



Load Variability, Resources, EV Implications

Discussion slides



January 27, 2022

EV – Technical Conference #2

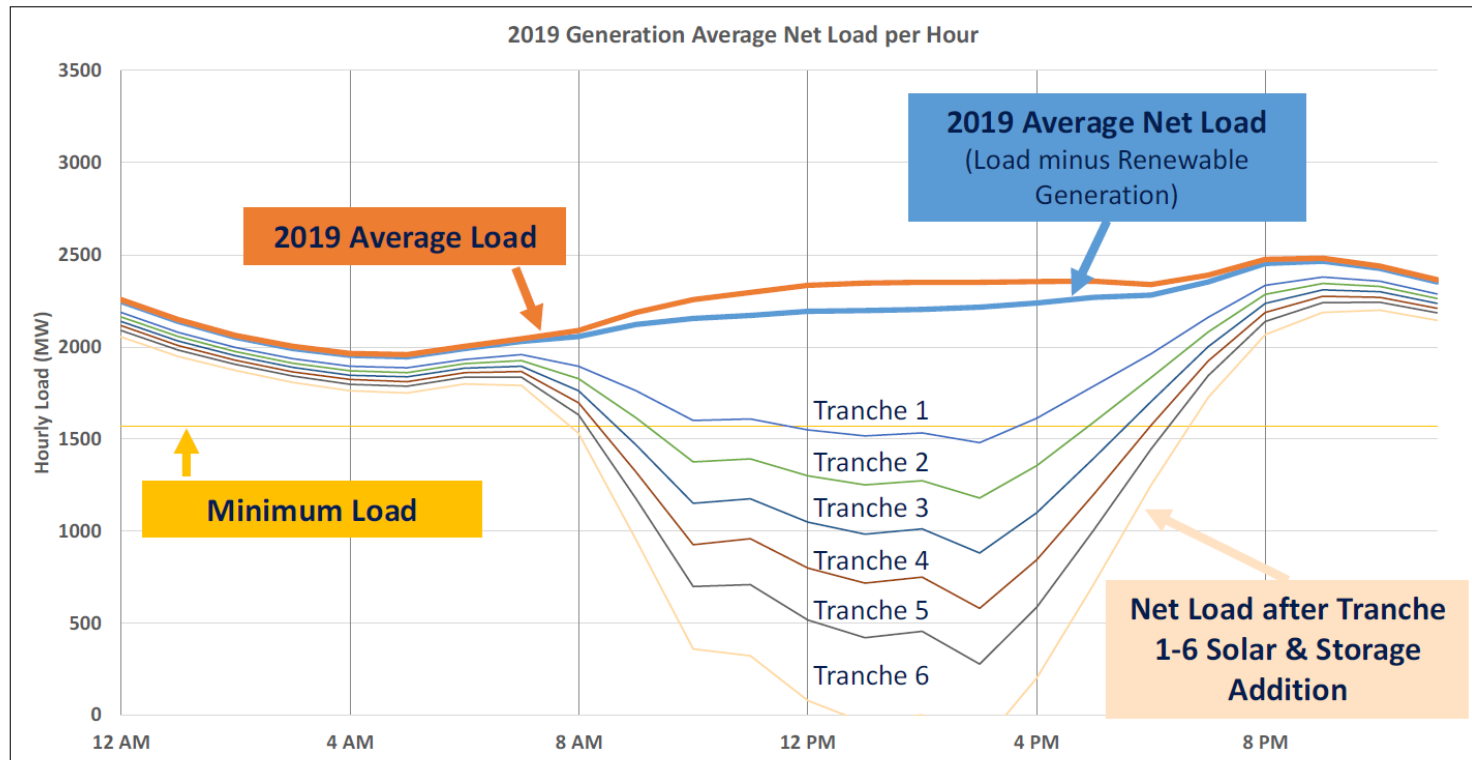


EV Load / Duck Curve Issues

- Overall EV load build – energy, peak – forecast, EV adoption pace
 - Not directly addressed in this segment – mitigation measures should focus on:
 - Managed charging – TOU / DR tariffs – EV load especially notable for controllability. Tariff and policy design critical.
 - EE/DR resource implementation and peak load reductions at other end uses can mitigate EV load effects absent other mitigation
- Ramping – Afternoon to Evening
 - Bulk system resources / battery installations
- Resource Adequacy
 - Meeting evening peak load, ramp and reserve requirements
- Distribution Issues
 - Not addressed here – other parts of conference

LUMA Duck Curve Illustration

Figure 2: Illustration of Potential Puerto Rico Duck Curve



- Exact patterns will depend on ratio of PV/battery additions, load forecast
- Notably (LUMA, p. 6, 11/5 submission):
 - Encouraging daytime charging ... to fill duck curve trough
 - Controllable storage to manage afternoon ramp



LUMA Concerns / Initial Responses / Duck Curve/Resource Adequacy Issues

- “Most vehicle charging is expected to occur during evening hours” [LUMA, p.4, 11/5 comments]
 - Not a pre-determined outcome that full EV load impact always directly coincidental with peak hour/hours, with managed charging approaches
 - But getting managed charging right from the start is critical
 - Smart approaches to daytime / workplace charging infrastructure part of the solution
- “While curtailment [BTM] cannot be required, there are managed charging controls and approaches that can be utilized... DER (solar and storage) can also be used to mitigate [daytime charging impacts]” p.5
 - Unclear if “curtailment cannot be required”? TOU/DR tariff can do this?
 - DER can be used to mitigate evening charging impacts, through use of BTM battery
- Demand Curve Challenges: “Typically, EV charging schedules will coincide with system peak demand, further exacerbating the duck curve issue by increasing the evening ramp and the daily system peak” p.5
 - Any evening peak load build, or peak load reduction, will affect this. Not unique to EV load.
 - IRP modeling by PREPA/Siemens demonstrated batteries plus existing fossil resources sufficient to meet ramp needs.
 - New resource implementation over next decade needs to continually account for load patterns.

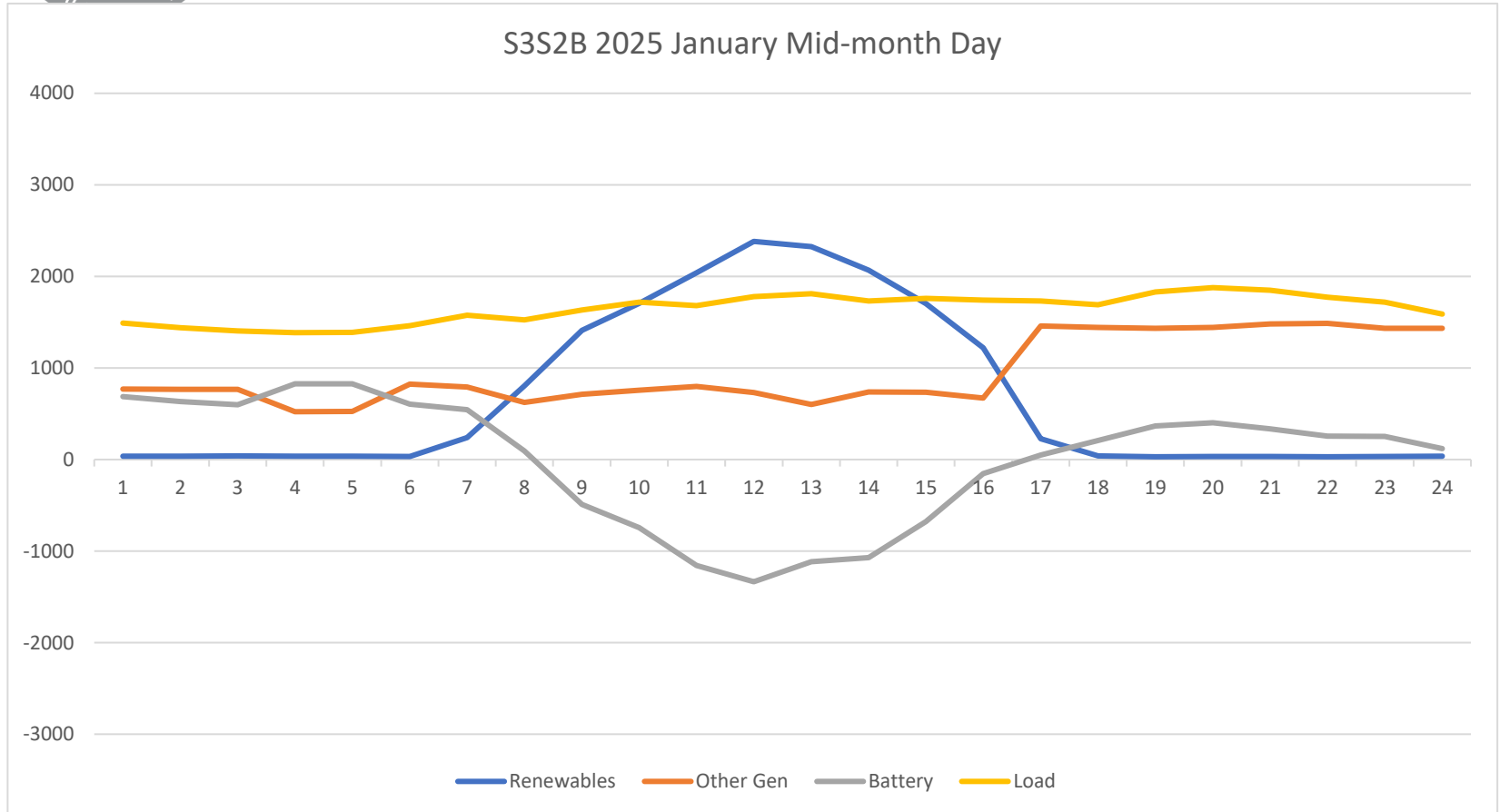


Duck Curve Issues

- IRP Modeling – Siemens / PREPA – workpapers with hourly data
 - With Puerto Rico buildout of solar PV and batteries, fossil use declines.
 - Batteries handle much of the daytime to evening ramp needs.
 - Remaining fossil still maneuvers, but well within parameters
- Increased loads from EV
 - Managed charging
 - EE / DR system peak load reduction efforts
 - Changing requirements for battery capacity quantities



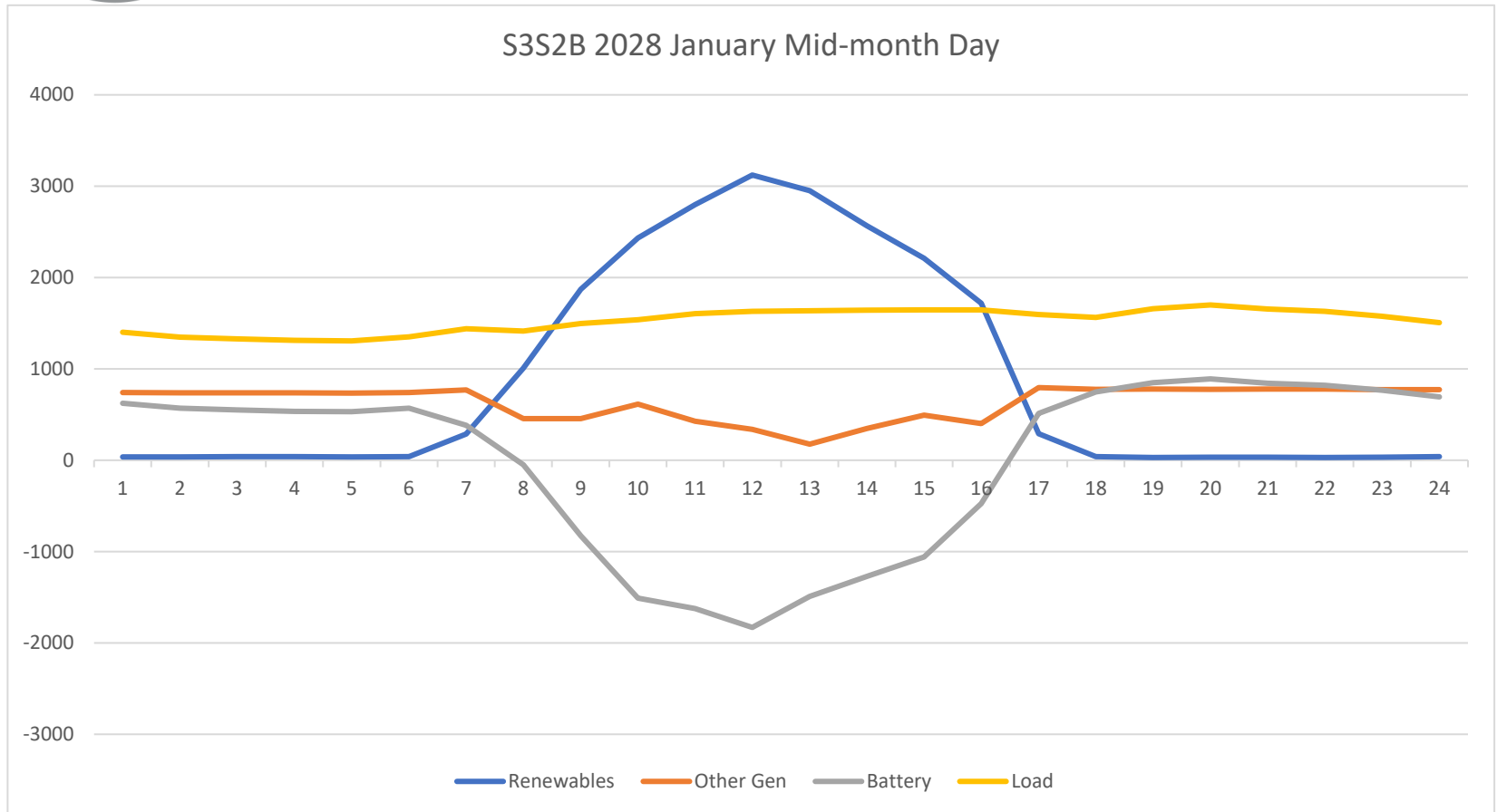
2025 Hourly January Mid-Month Day



- Batteries absorb daytime solar PV, discharge in evening and overnight
- Fossil resources ramp down, and then back up – in line with their capabilities



2028 Hourly January Mid-Month Day



- Same as 2025 – fossil ramping in line with capabilities. Additional battery capacity carries reserve, regulation needs