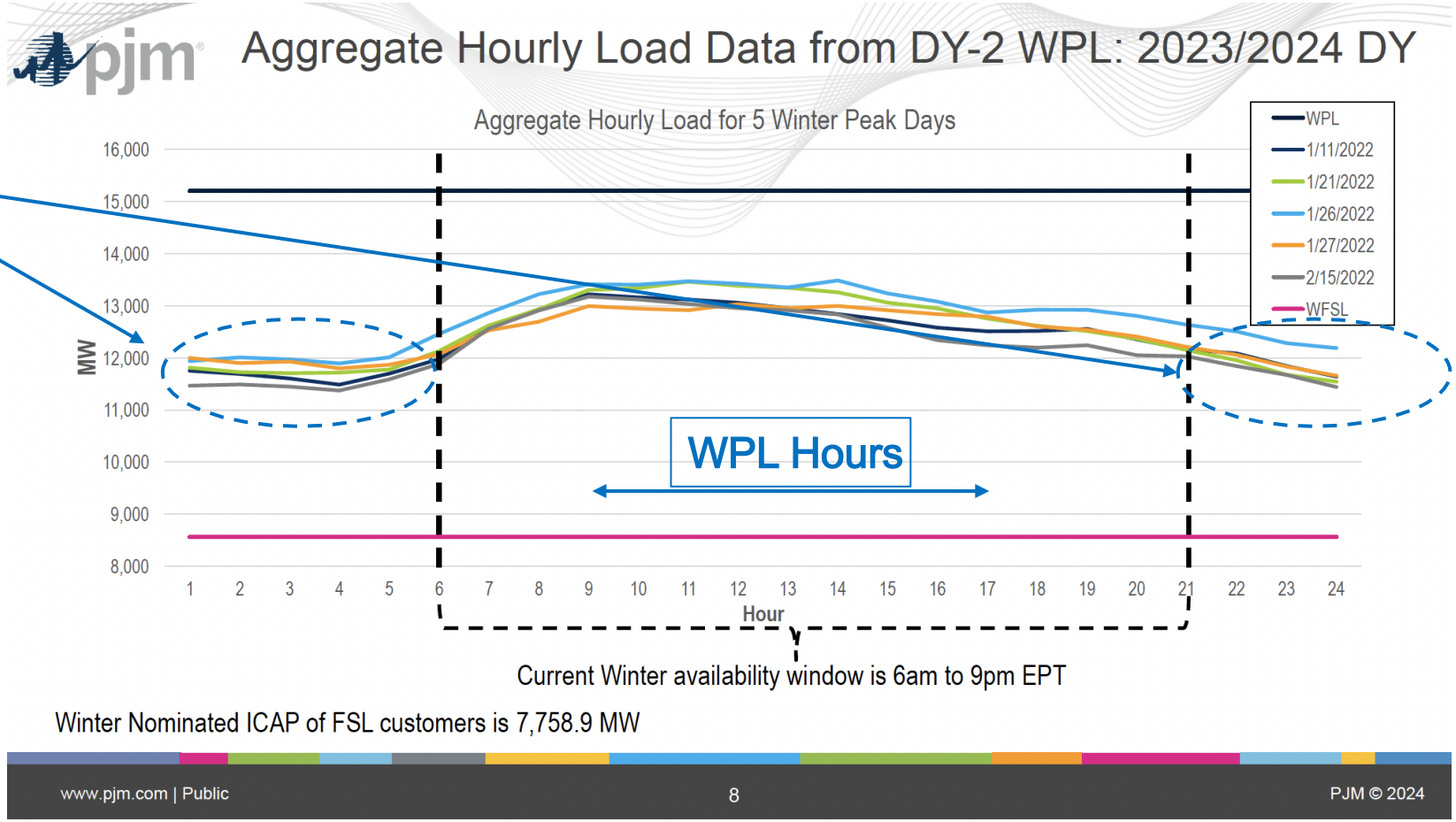
Comparing Aggregate DR Load to WPL and FSL on Selected Winter Days

(6/5/24 PJM presentation to MIC)

Key Points:

- DR is available outside the availability window

- Aggregate WPL for DR will be greater than the sum of registration's load for these hours as WPL is measured between 9 A – 5 PM on peak winter load days



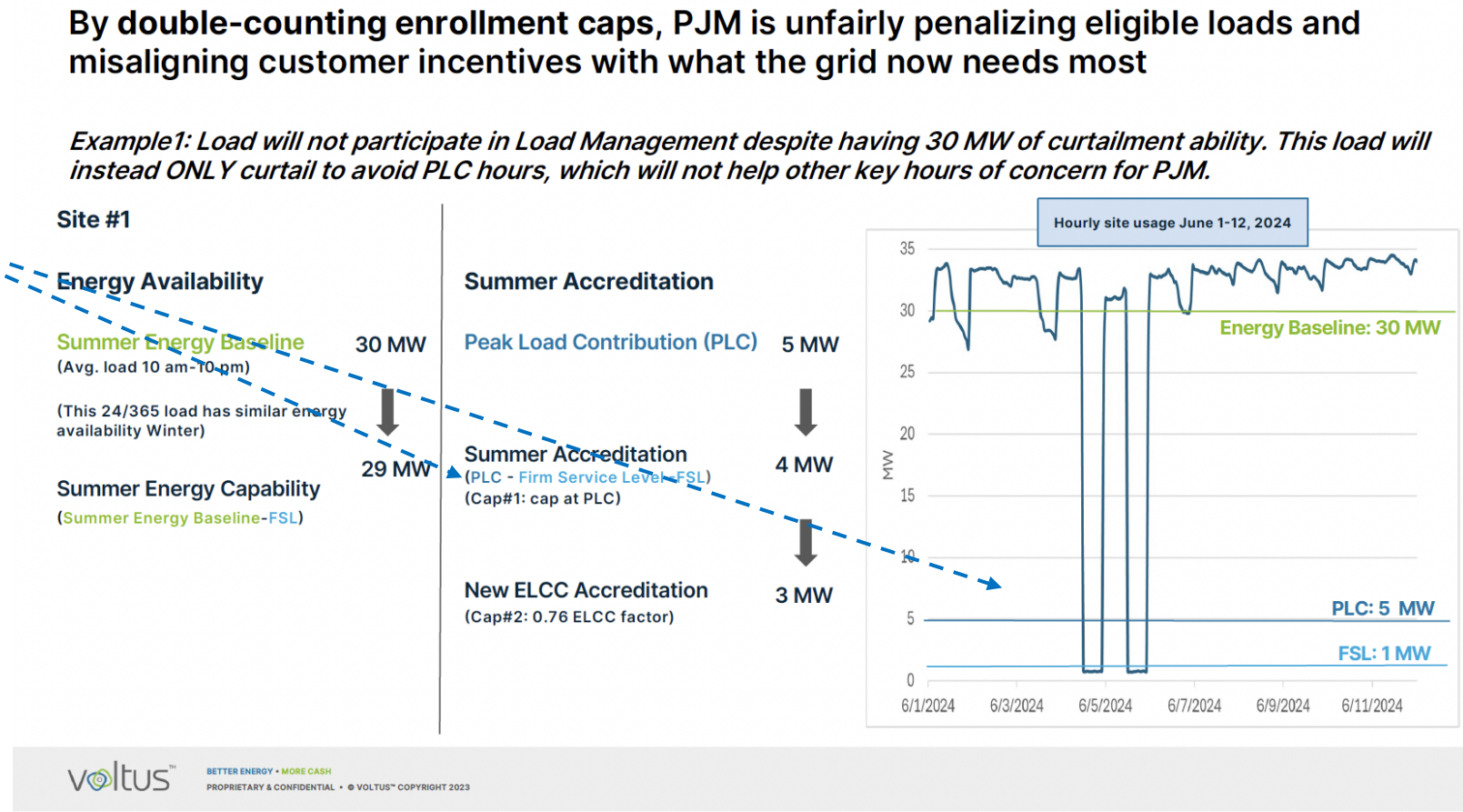
Data from Voltus Customers Shows Impact of Peak Shaving on PLC Calculation

(7/10/24 Voltus presentation to MIC)

Key Points:

- Summer ICAP is limited by the low PLCs that result from peak shaving.
- Even though WPLs can be higher than PLCs with winter and the same as summer FSLs, ICAP is limited to the Summer capability.

Manufacturing load and generation (not weather sensitive) represents 73% of DR MW.



Winter ICAP is Limited by Summer ICAP

(7/10/24 Voltus Presentation to MIC)

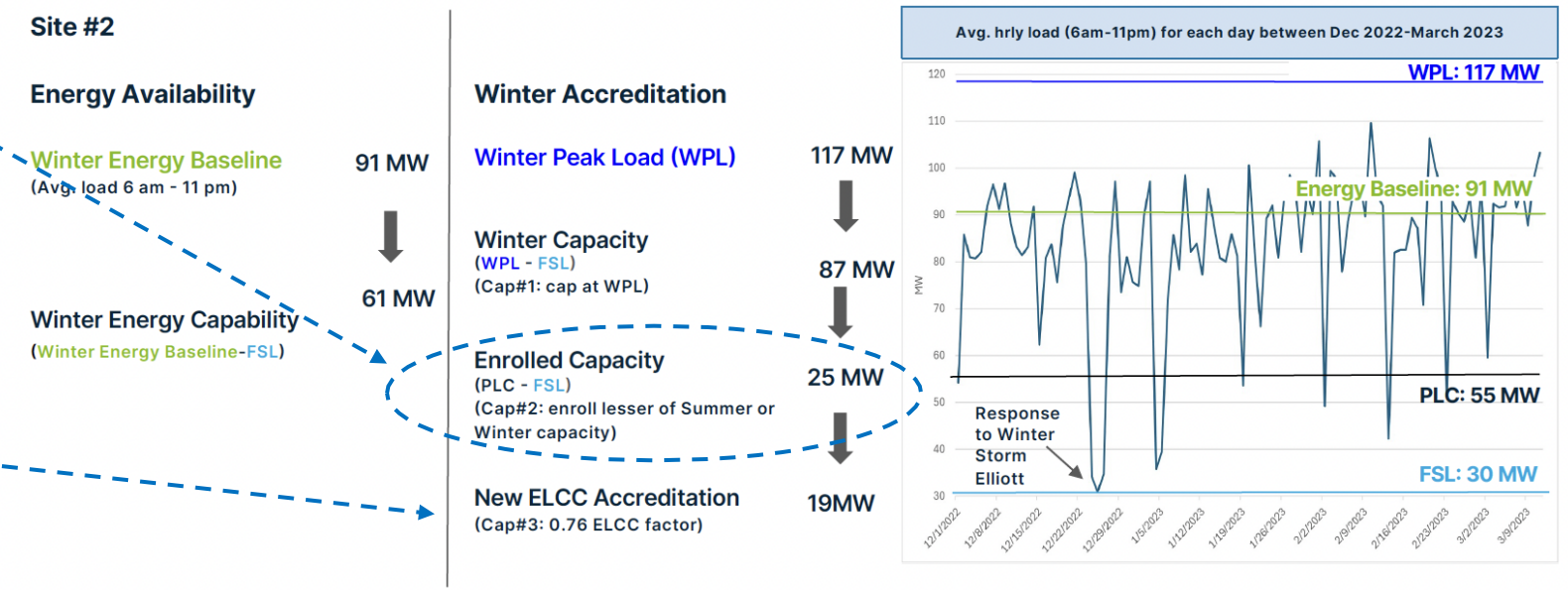
Key Points:

- Enrolled winter capacity is the lesser of summer & winter ICAP

- Combined with ELCC accreditation modeling (which assume zero DR outside availability hours) this creates stranded winter DR availability

By flooring enrollments at the lesser of their seasonal availability, PJM is especially penalizing eligible loads during winter hours of concern

Example2: Load is available for 61 MW against an energy baseline (CBL), but will only be accredited for 19 MW (< 50%)



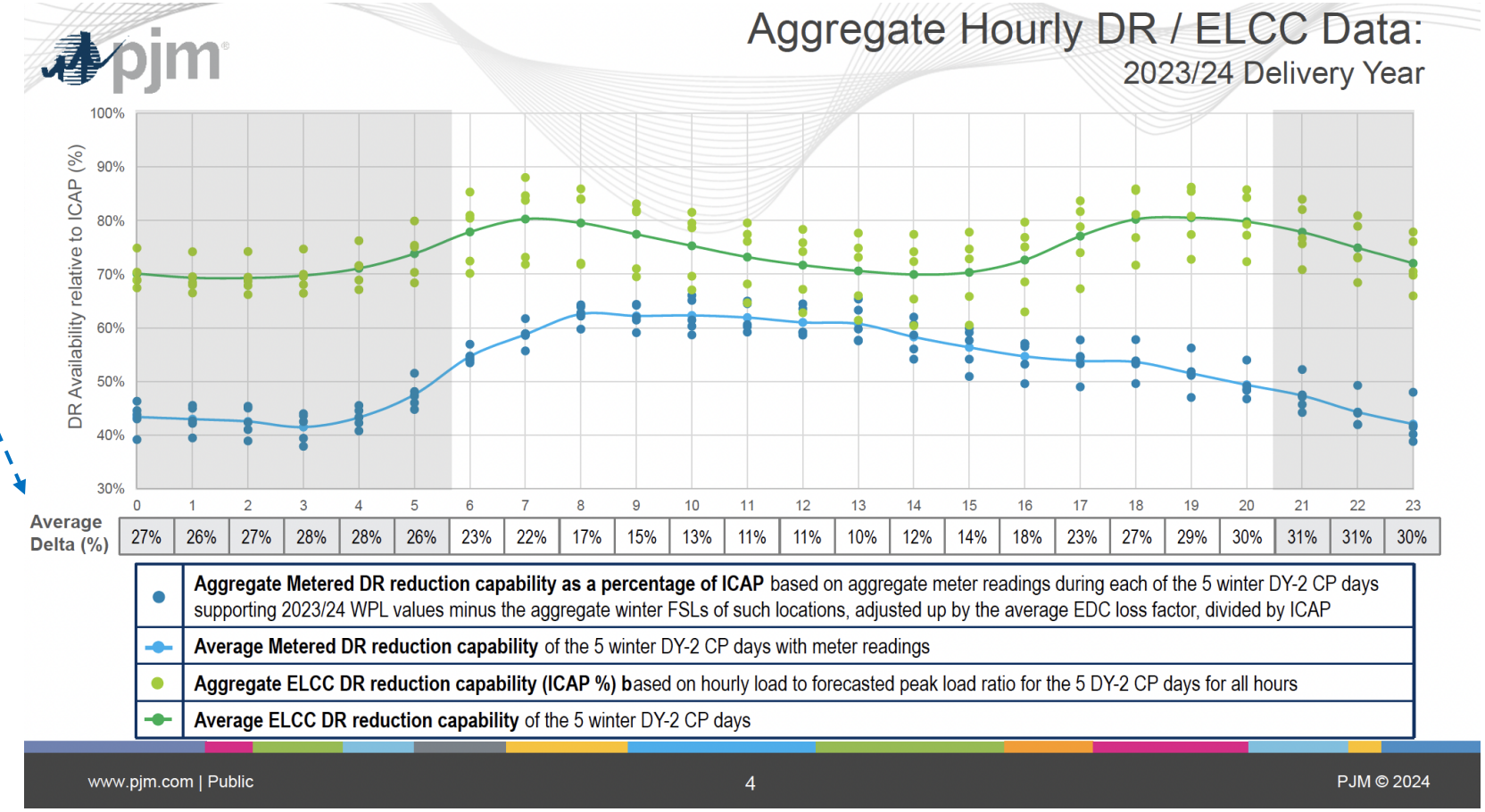
PJM's Modeling Approach for DR in Winter Needs Improvement

(8/7/24 PJM presentation to MIC)

Key Points:

- Accuracy of PJM's model of DR load in winter ranges between 10% to 31% on average and needs to be improved

- While it appears that PJM's model is overpredicting DR availability and allocating higher ELCCs, in fact it is unclear if DR ELCC is too high or too low since PJM forces DR availability to zero outside availability hours



Recap of Key Takeaways from Education Sessions

- PJM needs DR in winter shoulder hours to mitigate risk
- Current PJM approach precludes DR from participating in risk hours
- DR load is available in winter risk hours
- WPL overstates available DR load in winter (WPL hours do not align with availability window or risk hours)
- Winter ICAP is potentially greater than Summer ICAP, but under current approach Winter ICAP is limited Summer ICAP -> this approach creates stranded ICAP
- Accuracy of PJM ELCC model in winter to predict DR load ranges between 10% and 31% on average
- PJM's ELCC modeling for winter should reflect actual capability for both DR Load along with more accurate WPL and FSLs.

Questions

- Presenters
  - Bruce Campbell – bruce@campbellea.com
    - Consultant for DR Coalition
  - Kerinia Cusick - kcusick@center4ri.org
    - Consultant for Voltus