

Uncertainty in Operations

Stephanie Schwarz

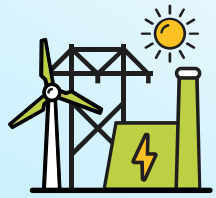
Brian Fitzpatrick

Emily Barrett

July 16, 2025

RCSTF

1. Review Sources of Uncertainty
2. Operations Examples of Challenges With Existing Reserves and Growing Renewables
3. Review Reserves Status Quo and Proposed Reforms
4. Next Steps



**Intermittent
Resources**
Solar, Wind

**Generator
Performance**



**Gas Fuel
Security/
Availability**



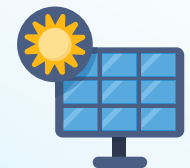
Load



Weather

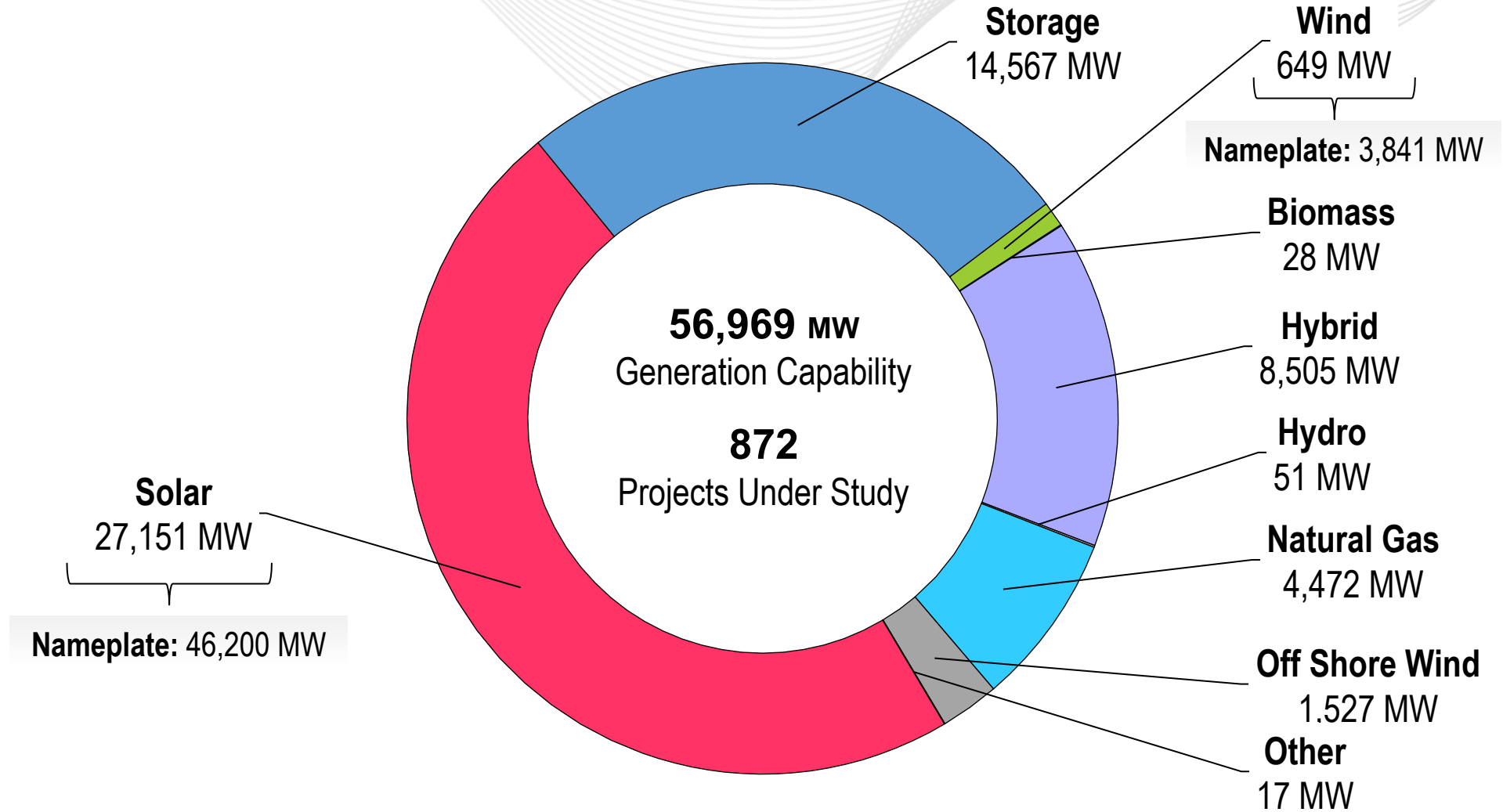


BTM Solar



Fuel Security: Queued Generation Fuel Mix

As of February 7, 2025



Natural Gas Supply

- Cold weather production freeze-offs
- Weekend/holiday multiday gas packages
 - Gas unit commitment/multiday commitments

Natural Gas Transportation

- NAESB gas nomination cycles
 - Correlation with PJM Dispatch timing
- Pipeline operating limitations
 - OFO, ratable take requirement, force majeure
- Contractual arrangements (firm vs. interruptible)
- Pipeline maintenance outage impacts



NAESB Gas Nomination Cycles

Cycle	Nomination Deadline	Confirmed by Pipeline	Scheduled by Pipeline	Gas Flow Starts	Flow Duration
Timely	2 p.m.	5:30 p.m.	6 p.m.	10 a.m.	24 hours
Evening	7 p.m.	9:30 p.m.	10 p.m.	10 a.m.	24 hours
Intraday 1	11 a.m.	1:30 p.m.	2 p.m.	3 p.m.	19 hours
Intraday 2	3:30 p.m.	6 p.m.	6:30 p.m.	7 p.m.	15 hours
Intraday 3	8 p.m.	10:30 p.m.	11 p.m.	11 p.m.	11 hours

Gas Day: 10 a.m.–10 a.m.

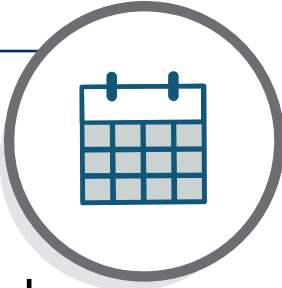
- Nominated volume expected to be delivered on a uniform 24-hour basis, especially during tighter operating conditions
- Timely and evening cycles for next gas day – higher pipeline scheduling priority
- Intraday cycles for current gas day – lower pipeline scheduling priority
- Interruptible nominations can be bumped by firm nominations except for the intraday 3 cycle.
- Once past the timely nomination deadline, gas liquidity typically becomes more difficult to procure.

Gas commodity market tends to be illiquid over weekends,
especially during high gas demand periods and over longer holiday weekends.

Traditionally, LDCs and industrial customers nominate their gas needs on Friday morning for the Saturday, Sunday and Monday gas days (and Tuesday if it's a holiday), as their loads are more predictable.

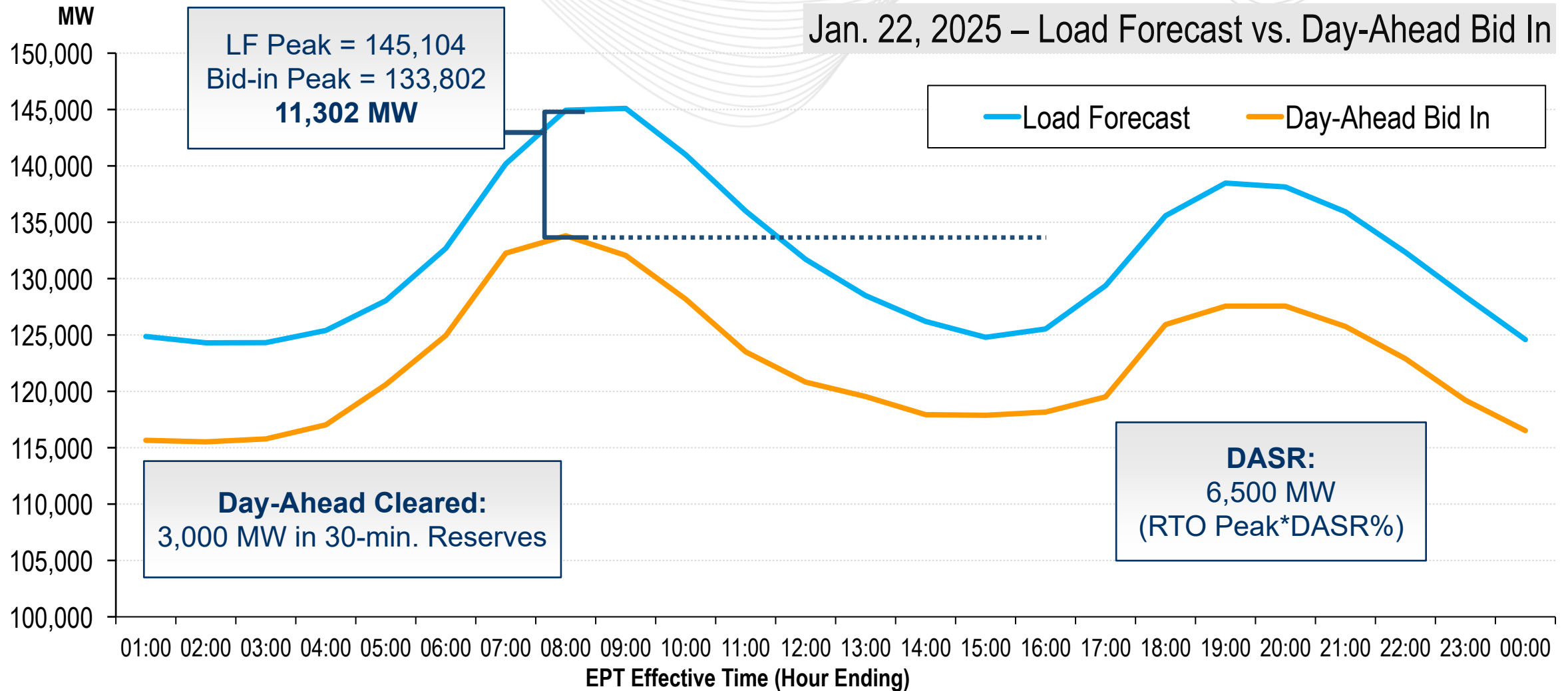
Generators can also buy gas on Friday for each day of the weekend but would take on increased financial risk if they are not dispatched commensurate with those purchased gas volumes.

Gas volume not burned would have to be liquidated, likely at a loss, if loads didn't materialize. Also, large volumes of gas left on a pipeline create increased operational risk for the pipeline.

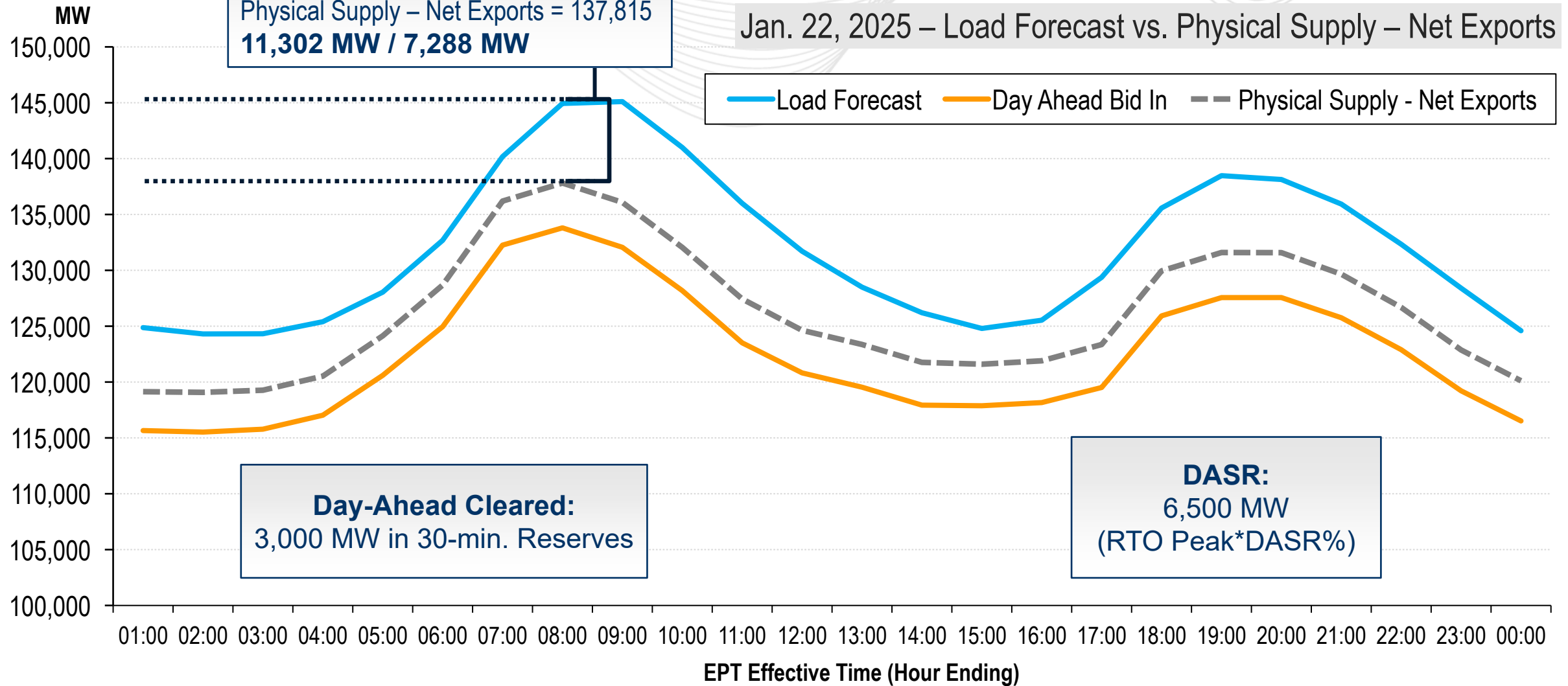


This inherent weekend gas illiquidity can also drive increased gas prices, especially during constrained periods.

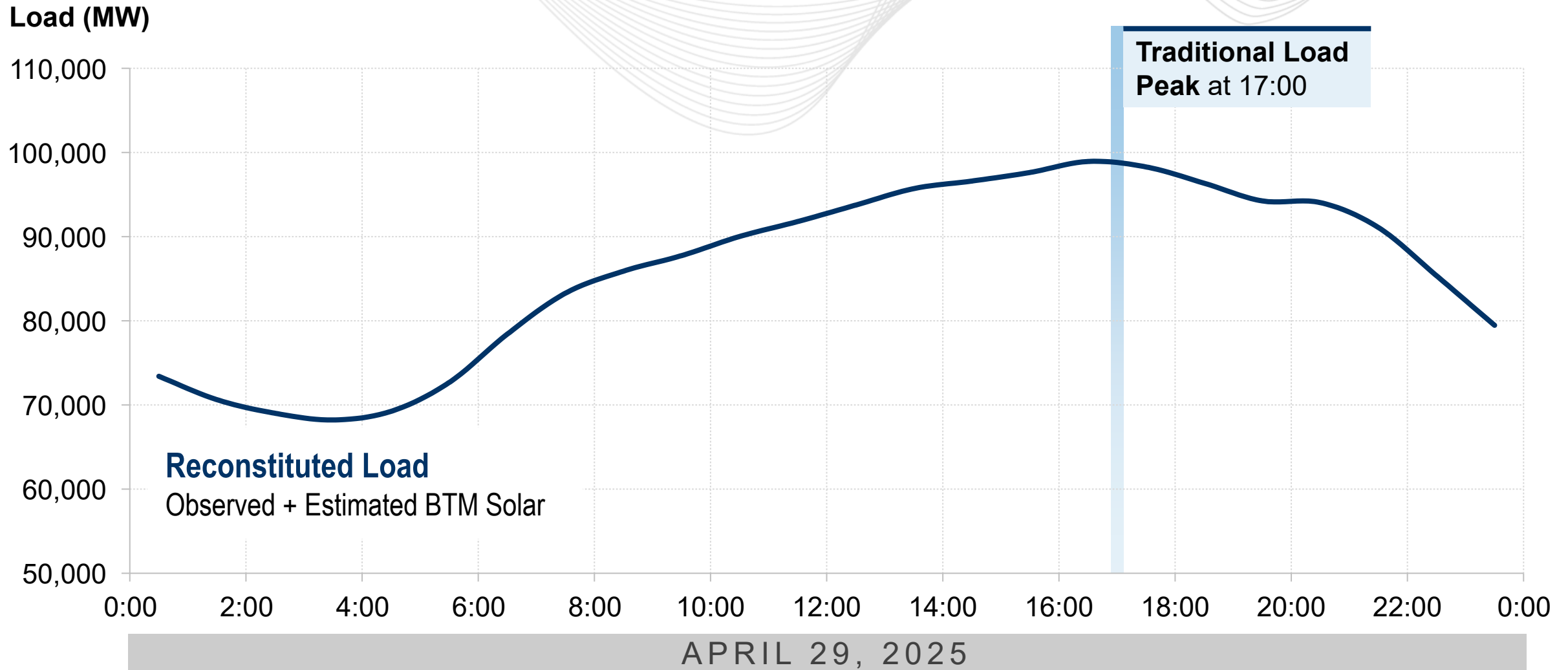
Status Quo – Challenges in Day Ahead



Status Quo – Challenges in Day Ahead

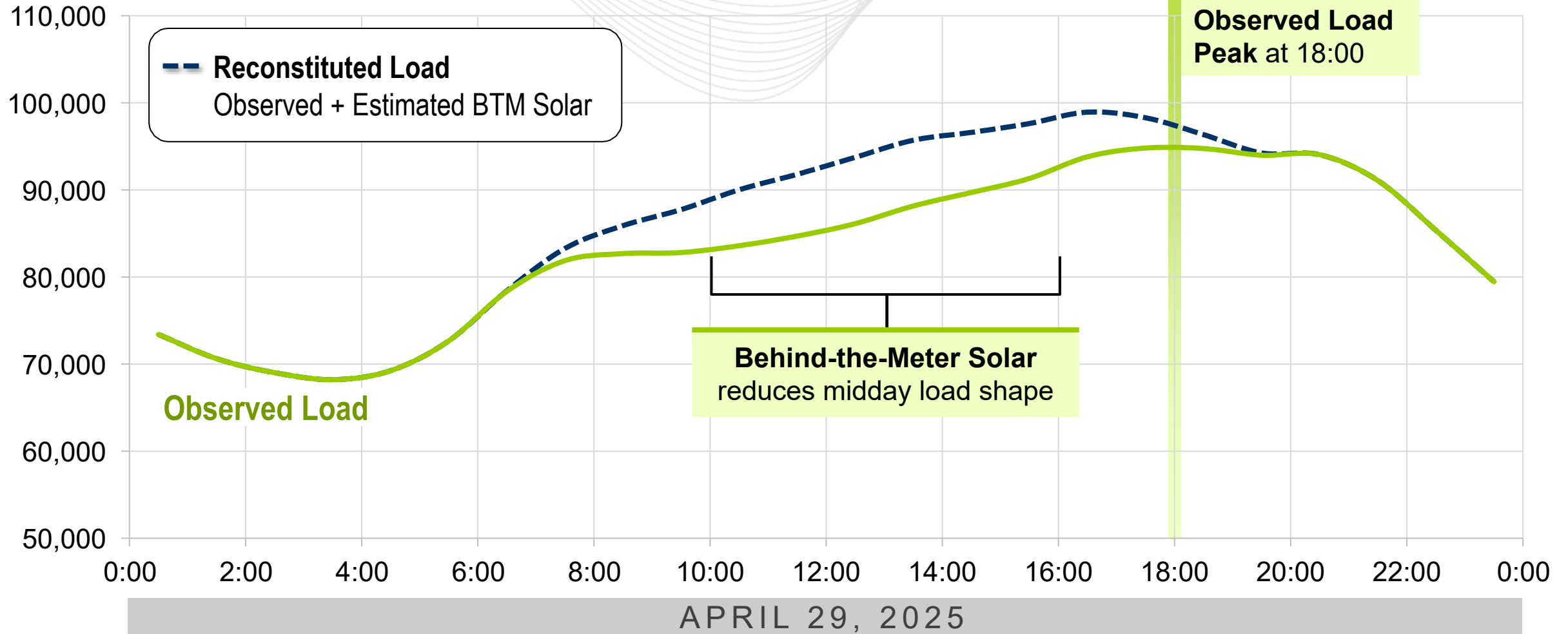


Renewable Growth Increases Net Load Ramps

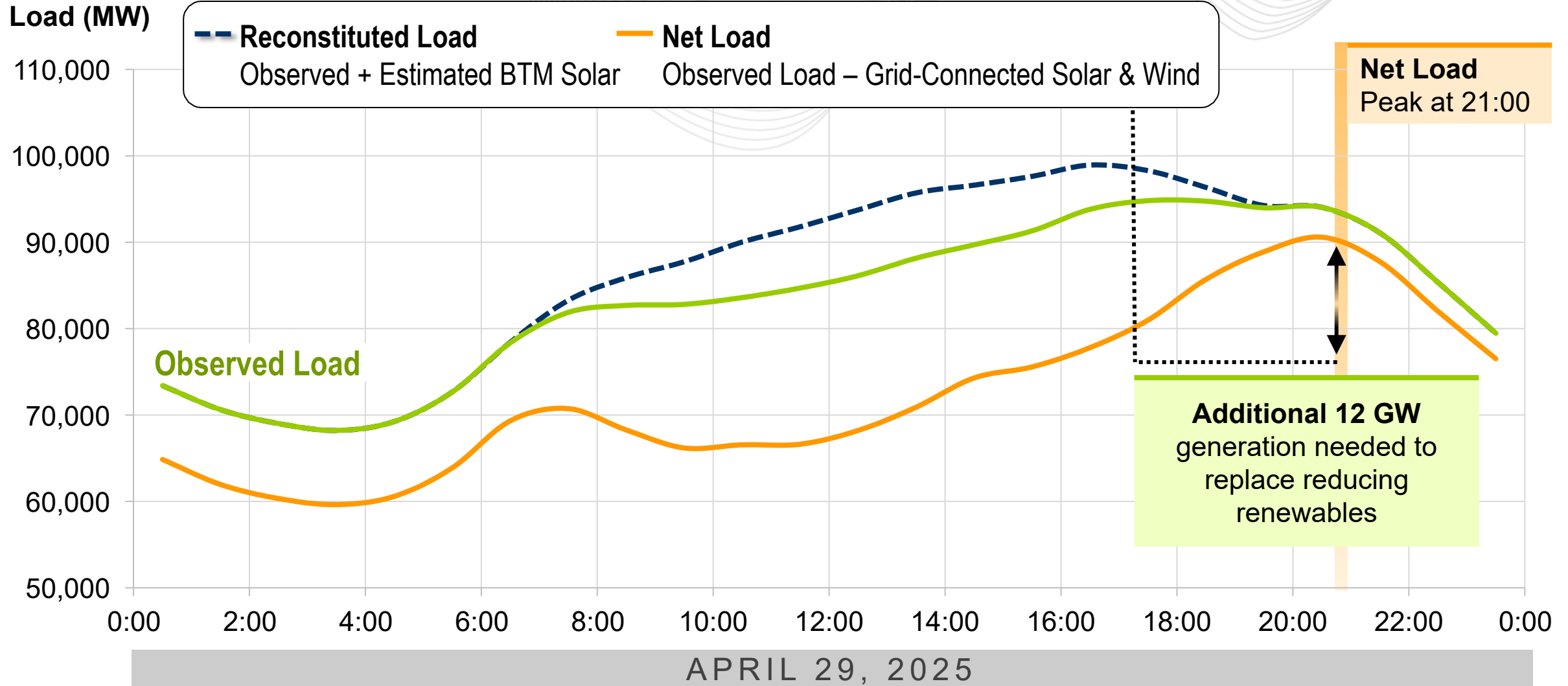


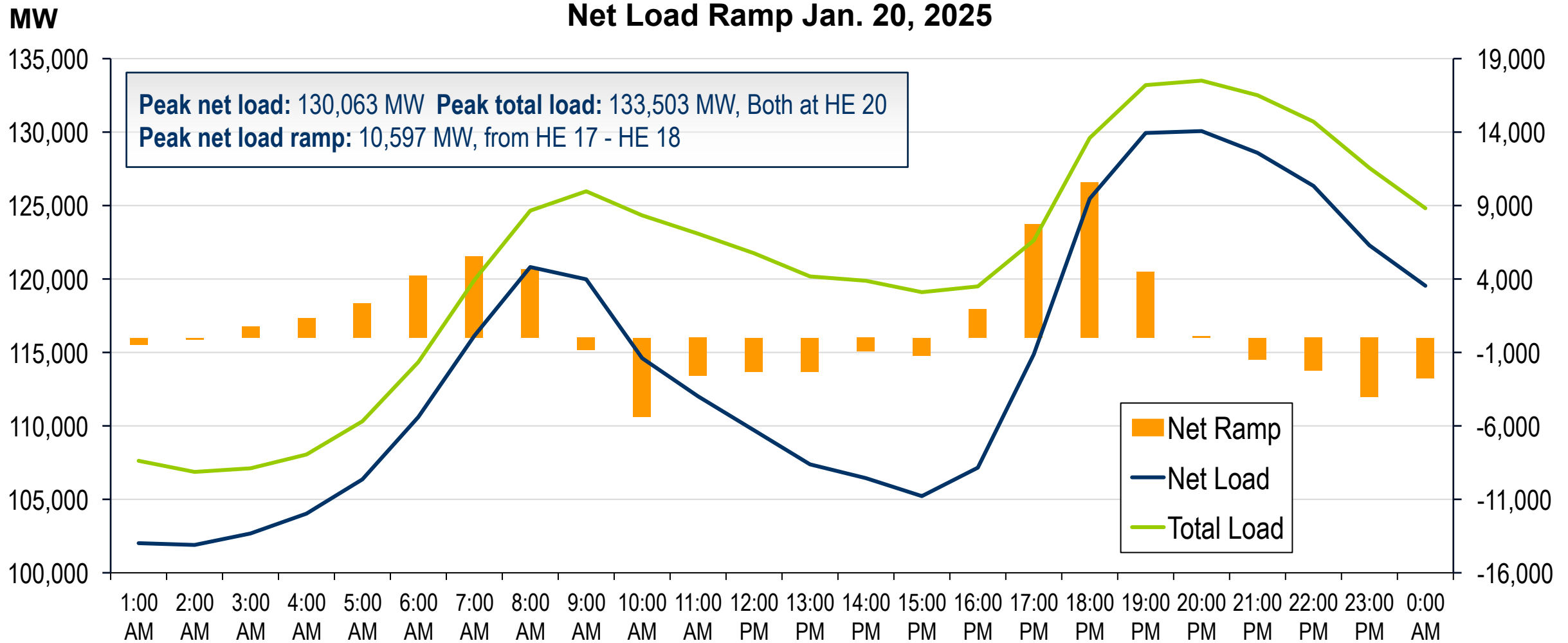
Renewable Growth Increases Net Load Ramps

Load (MW)

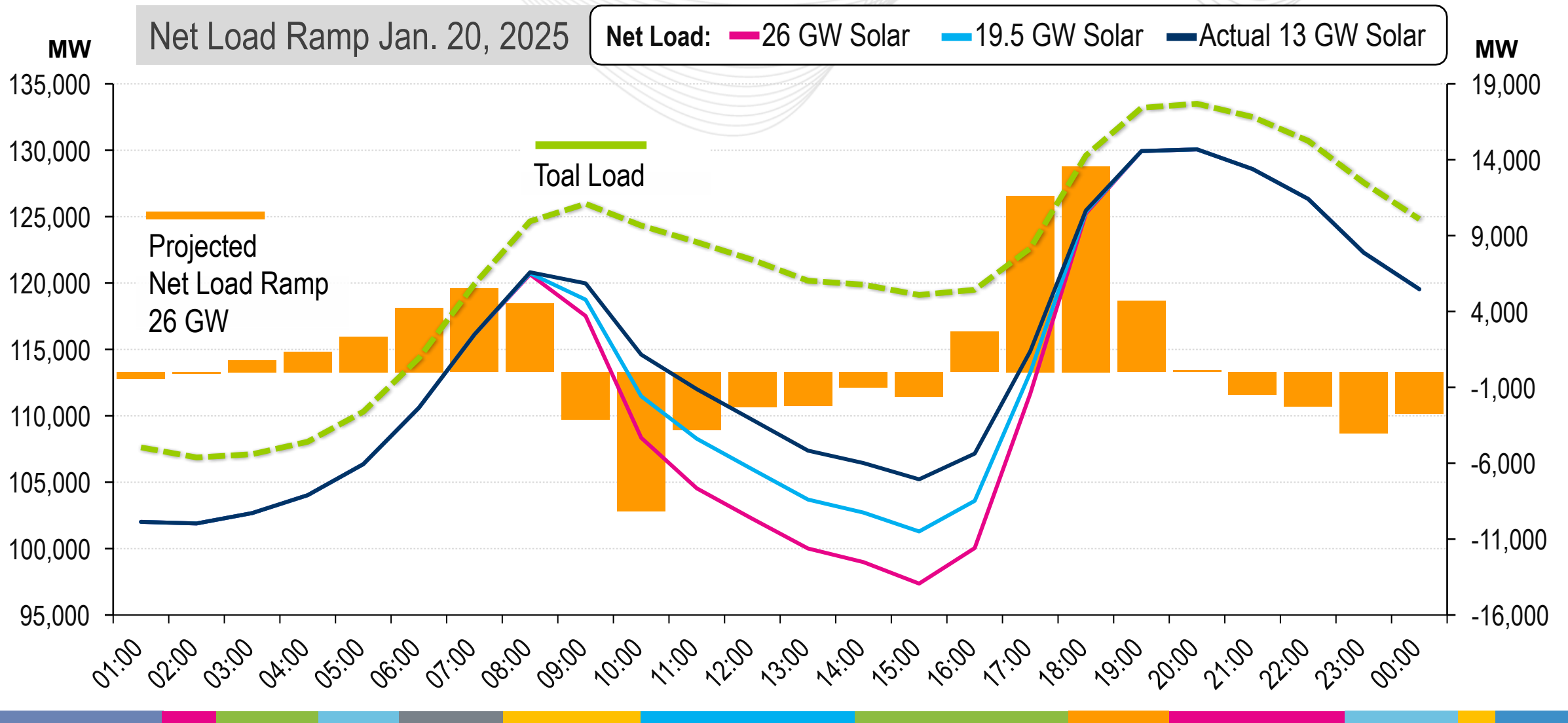


Renewable Growth Increases Net Load Ramps





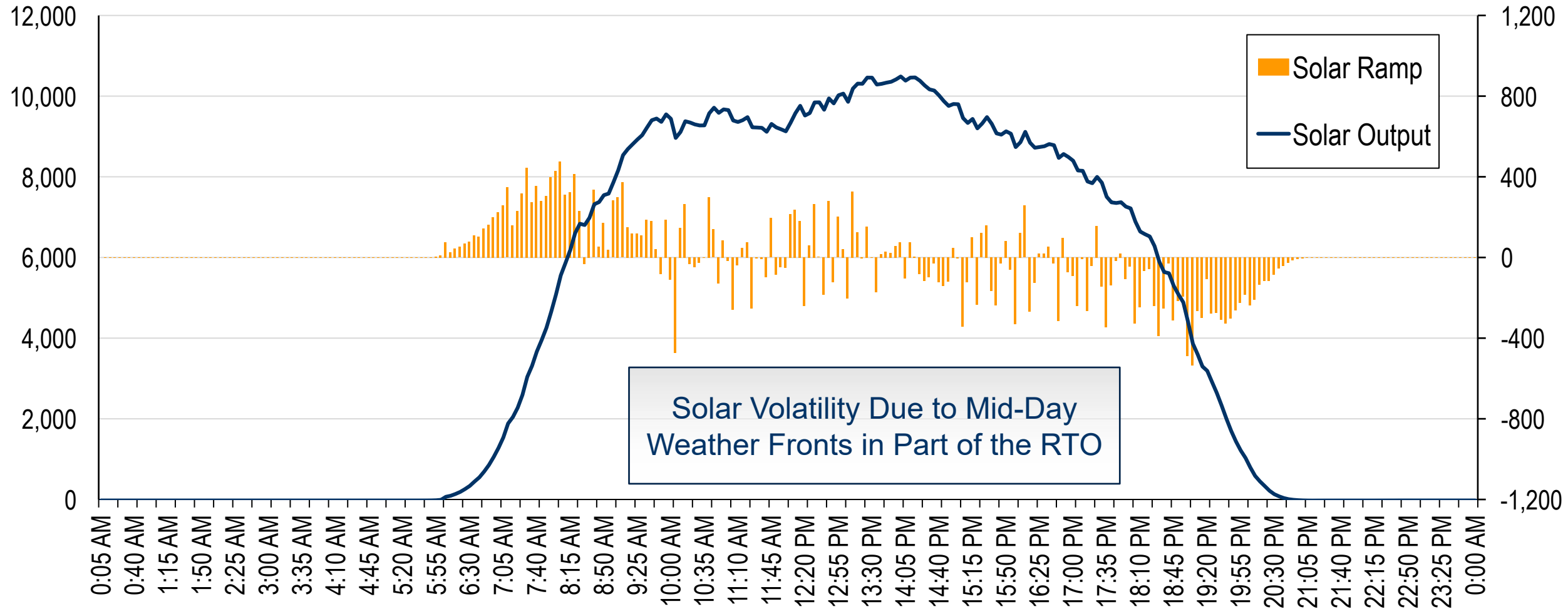
Projected Solar Growth Impact on Net Load Ramp



Solar Output

Solar Output (May 18, 2025)

Solar Ramp



30-min. Reserves – Max(3000, PR, Gas Contg)

Replacement reserves for contingency events

Primary Reserves (PR)
(10-min. Reserves) – 150% SR
Contingency reserves and ACE recovery

Synchronized Reserves (SR)
(10-min. Reserves) – 100% MSSC*
Contingency reserves and ACE recovery

30-minute Reserves do not capture uncertainty PJM's operations deals with and needs to plan for today.

- Reserve Price Formation removed the DASR (capturing uncertainty) and proposed a downward-sloping demand curve to capture reserves for uncertainty, but implementation post-remand resulted in PJM being unable to account for uncertainty DA.

All reserve products are nested today, meaning at times today we carry no 30-minute Reserves above SR and PR.

**SR Most Severe Single Contingency (MSSC) is adjusted for measured performance. Requirement is currently 130% MSSC.*

Day-Ahead Reserves

Addresses uncertainty DA that does not need to be carried into RT
Inclusive of the need to have energy and reserve commitments to meet the next day load forecast (energy gap)

30-min. Reserves – Updated

Replacement reserves for contingency events and capturing uncertainty

10-min. Reserves – Ramp/Uncertainty Up and Down Reserves

Addresses net load ramping needs and allows PJM to meet interval by interval energy and reserve needs

Primary Reserves (PR) (10-min. Reserves) – 150% SR

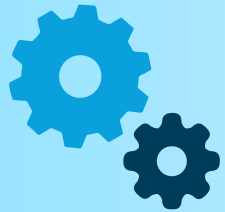
Contingency reserves and ACE recovery

Synchronized Reserves (SR) (10-min. Reserves) – 100% MSSC*

Contingency reserves and ACE recovery

These Reserves can Assist with Operational Day-Ahead and Large Net Load Ramp Challenges

These Reserves can Assist with Intra-Day Volatility



**PJM Operations
determination of
uncertainty and risk
framework**

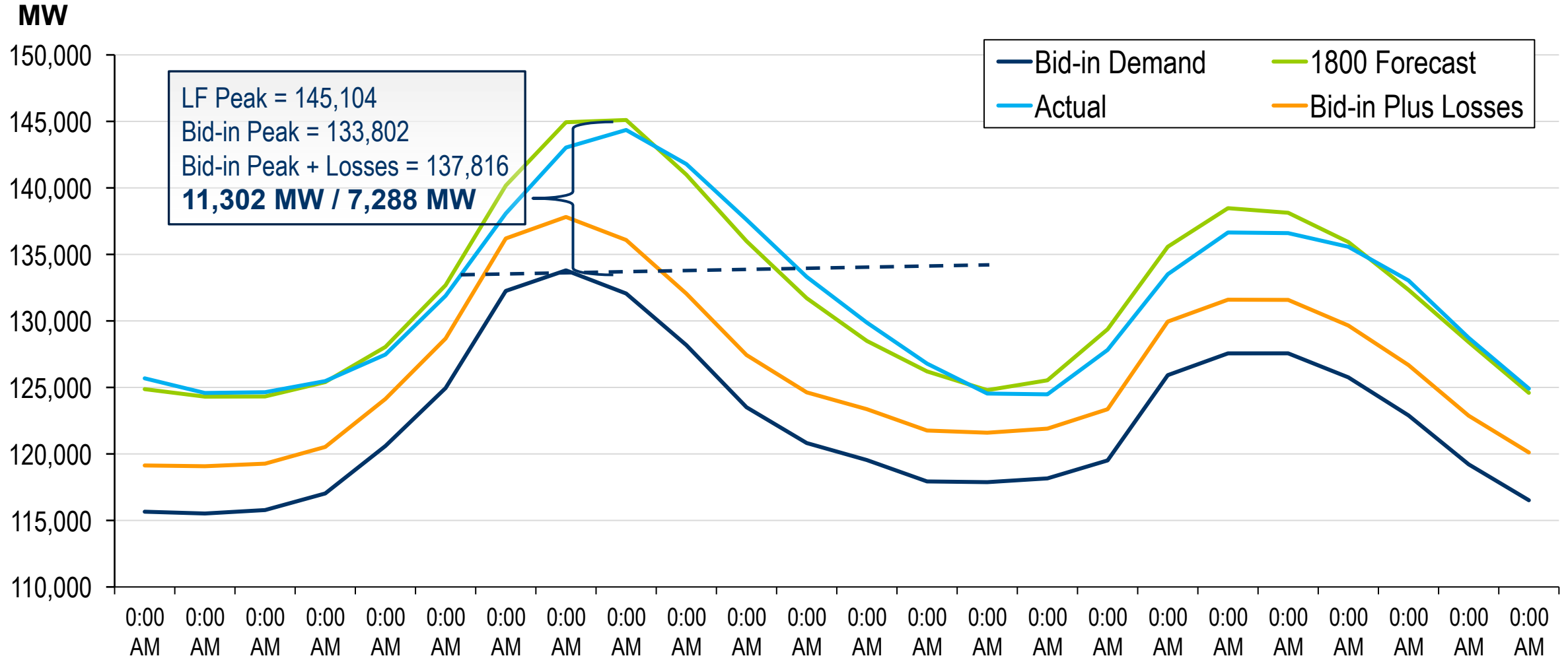


Quantification of solar and
wind, load, weather,
generation performance
uncertainty



Risk determination
for future reserve
requirements

Appendix



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