What Is Net Load?

Historically, system operators relied on the projected load, the total electricity demand at any moment, to determine how much generation was required. With intermittent wind and solar now a large share of the resource mix, this no longer fully reflects system needs.

***Net load* has become the key measure of what must be served by non-intermittent resources:**

Net load reframes customer demand by showing how much conventional generation is needed after renewables are accounted for.

Even if total demand is steady, a sudden drop in wind output or the evening decline in solar can create steep net load ramps that operators must be prepared to reliably address.

Net Load = Observed Load – Grid-Connected Solar – Grid-Connected Wind

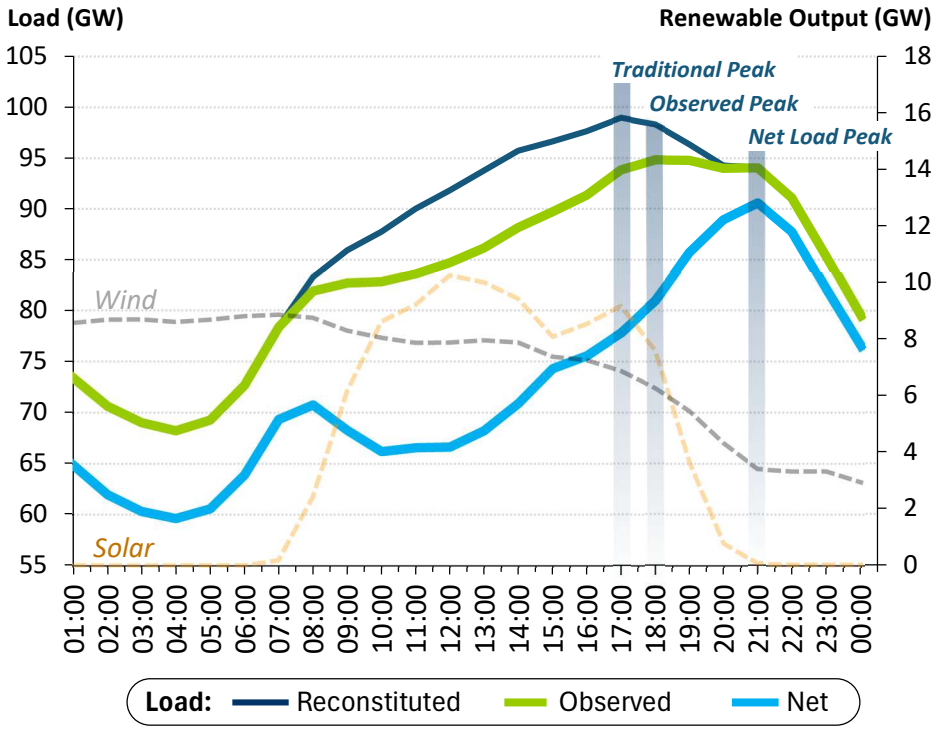
Key Characteristics of Net Load

Summer: Offset Between Load Peak and Net Load Peak

- Peak load and peak net load can occur at different times, as peak load might be served by ample solar and wind.
- An evening net load peak occurs when solar output decreases faster than load decreases.
- Traditional resources, such as steam, hydro or combustion turbines (CTs) must be dispatched to higher outputs after the observed load peak to replace the decreasing solar as the net load continues to increase.

Example: Misaligned Peaks

On April 29, 2025, PJM noted a **12.8 GW** increase in net load between the reconstituted peak at 5 p.m. and net load peak at 9 p.m., as well as a **9.6 GW** increase between the observed peak at 6 p.m. and net load peak at 9 p.m.



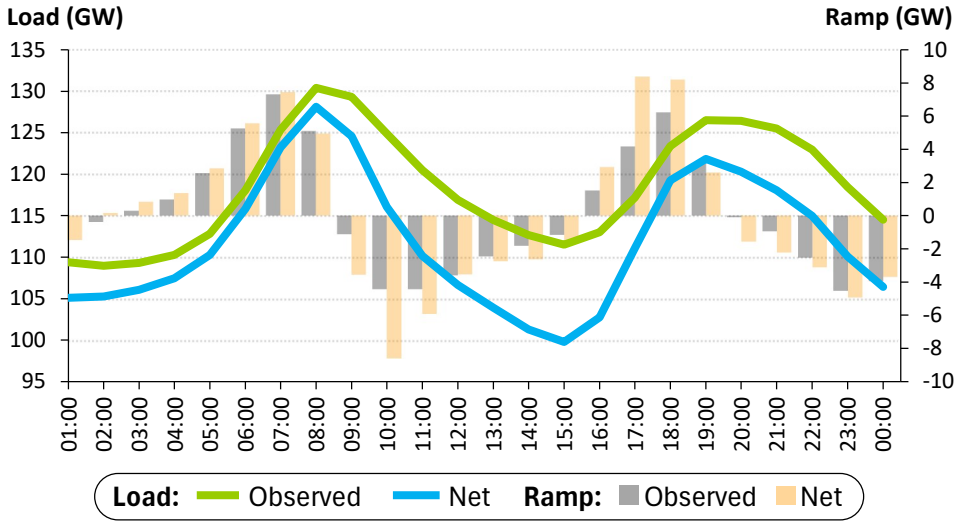
Winter: Steep Evening Net Load Ramp

- Winter load typically peaks when solar output is low or zero, so misaligned peaks are less likely.
- However, increasing loads as the peak approaches coinciding with a declining renewable output creates a steep evening ramp that requires flexible generation.
- Solar rises as load falls after the morning peak with the inverse occurring in the evening, which creates large swings in net load.

Example: Net Load Ramp

On Jan. 15, 2025, PJM saw an **8.5 GW** net load drop in one hour in the morning. This was followed by a **16.7 GW** drop (6.2 GW of which was due to decreased renewable output) over two hours in the evening.

Ramps like these will only become steeper as renewable penetration increases.

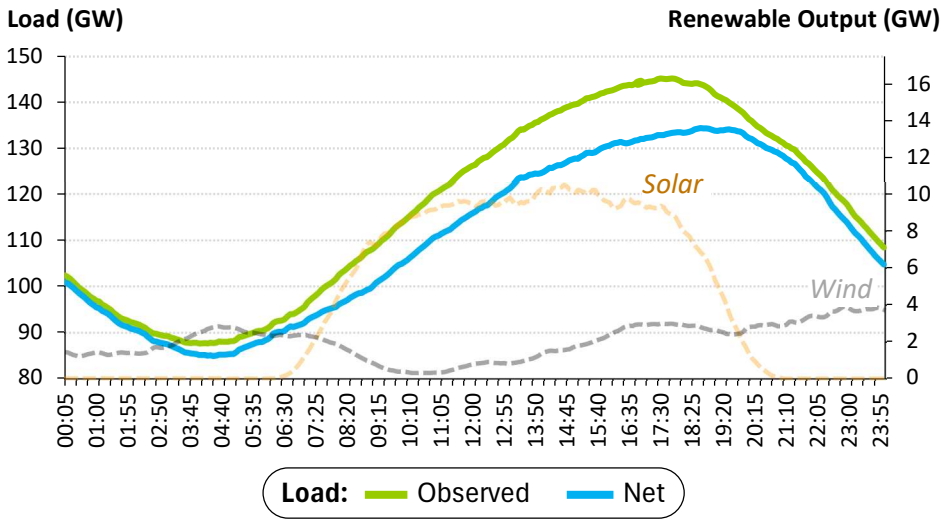


Year Round: Real-Time Volatility

- Renewable generation, especially solar, is subject to rapid fluctuations.
- Cloud cover variability can instantly cut solar output, introducing sharp swings in net load.
- Operators must manage these fluctuations continuously in real time, balancing generation and load while ensuring transmission constraints are not violated.

Example: Rapid Net Load Fluctuations

On July 11, 2025, **solar volatility** drove sudden, sharp intraday changes.



Transmission Impact

The changes in net load from hour to hour and additional uncertainty in forecasts can also create transmission and generation deliverability issues. Behind-the-meter and grid-connected solar are often concentrated in specific areas, and loading on transmission equipment in these areas can change drastically as solar output varies and replacement generation comes online.

Changes in net load from hour to hour can also create local transmission and generation deliverability issues.

Overall, the PJM system will experience a change to the interregional flows requiring a sizeable generation dispatch several times a day as behind-the-meter and grid-connected solar, predominantly in the east, comes online in the morning or offline in the evening. A substantial error in the net load forecast will challenge PJM to reliably meet demand in transmission-constrained portions of the RTO. This is a particular concern on a daily basis when solar generation is reducing at a faster pace than the energy demand in the load centers, on a biannual basis during shoulder seasons when substantial amounts of transmission and generation equipment are out of service for maintenance.

Future Outlook

With more than 32,000 MW of solar and 15,000 MW of wind in PJM's queue (maximum facility output), net load impacts will become more extreme in the future. Midday valleys will deepen, evening ramps will grow steeper, and the net load peak in the summer will exceed the net load at the traditional load peak by increasingly higher amounts. These changes will potentially result in dispatch systems signaling a call for generation and higher system locational marginal prices later in the evening. Net load can be forecasted; however, incorporating solar and wind projections introduces additional sources of error. Operators must plan for this increased uncertainty by ensuring flexible resources and reserves are available to cover forecast error while also respecting transmission constraints.