DR Availability Window:
PJM Package

Pat Bruno
Market Design

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Background: DR Nominated Value and ICAP

For Firm Service Level (FSL) customers, Nominated Value and ICAP are based on the difference between customer's Peak Load and FSL in each season

Summer Nominated Value = PLC – SFSL (adjusted for loss factor)

- Peak Load Contribution (PLC) = customer's load usage during PJM system 5 summer coincident peak days and hours (EDC-specific calculation)
- Summer Firm Service Level (SFSL) = pre-defined level for which a customer's load can be reduced to when dispatched in the summer

Example:

PLC = 10 MW

SFSL = 0 MW

Summer Nominated Value = 10 MW

Winter Nominated Value = WPL x ZWWAF – WFSL (adjusted for loss factor)

- Winter Peak Load (WPL) = Average of customer's specific peak hourly load between HE7 through HE21 on the PJM defined 5 coincident peak winter days
- Zonal Winter Weather Adjustment Factor (ZWWAF) = Weather normalization factor
- Winter Firm Service Level (SFSL) = pre-defined level for which a customer's load can be reduced to when dispatched in the winter

Example:

WPL = 12 MW

ZWWAF = 1.0

WFSL = 0

Winter Nominated Value = 12 MW

Annual ICAP of Demand Resources = lesser of Summer and Winter Nominated Values

Background: Simulated DR Availability in ELCC Model

- Demand Resources have performance windows that differ by season

Summer	Winter
10:00AM to 10:00PM EPT	6:00AM to 9:00PM EPT

- In the ELCC analysis, DR availability during hours within the performance window is modeled to be scaled proportional to system load

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

- DR availability during hours outside of the performance window is assumed to be zero

Review: DR Analysis and Observations: Winter Peak Load (WPL)

- Winter Peak Load (WPL) values are used to determine the winter nominated value of DR customers and registrations
- The current WPL calculation uses the average of each customer's specific maximum hourly load between HE7 through HE21 on the five PJM defined winter coincident peak days (5WCP), with limited exception

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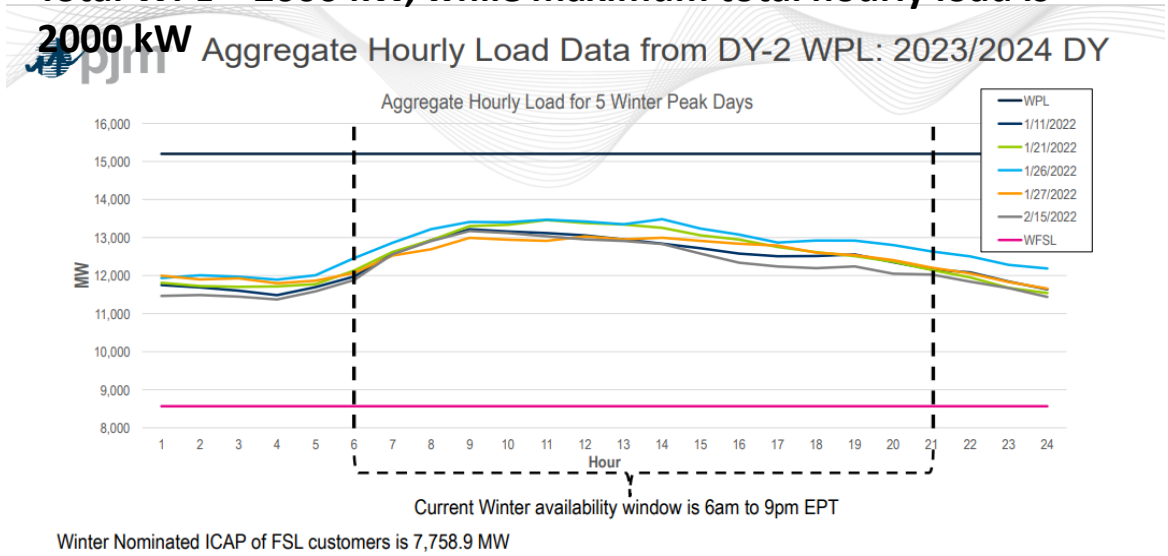
- When this formula is used for many individual customers, it results in a total WPL that overstates the expected load and corresponding reduction capability of the DR fleet in any one hour, as different customers experience their peak loads at different times of the day
  - *This issue is illustrated in the simple example at right*
  - *Observed in DR registration data for different DYs when comparing aggregate WPL to the total hourly loads of customers during the 5 winter peak days*

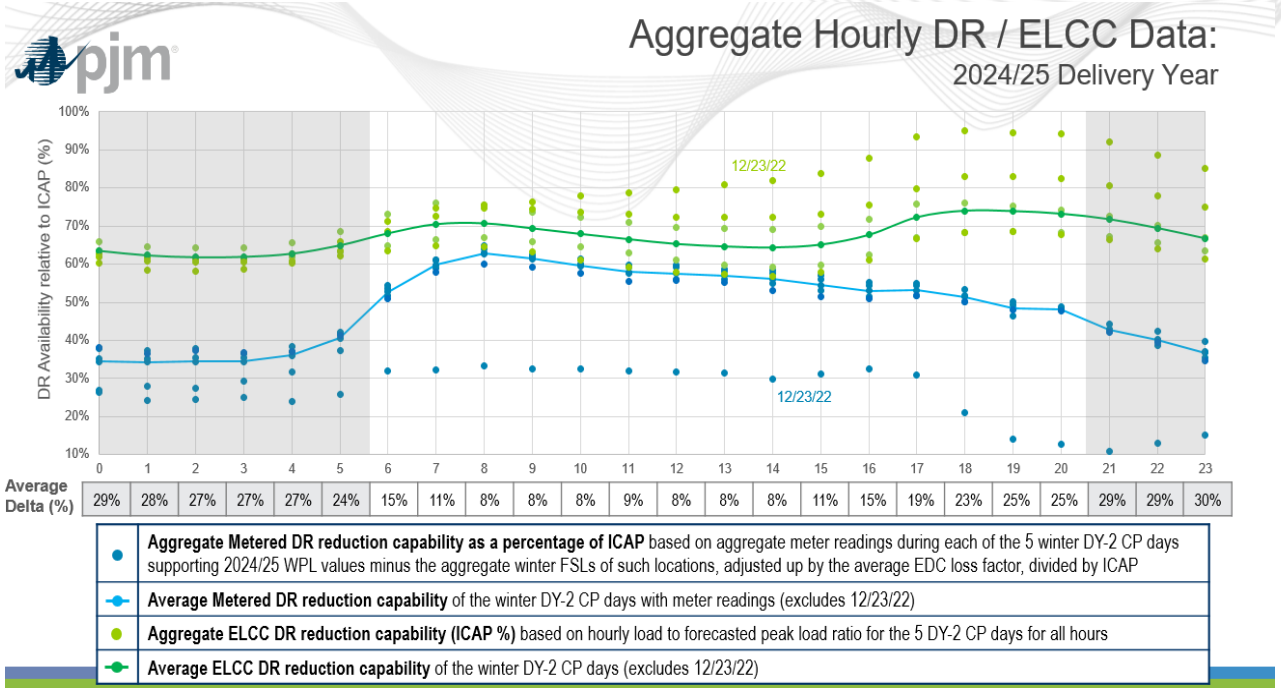
Example Customer Load (kW) during 5 winter peak days

Customer	7AM	8AM	9AM	5PM	6PM	Max
A	500	600	500	500	500	600
B	500	700	1000	400	400	1000
C	500	500	500	1000	900	1000
Total	1500	1800	2000	1900	1800	**2600**

Total WPL = 2600 kW, while maximum total hourly load is 2000 kW



Review: DR Analysis and Observations: Winter ELCC Modeling vs. Historical Loads



Presented at the Aug. 7 MIC, the figure above compares the estimated reduction capability of DR based on the aggregate hourly metered loads of customers during the 5 winter peak days minus winter FSL (in blue) to the reduction capability used in the ELCC analysis during those same days (in green), as a percentage of winter ICAP for the 2024/25 DY

- The current ELCC heuristic (green line in figure) tends to overestimate the reduction capability of DR during winter hours within the performance window, and would further overestimate reduction value if extended for hours outside the current performance window
- There is a fairly significant amount of load above the WFSL from DR customers today in hours outside the current performance window, such that expanding the window to include those hours could provide substantially more reduction capability and reliability value from DR that is not captured today
- The aggregate hourly load shape of DR customers in the winter tends to have a different shape than the system load (slow decline after the morning peak with no second peak)

PJM Proposal

Design Component	Status Quo	Solution Option
DR Availability Window	**Summer:** 10AM-10PM EPT **Winter:** 6AM-9PM EPT	Extend the current DR performance window to 24 hours and reflect expected reduction capability in all hours in ELCC analysis and other RA studies. **Key Benefits** • Captures the load and curtailment capability of existing DR customers in the risk analysis and accreditation during hours of reliability risk outside the current window • Improves incentives to have CSPs sign up customers that are capable of responding during any hour of reliability risk and sets performance expectations for existing / new DR customers to respond at such times • Improves parity with generation resources that have 24x7 performance obligations *Note: This solution option would only be considered in conjunction with other reforms to improve modeling of DR capability in extended winter hours.*

PJM Proposal (cont'd)

Design Component	Status Quo	Solution Option
DR ICAP: **Winter Nominated Value**	Winter Nominated Value = (WPL * ZWWAF – WFSL) * Loss Factor WPL (Winter Peak Load) based on each customer's peak usage between HE7 through HE21 during 5WCP days ZWWAF (Zonal Winter Weather Adjustment Factor) WFSL (Winter Firm Service Level)	Modify the WPL calculation to be based on the customer's load during a consistent peak hour across the 5WCP days to address overstated WPL issue. Initially proposing to use an hour during the morning peak of the winter (i.e. HE9) where we see the highest aggregate load levels of DR customers, most of the winter loss-of-load risk, and most of the recent historical winter coincident peak hours (to be reviewed over time). *Note: CSPs will still be required to provide PJM 24 hour metered load data during the 5WCP days to inform ELCC load profiles and reduction capability of DR customers in the winter.*

PJM Proposal (cont'd)

Design Component	Status Quo	Solution Option
ELCC Analysis: **Modeling of Hourly DR Availability and Reduction Capability**	Hourly DR availability and reduction capability scaled up and down proportional to system load $\frac{Simulated\ HourlyLoad_i}{50/50\ Simulated\ Peak\ Load\ Forecast} \times ICAP\ of\ DR$	**Winter:** Determine a forecasted level of DR Winter Nominated Value to use in the ELCC analysis. Shape the hourly DR load and reduction capability in the ELCC analysis based on the aggregate hourly load profiles provided in support of WPL values from recent registrations to address the differences observed between system load shape and DR loads. **Summer:** Status quo (risk concentrated in peak hours during summer; looking to collect additional information in DR registrations in future on summer hourly load profiles during summer peak days)

Winter Example: Forecasted Winter Nominated DR = **8,000 MW**, assuming WPL = 8,000 MW and WFSL = 0 for simplicity

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Aggregate average hourly DR load profile (relative to WPL in HE9) during PJM defined 5 winter coincident peak days:																							
0.65	0.63	0.63	0.63	0.65	0.72	0.85	0.93	1.0	0.98	0.97	0.95	0.95	0.93	0.92	0.88	0.85	0.85	0.83	0.8	0.77	0.73	0.68	0.65
Aggregate hourly DR reduction capability in winter:																							
5200	5040	5040	5040	5200	5760	6800	7440	8000	7840	7760	7600	7600	7440	7360	7040	6800	6800	6640	6400	6160	5840	5440	5200

Proposal Summary and Key Benefits

1. **Extend the DR availability window to include all hours**
   - Improves reliability and parity with generation by setting a performance obligation on committed DR during any hour of reliability risk during the year (not just those hours within the current window), and captures the load and reduction capability DR provides in those additional hours outside the current window within the risk analysis and accreditation
   - Improves incentives for CSPs to sign up customers that are capable of responding during any hour of risk
2. **Address overstated WPL by requiring a consistent peak hour be used across customers during the 5 WCP days in the calculation**
   - Improves reliability by better modeling the expected hourly winter load levels and reduction capability of DR in the risk analysis and accreditation, and improves the calculation of the actual reduction value provided by DR in winter performance assessments
3. **Improve winter hourly shaping of DR load and reduction capability in ELCC analysis**
   - Improves reliability by better modeling the expected hourly winter load levels and reduction capability of DR in the risk analysis and accreditation

Appendix: ELCC Sensitivities and Reference Materials

ELCC Sensitivities under Proposed DR Reforms

ELCC Runs	Status quo	Sensitivity 1	Sensitivity 2
ELCC DR Modeling (26/27 BRA)	• DR ICAP = 7954 MW • DR reduction capability scaled proportional to system load within performance window • DR reduction set to zero outside window	• DR ICAP = 5705 MW • WPL and winter hourly profile / reduction capability based on 24/25 registration data • Assumes no change to nominated winter FSL • 24/7 performance window	• DR ICAP = 7954 MW • Similar to Sensitivity 1, except winter FSL reduced and Winter Nominated Value scaled up to equal original forecasted DR ICAP
FPR	**0.9367**	**0.9573**	**0.9577**
DR ELCC Rating	**74%**	**92%**	**94%**

ELCC Sensitivities under Proposed DR Reforms (cont'd)

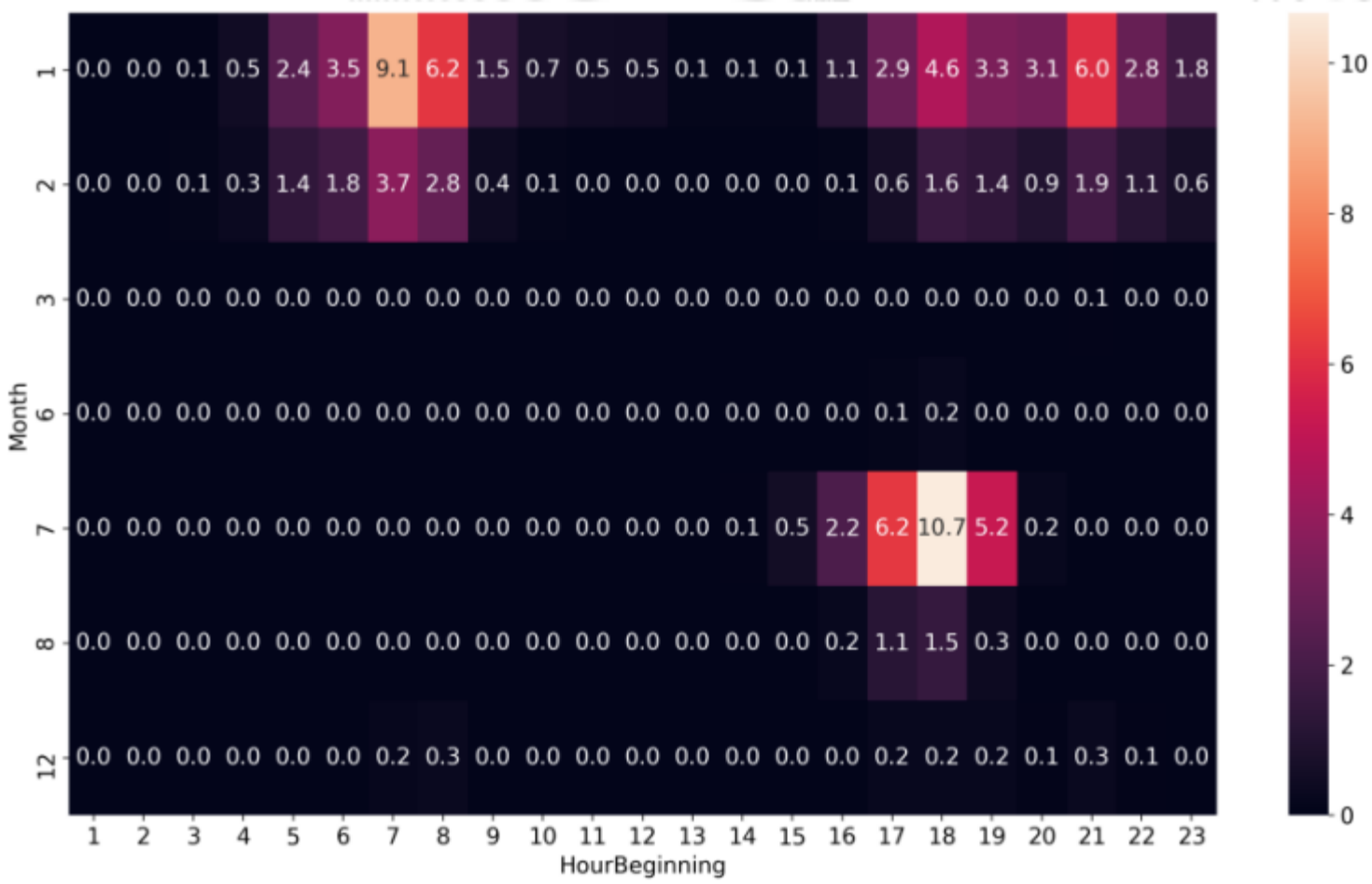
ELCC Runs	EUE	LOLH	LOLE
Status quo	W:87% S:13%	W:71% S:29%	W:55% S:45%
Sensitivity 2 *(near identical results observed in Sensitivity 1)*	W:83% S:17%	W:66% S:34%	W:51% S:49%

- Majority of ratings remain unchanged or move +/- 1% or +/- 2%, largely driven by decrease in winter share of loss of load risk

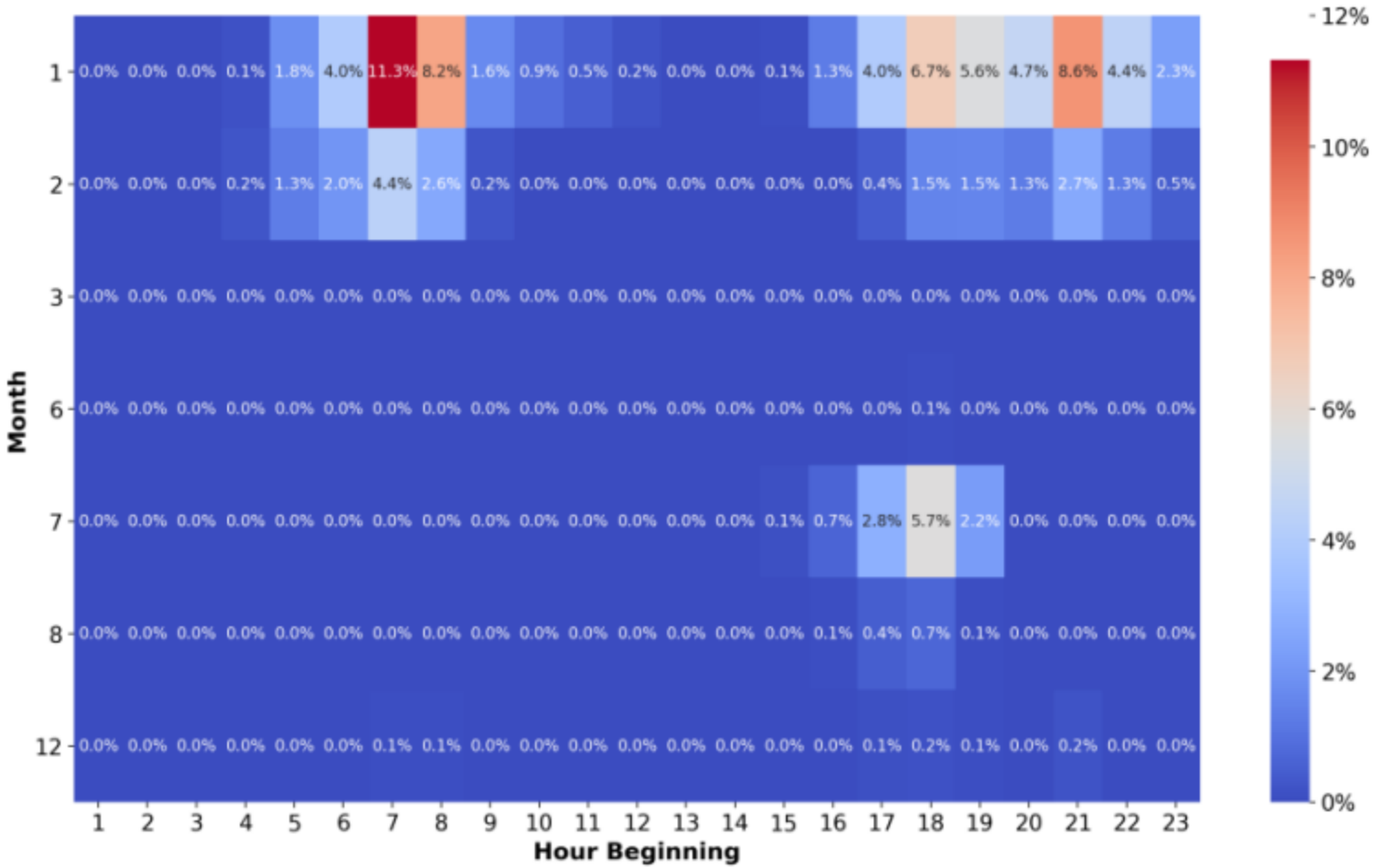
- After DR, storage classes see largest increase in rating, largely driven by relatively shorter loss of load events observed in the winter compared to status quo

Class	Status Quo	Sensitivity 2	Delta
Onshore Wind	34%	32%	-2%
Offshore Wind	61%	57%	-4%
Solar Fixed	8%	9%	1%
Solar Tracking	13%	14%	1%
Landfill Gas Intermittent	54%	55%	1%
Hydro Intermittent	38%	38%	0%
4-hr Storage	57%	67%	10%
6-hr Storage	65%	76%	11%
8-hr Storage	68%	77%	9%
10-hr Storage	78%	86%	8%
DR	74%	94%	20%
Nuclear	95%	95%	0%
Coal	84%	84%	0%
Gas CC	78%	79%	1%
Gas CT	68%	70%	2%
Gas CT Dual	79%	80%	1%
Diesel Utility	91%	91%	0%
Steam	74%	75%	1%

26/27 BRA LOLH Month/Hour Heatmap



26/27 BRA EUE Month/Hour Heatmap



Contact

Facilitator:
Foluso Afelumo,
Foluso.Afelumo@pjm.com

Secretary:
Stefan Starkov,
Stefan.Starkov@pjm.com

SME/Presenter:
Pat Bruno,
Patrick.Bruno@pjm.com

DR Availability Window – PJM Package

Member Hotline

(610) 666-8980

(866) 400-8980

custsvc@pjm.com

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