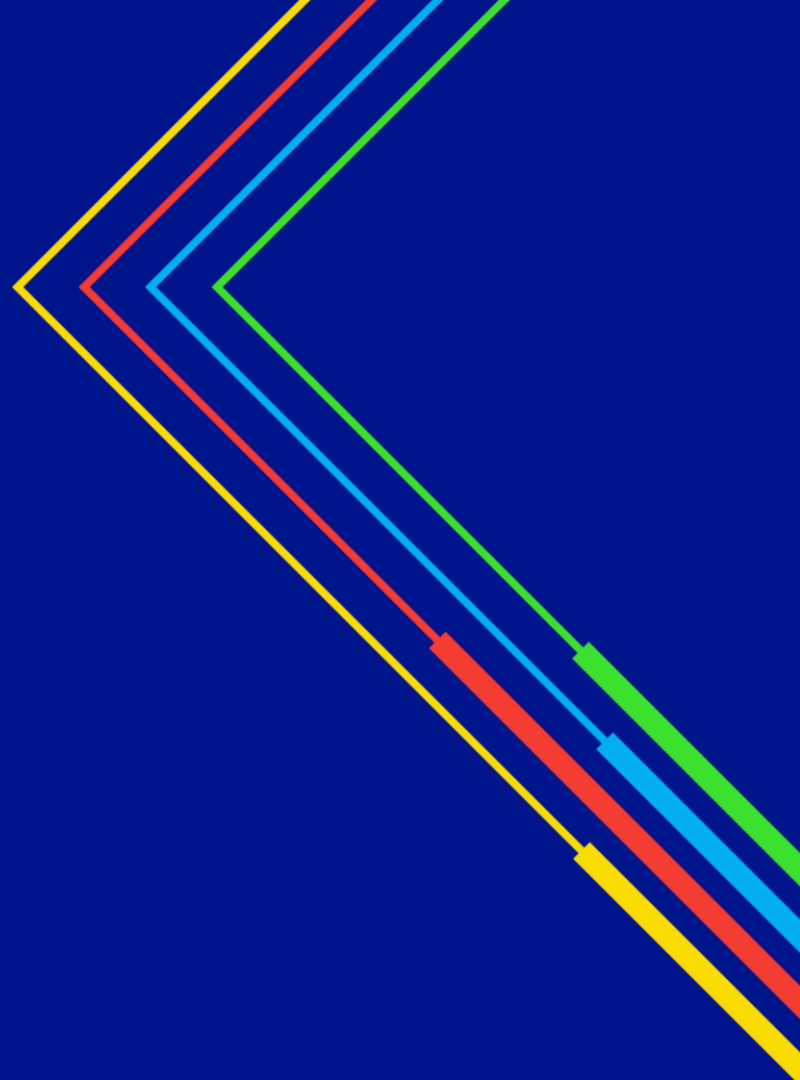


MA-TSRG National Grid Update- Fraunhofer- Global Scheduler

Samer Arafa & Matt Kromer

November 7, 2019



National Grid's Solar and Storage Program



Goal: Reduce customer interconnection cost and time. Move from interconnecting DER to integrating it.



Promising Technologies We are Exploring

Key Areas of Research in the program	Partner	Share updates
Increasing Hosting Capacity-Interim Report	EPRI	Offered Q2, 2018
DC Arc flash study	EPRI	Offered Q3, 2018
Increasing Hosting Capacity-Smart Inverters	EPRI	Offered Q2, 2019
PV +Storage+ Load Management systems	Fraunhofer	Q4, 2019
Distribution Resource Open Management Optimization System (DROMOS)	Sandia	Q1, 2020
Cost/Benefit Analysis of Smart Inverters	EPRI	Q2, 2020
Risk of Islanding of Smart Inverters	NPPT	Q3, 2020
Grid Edge DTT	Grid Edge	Q4, 2020

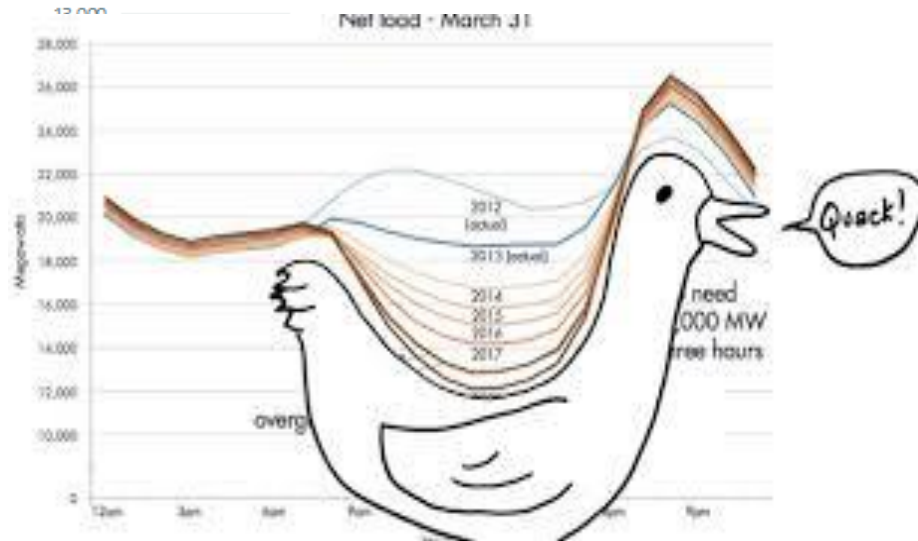
National Grid



The Duck Will Grow

Historic Dip in Midday Demand Follows Record-High Solar Power Output on April 21, 2018

A sunny spring day pushed distributed solar output to an estimated record high of 2,309 MW at 1:30 p.m. and drove down electricity demand on the regional power system. In effect, New England consumers were using more grid electricity while they slept than in the middle of the day. (Data subject to adjustments.)



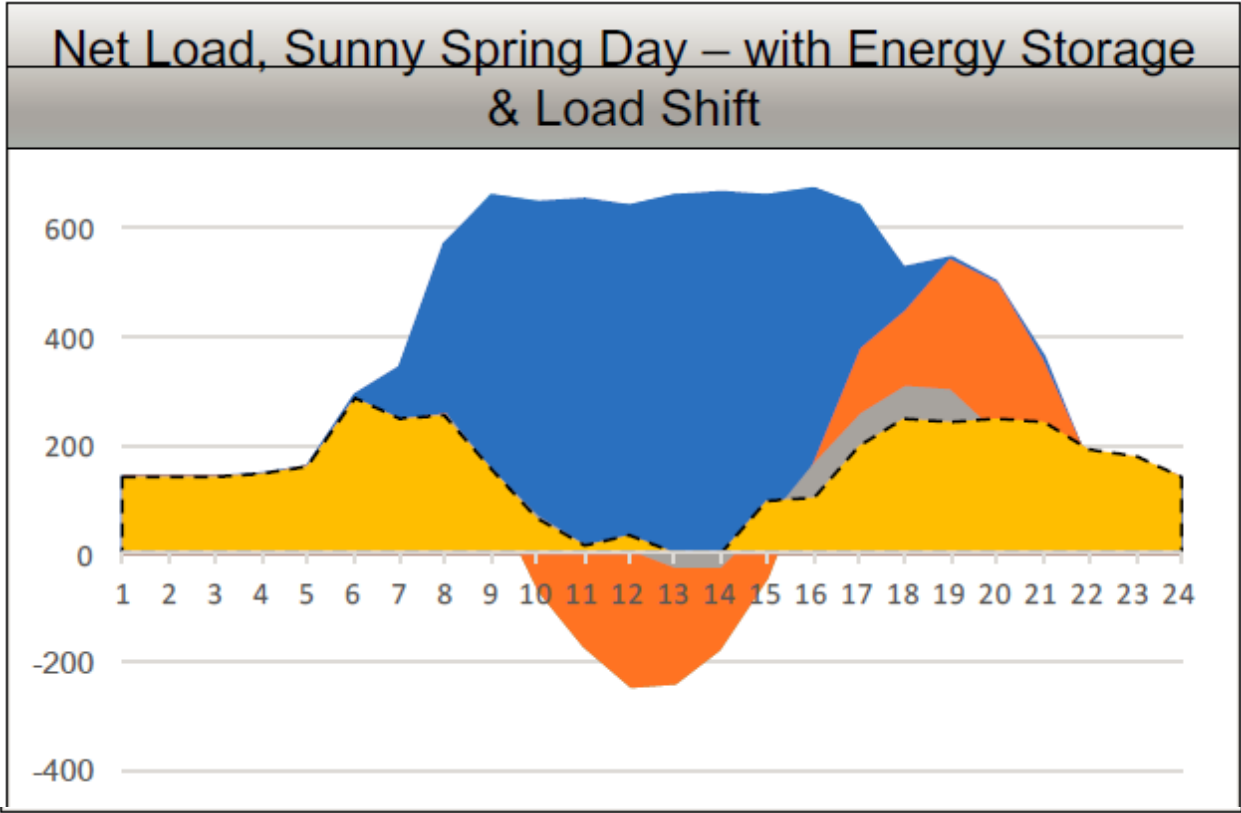
Source: ISO New England



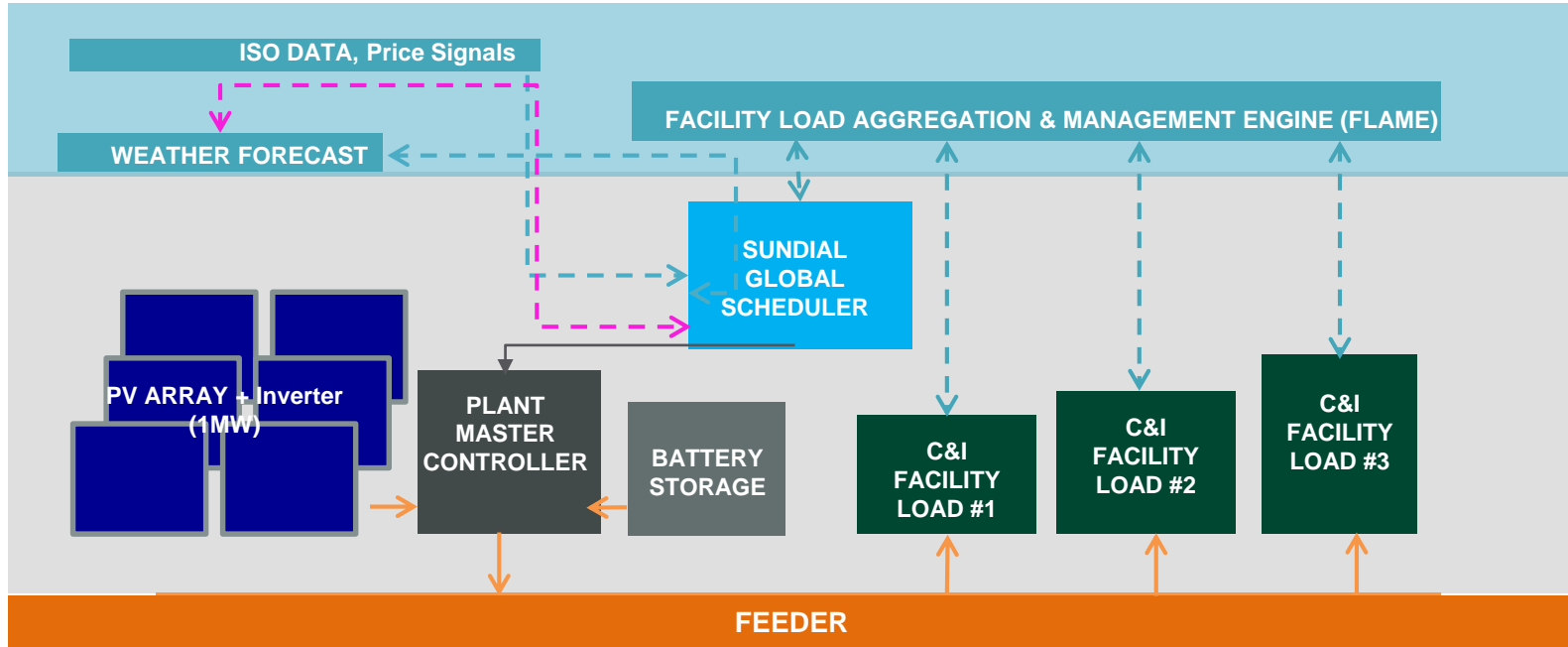
<https://pv-magazine-usa.com/2018/05/08/the-duck-curve-comes-to-new-england/>

National Grid

Stopping The Monster



SUNDIAL Global Scheduler



National Grid Solar + Storage Plant



9MVA feeder, approx. 7MW PV installed

Controllable DERs:

Solar: 1.5 MW, aggregated across two adjacent PV fields. (*Only 500kW PV controlled for testing*)

ESS: 0.5MW / 1.0MWh Tesla PowerPack

Global Scheduler

Potential Use Cases / Value Streams

Demand Management

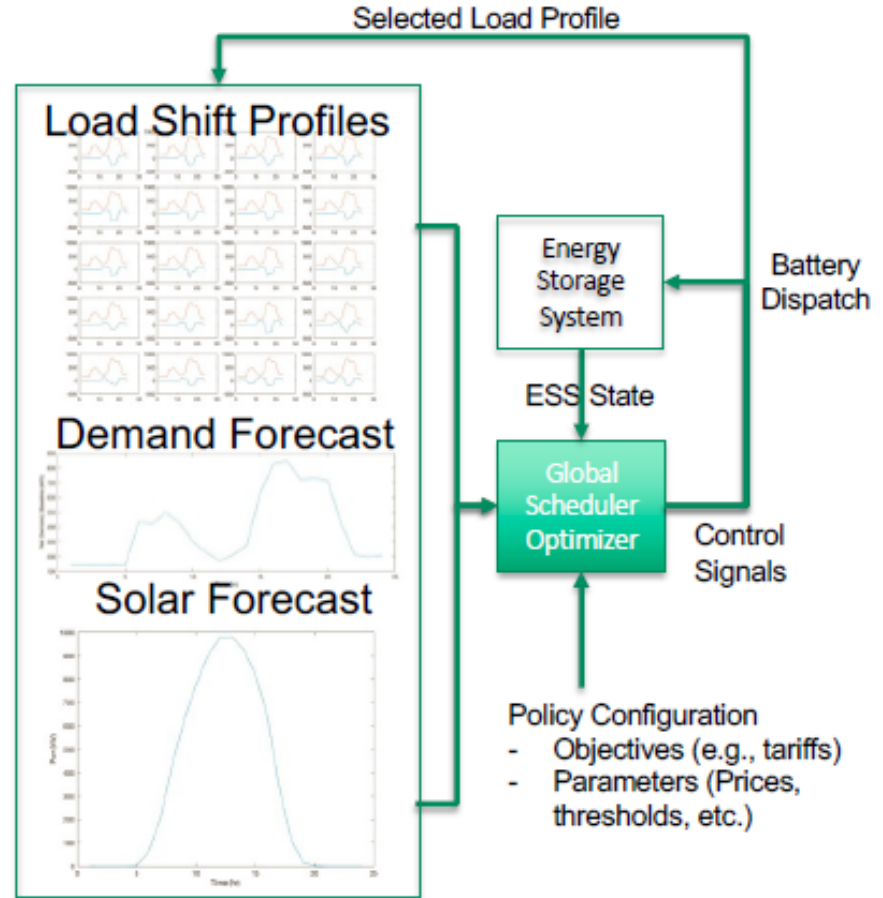
Peak Shaving

Energy Arbitrage

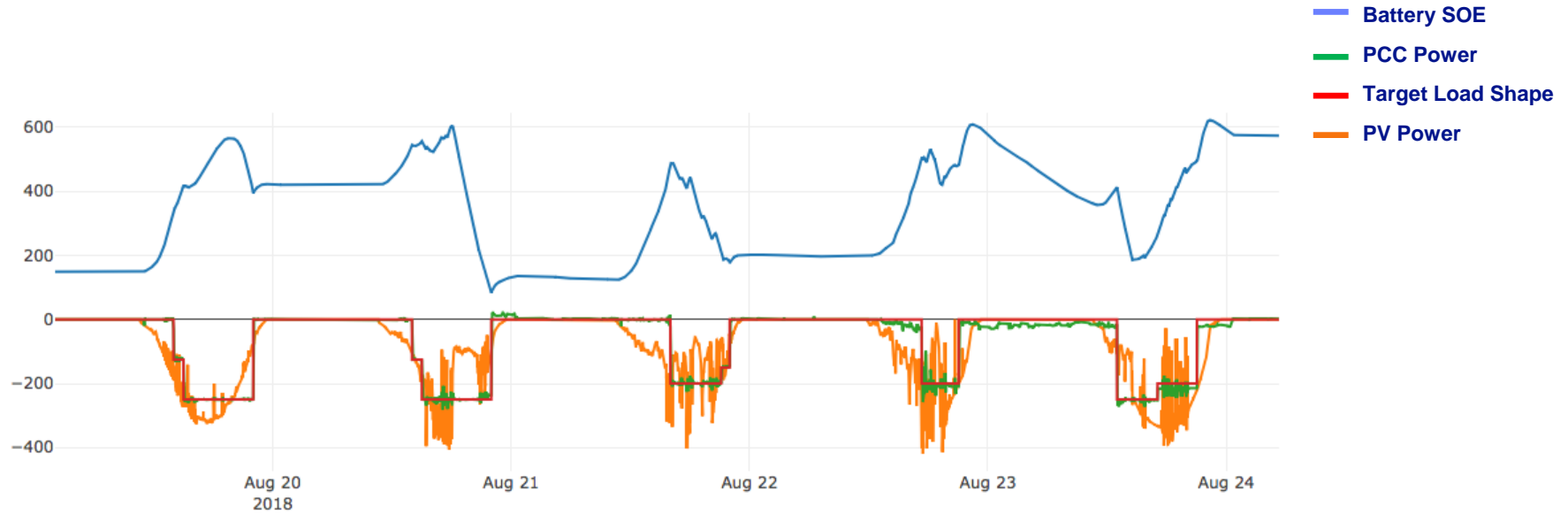
Power firming

Optimize Battery Life

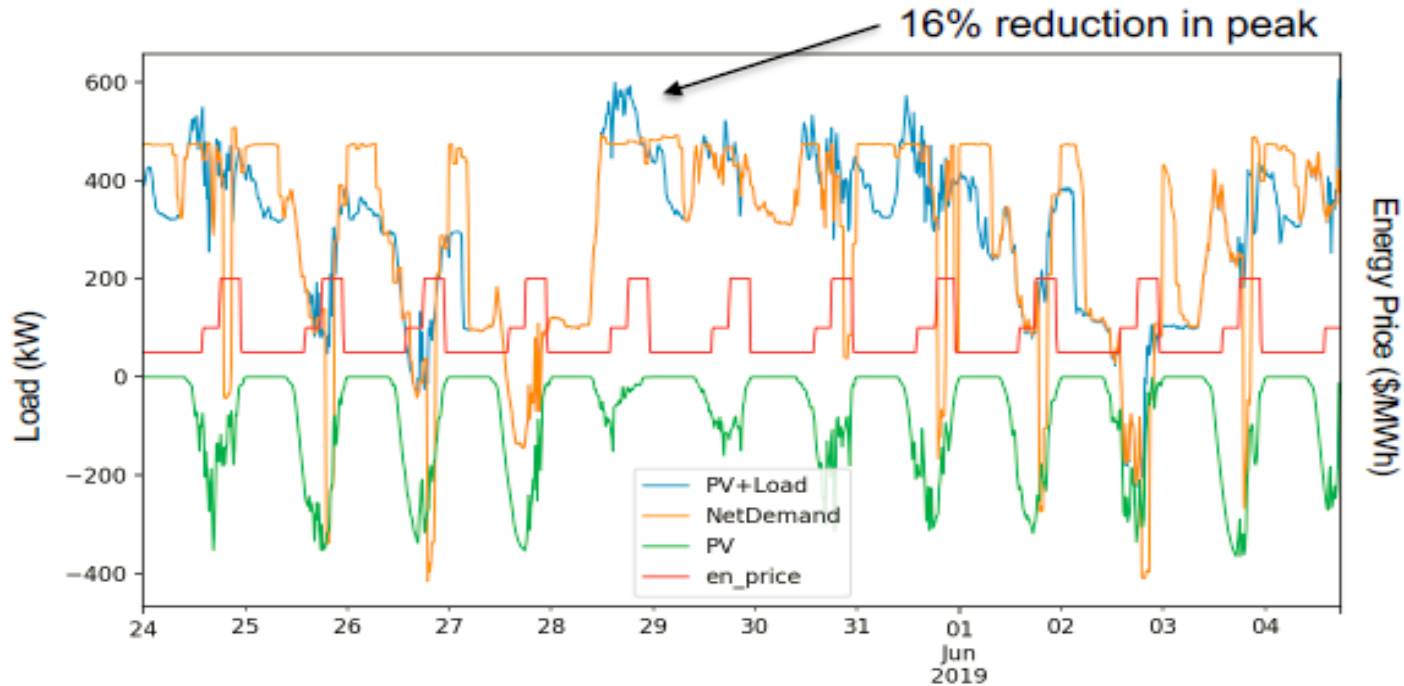
National Grid



PV Firming



Peak Load Shaving + Energy Arbitrage



Load Management Portfolio

School:

Load management by adjusting zone temperature cooling setpoints for packaged rooftop units (RTUs) via building automation system

Food Processing:

Can shift multiple loads, with varying frequency and duration

Manual actuation: Facility unwilling to fully automate control of core production processes

Food Production:

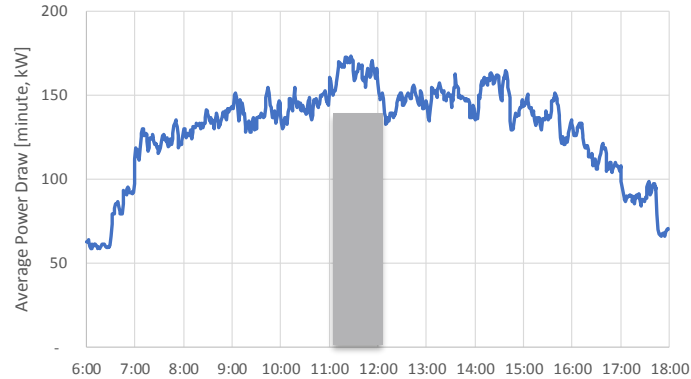
Control charging schedule of forklift and rider pallet jacks on multiple circuits

Approximately 3.5MW, 10-20% shiftable

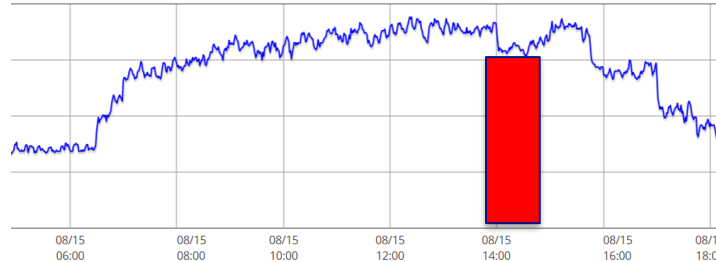


Load Shifting: School AC

T_{set} decrease from 11AM-noon; Average daily temperature, $T_o = 70^\circ\text{F}$

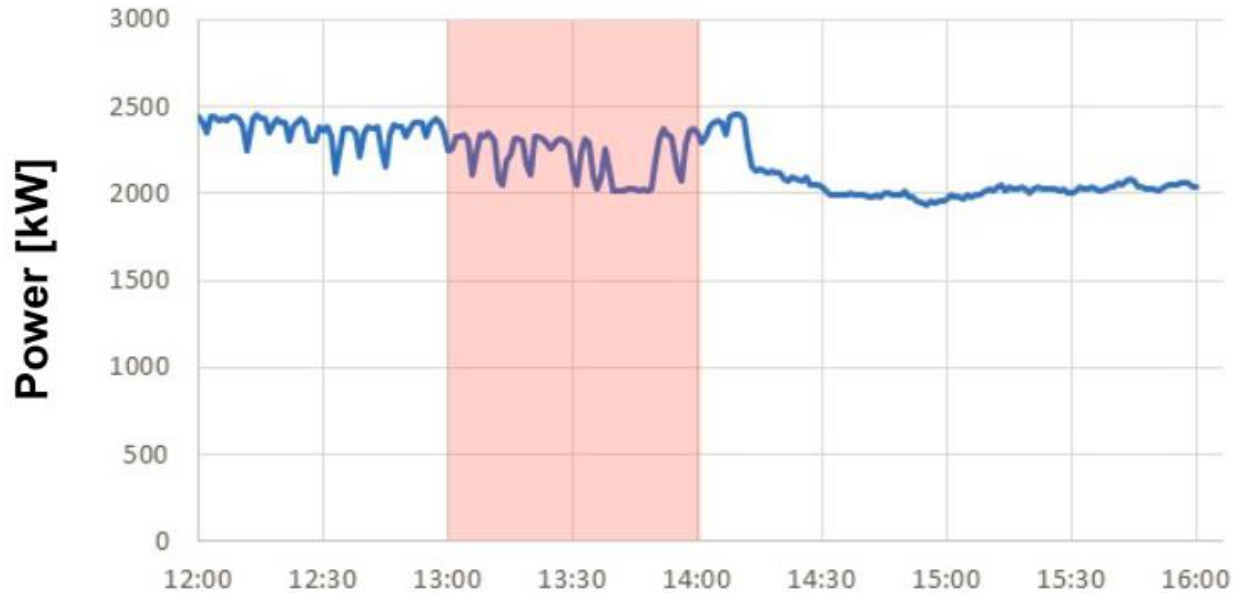


T_{set} increase from 2-3 PM; $T_o = 77^\circ\text{F}$



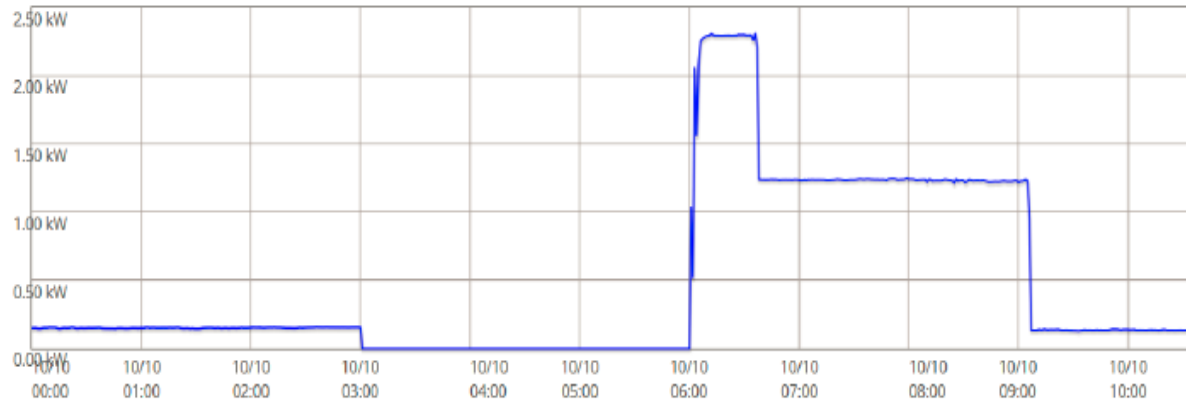
Postponing Secondary Processes

Pausing process decreases power by ~130kW, visible despite train unloading event.

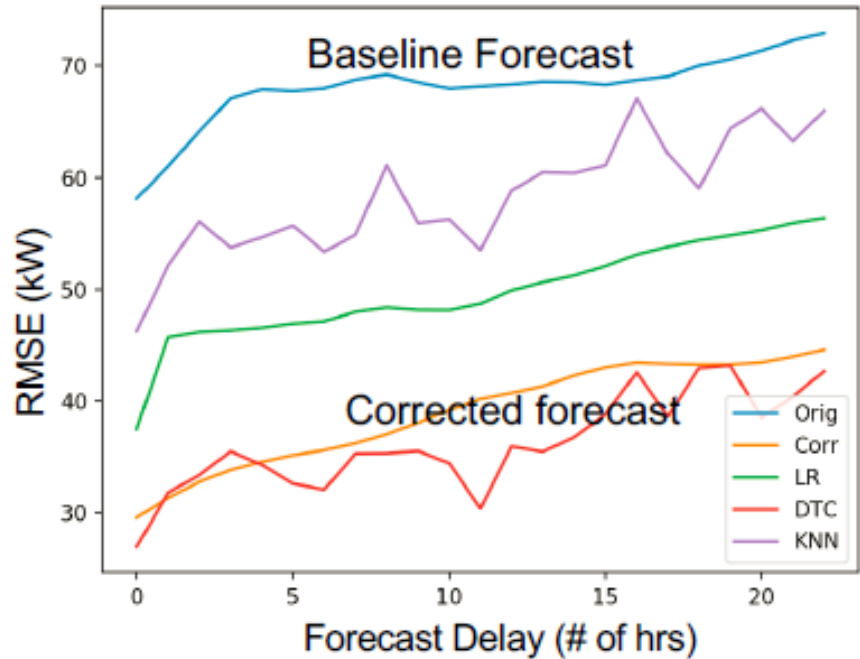
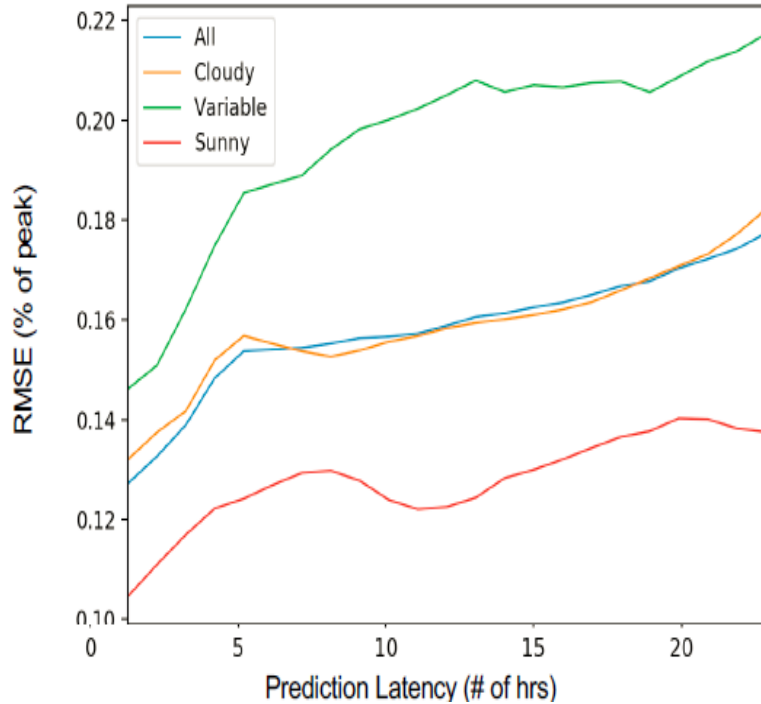


Blocking EV Charging

Charging locked out from 3-6AM, enabled thereafter

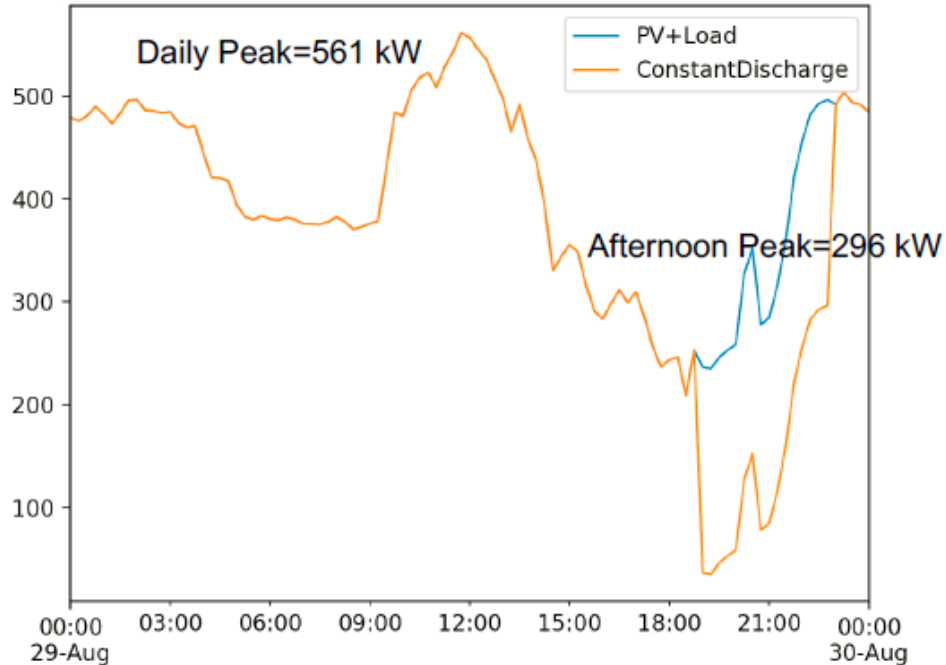


Challenges: Forecasting

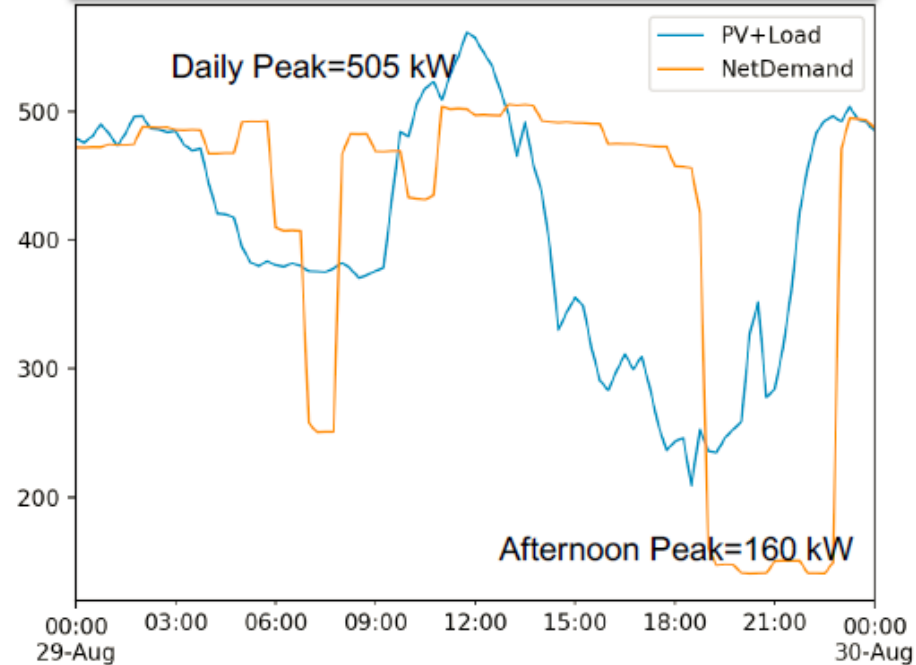


Challenges: Peak Shaving

Constant-ESS Discharge Strategy



Adaptive ESS Control Strategy



References

Integrated system to enable high-penetration feeder-level PV: Preliminary design and simulation results

<https://ieeexplore.ieee.org/document/8085967>

The SunDial Framework: Enabling High Penetration Solar through the Integration of Energy Storage, Demand Management, and Forecasting

<https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8547884>

***Links may need to be copy and pasted into Chrome**





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national**grid**