vybeenergy

AI-Driven Whole Building Energy Management

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Agenda

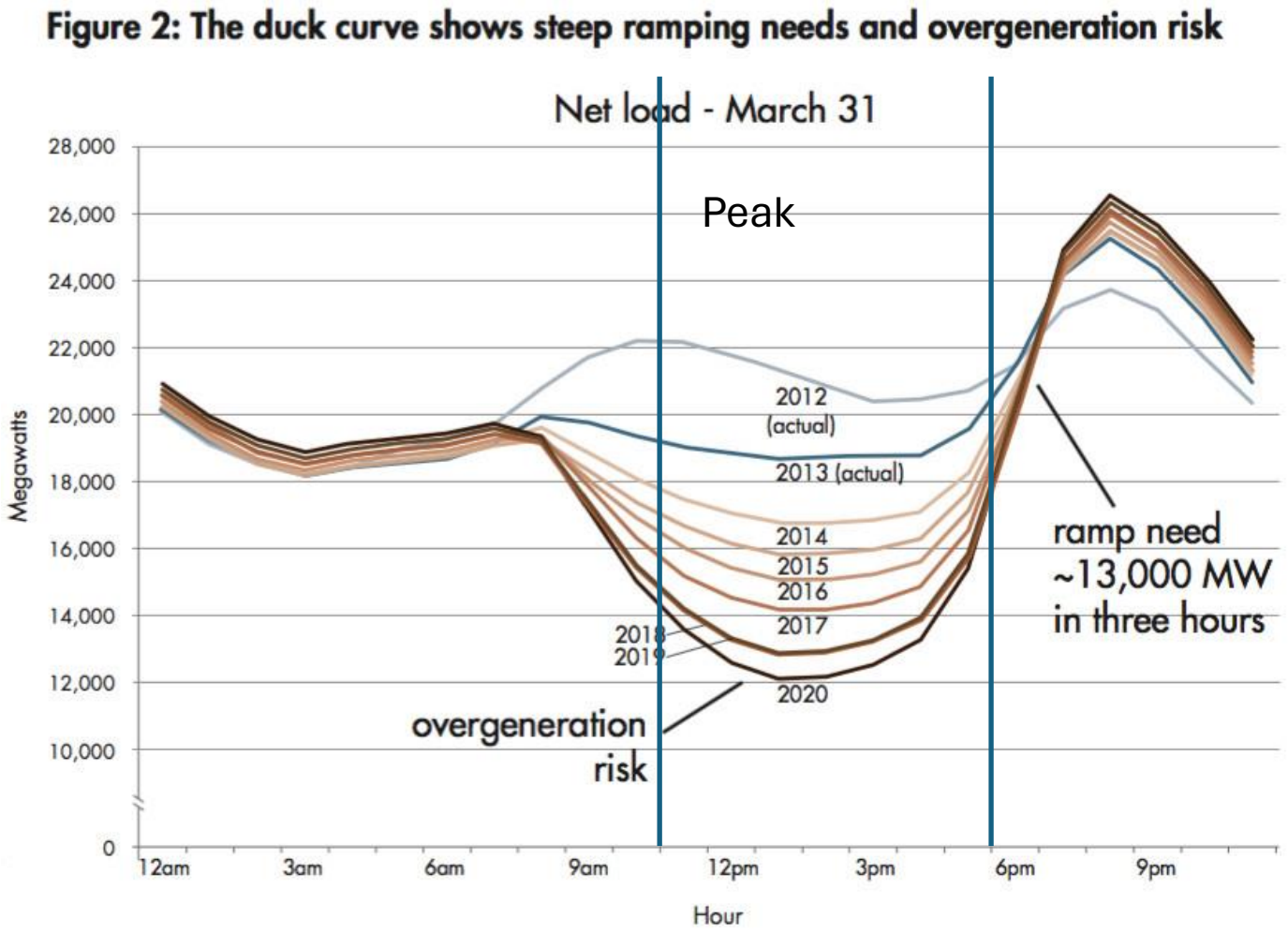
- Intro and background
- Opportunities for C&I customers
- C&I Challenges
- AI-Driven Whole Building Energy Management
- Vybe’s Approach
- Questions

Opportunities for C&I Customers

FERC 2222: Distributed Energy Resource (DER) owners can capitalize on energy arbitrage opportunities in the wholesale energy markets	Higher electricity costs = self-generation more profitable	Federal and Municipal incentives for storage and generation	Utility time-of-use rates incentivize reduced energy use and instead activate storage and other onsite resources
			

A confluence of factors is making it easier and more lucrative for **C&I customers** to directly participate in energy markets while saving money.

New TOU periods in CA have incentivized energy storage projects



Reliance on the grid for power during core business hours on weekdays is reduced due to development of more solar projects.

The reliance on the grid has now been shifted to the evening hours after solar projects stop producing

This has led utilities to shift their peak hours from between 11 AM and 6 PM to between 4 PM and 9 PM to incentivize people to use less electricity

But this also creates an opportunity to deploy behind-the-meter batteries

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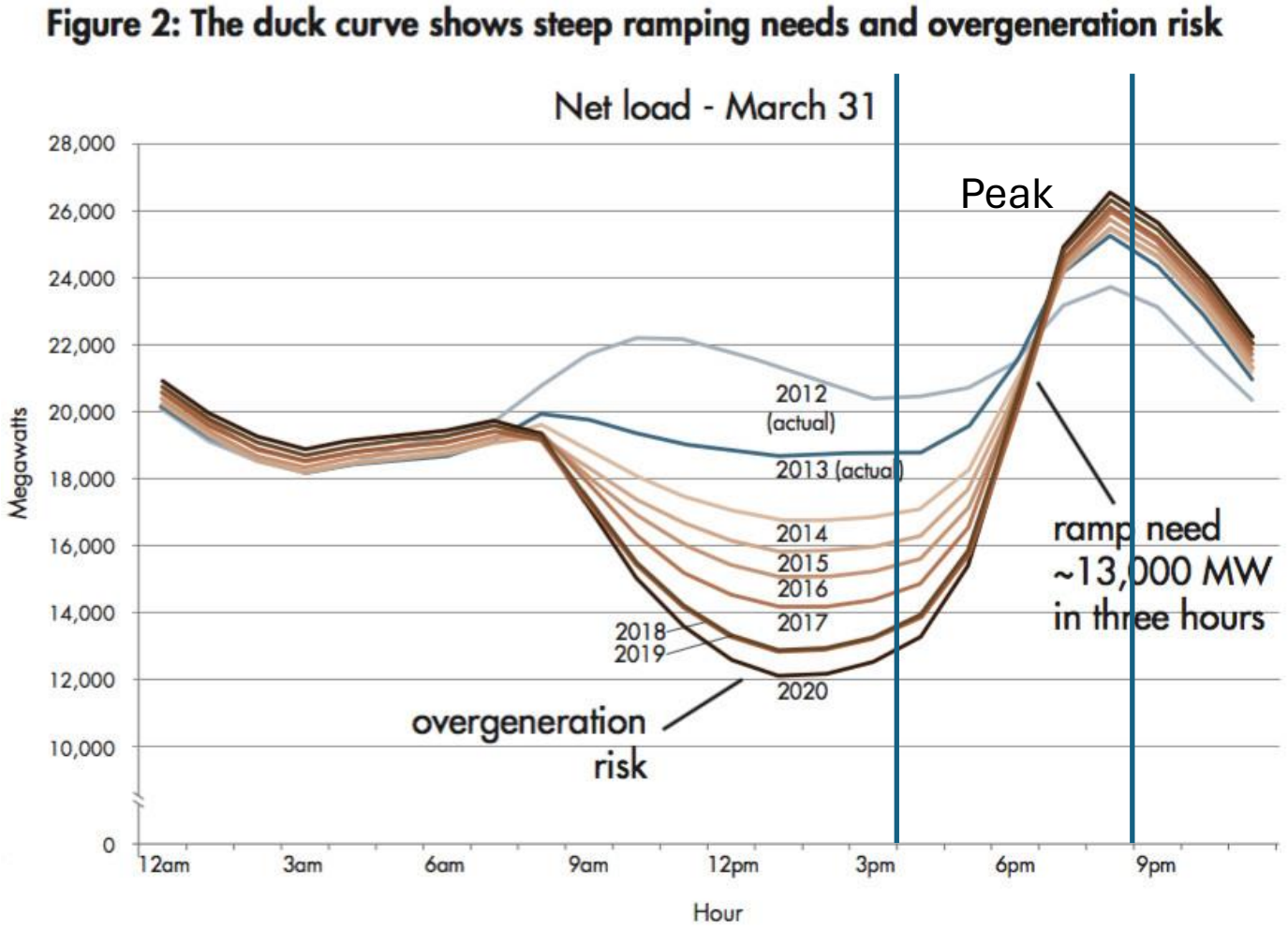

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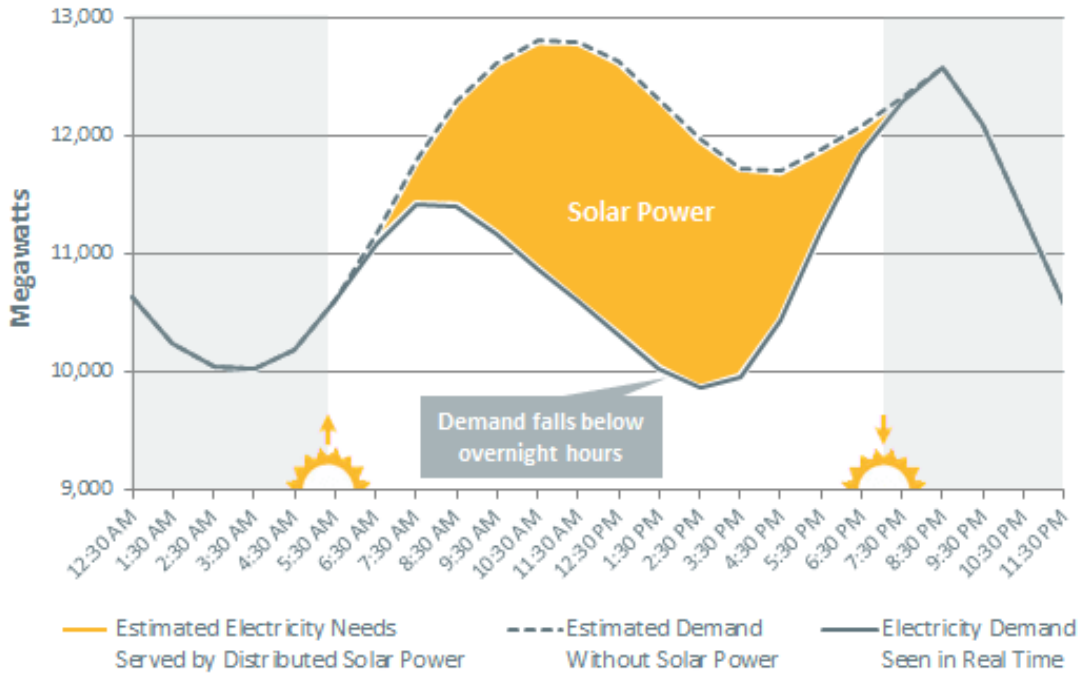
MA, NY and other states are trying to stay ahead of their own evolving duck curves by incentivizing batteries before the lack of ramp-up capacity becomes a problem.

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

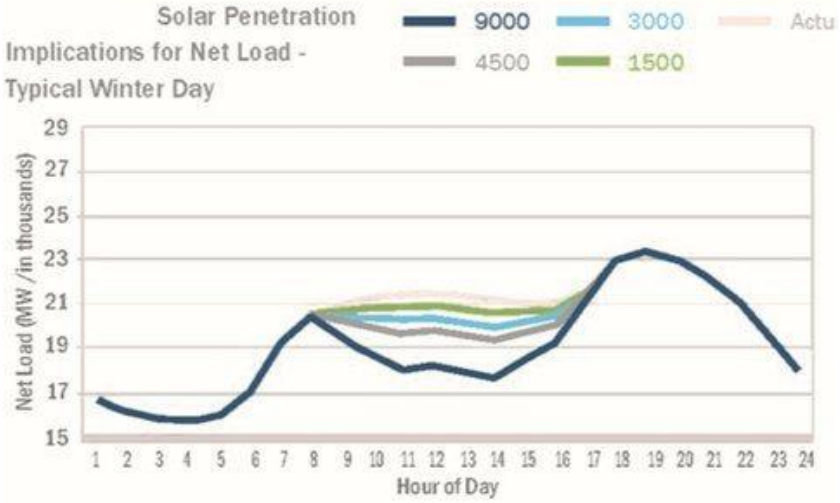
A sunny spring day pushed distributed solar output to an estimated record high of 2,309 MW at 1:30 p.m. and drove down electricity demand on the regional power system. In effect, New England consumers were using more grid electricity while they slept than in the middle of the day. (Data subject to adjustments.)

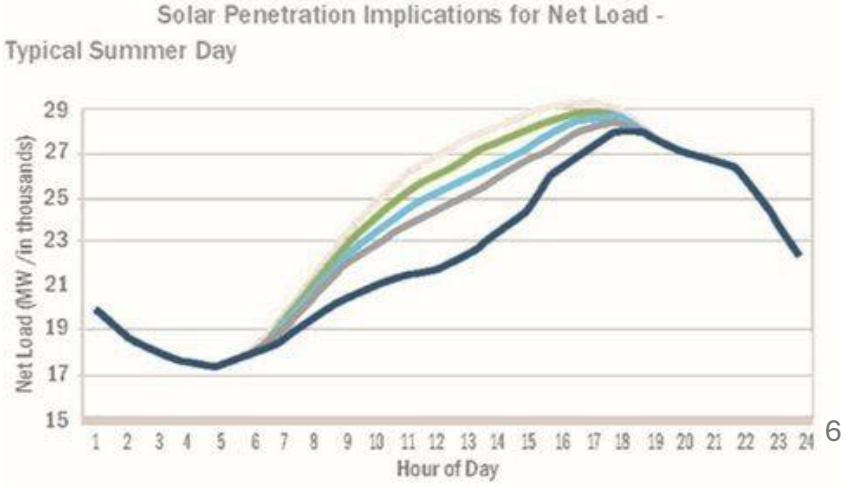


Source: ISO New England

NY's mini version of California Duck Curve

Capacity Factor of Generators by Type





US Energy Sector

The US energy sector is complex.

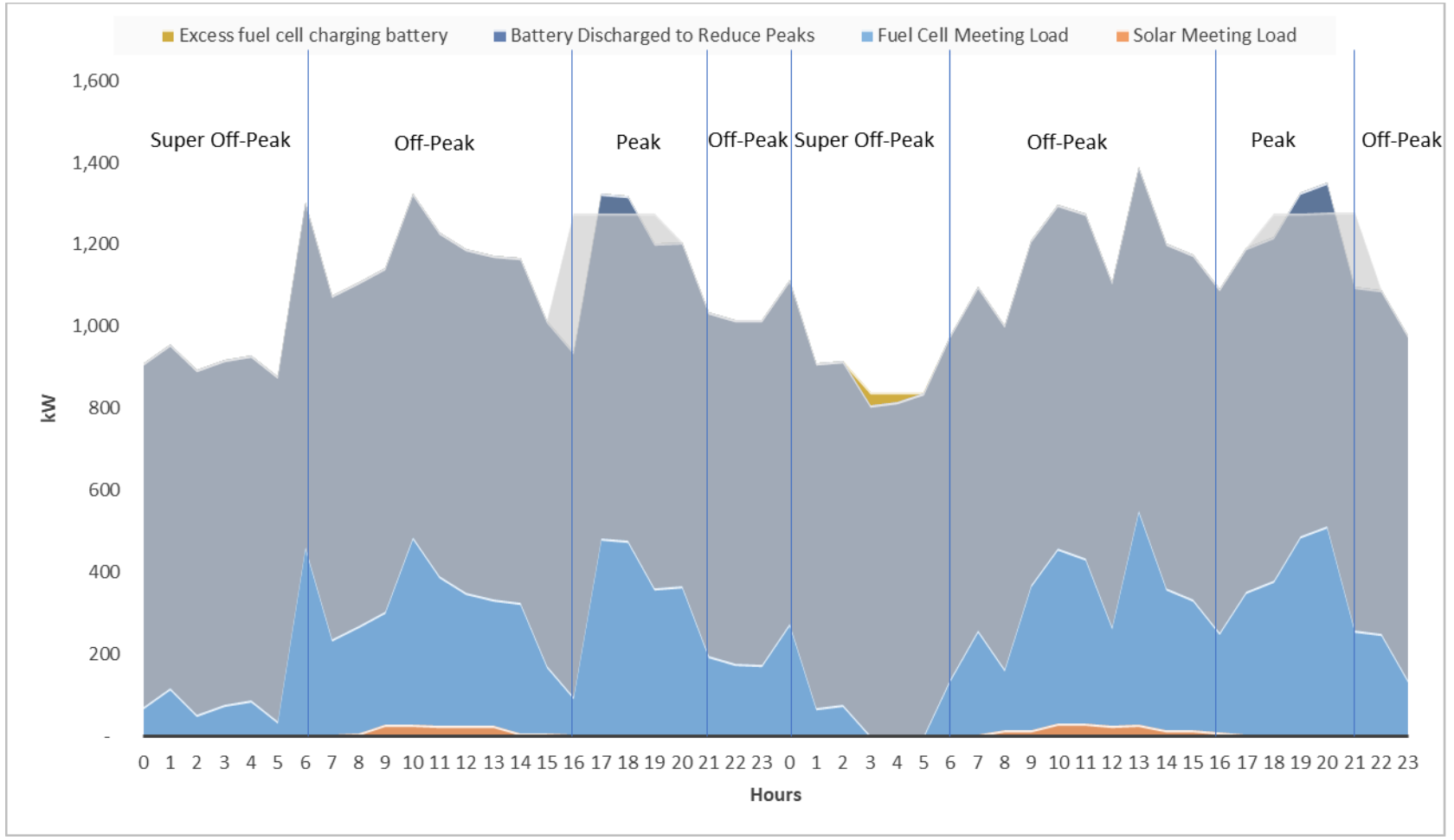
There are over 2,900+ utilities in the US serving 154 million customers. Each is governed by its own set of policies and rates dictated by the jurisdiction in which they reside.

We have modelled the impact of load growth on utility costs and returns on numerous renewable + storage projects:

- 35+ utilities
- Regulated and deregulated markets
- 105+ tariffs
- 300+ sites
- 2GW+ load data
- 18+ US states (both regulated and deregulated markets)
- Also have experience in the Caribbean, Mexico, India, Kenya, South Africa among others

- Extensive experience in multiple independent system operator (ISO) territories (e.g., NYISO, CAISO, ISO-NE, ERCOT, and PJM)
- Multifamily residential
- Hotels/resorts
- Commercial and government office buildings
- Manufacturing
- K-12 schools
- Universities & Campuses

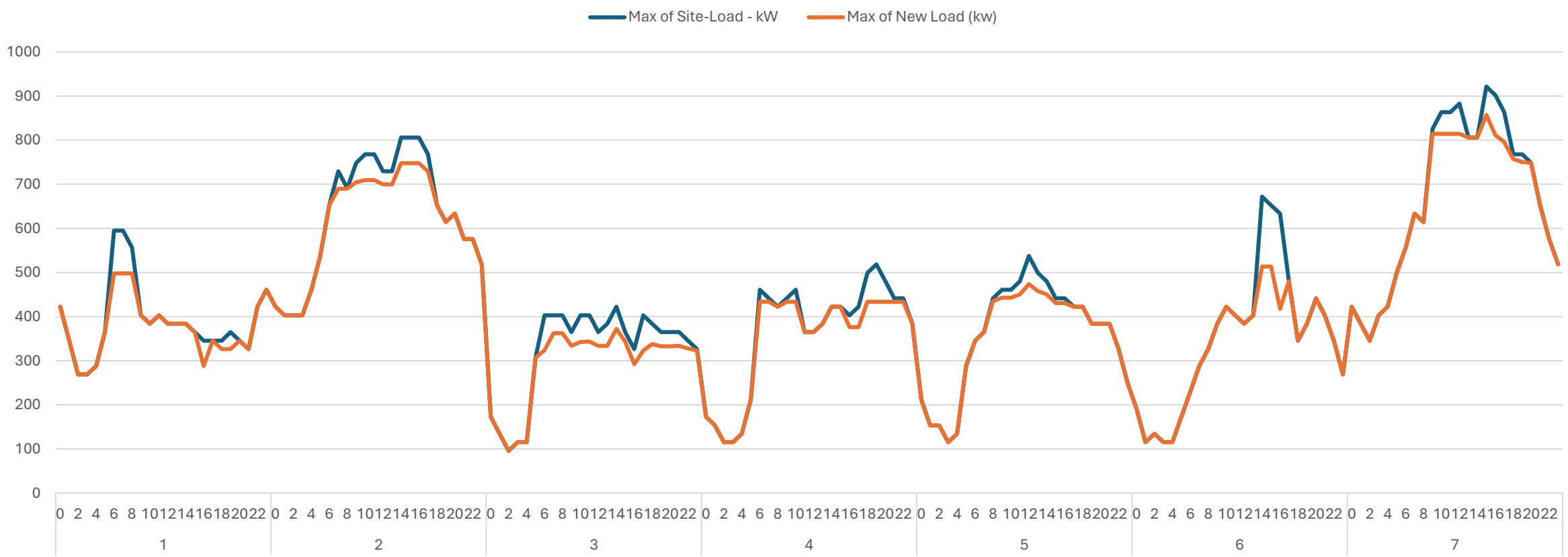
The duck curve is making batteries more attractive



We look at individual Time-Of-Use rates and identify those time periods high demand charges and strategically discharge the battery to maximize savings for our client

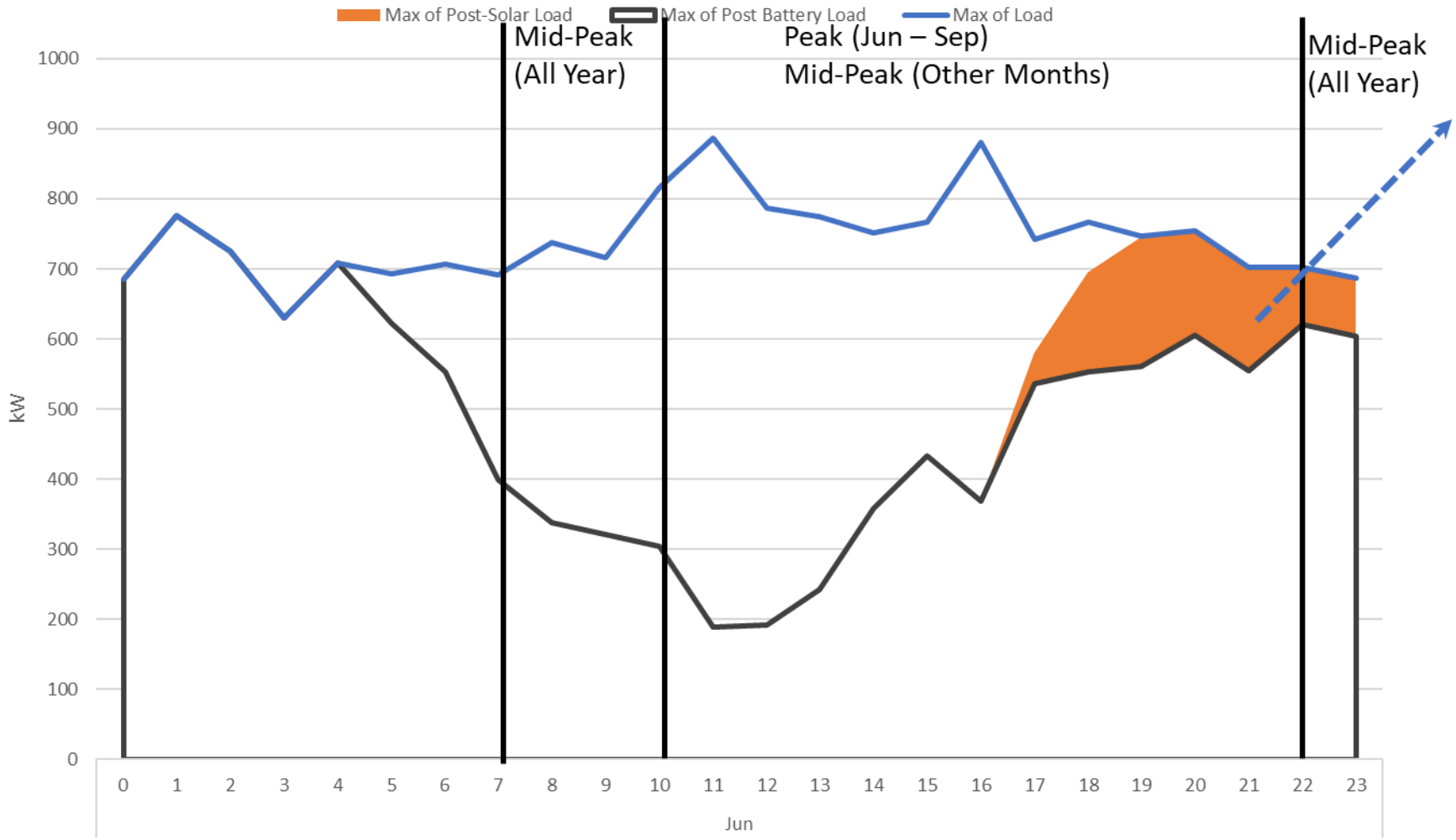
This site in CA has three time of use periods as well as monthly max demand charges which must also be considered in deploying the battery

A 190 kWh battery could save this site $24,000 in demand charges from January to July 2018



* Assumes battery is charged with excess fuel cell

This example from NJ/NY area shows how batteries can be used to reduce BTM demand charges in just the month of June



Demand savings (June) :

After solar: $4,806
After batteries: $5,746 (additional)
Total: $10,552

Demand Savings (Year):

After solar: $17,069
After batteries: $25,904 (additional)
Total: $42,973

C&I Challenges

How can we bring that predictability and certainty that you get from modelling into the real world?

One way to do it would be to use all the available levers you have within a building to manage the load.

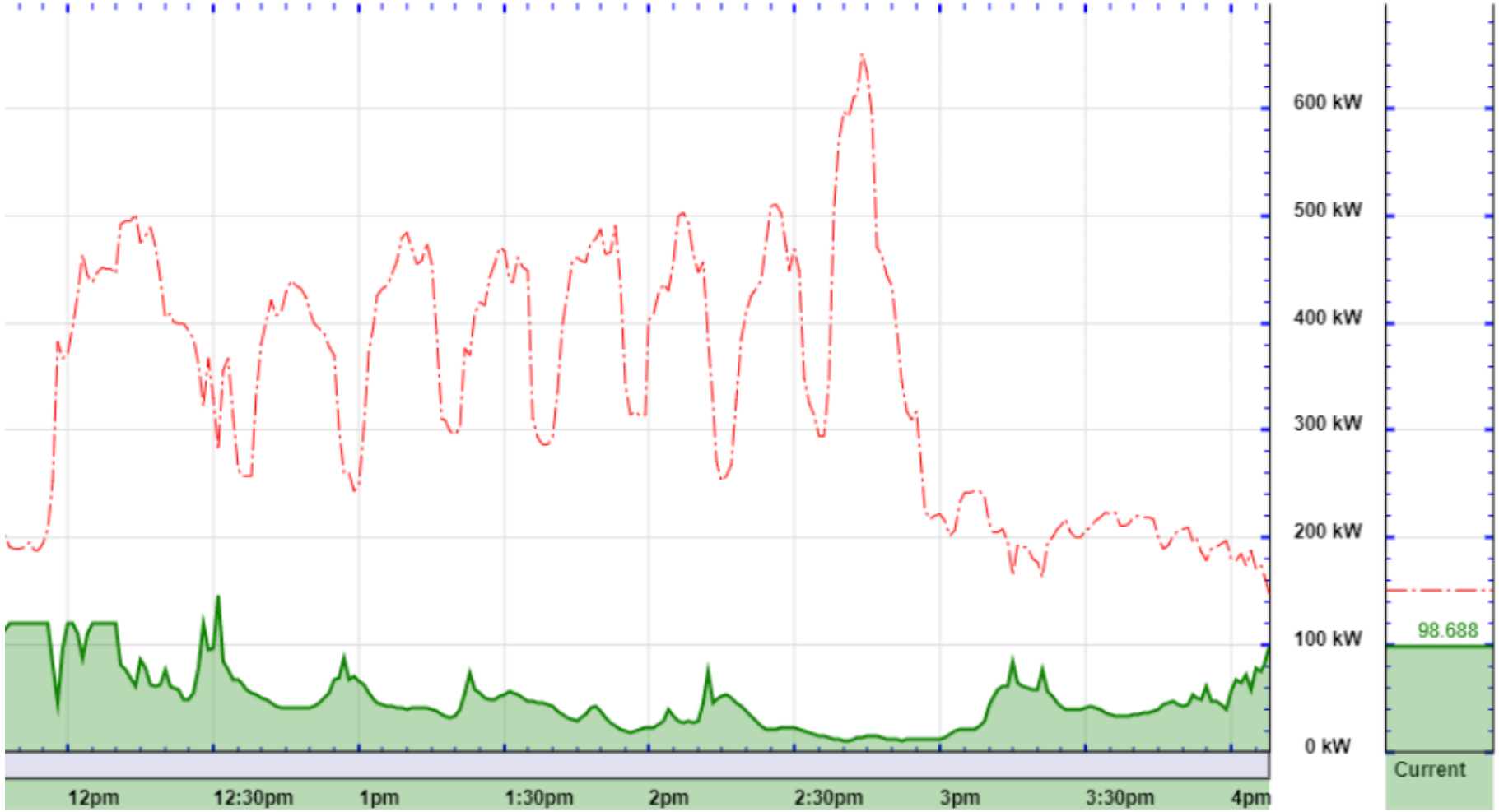
- Missing one peak event can reduce your savings and cost you more money

Between $20 and $60 billion in additional annual energy costs from siloed control of energy assets in buildings driven by

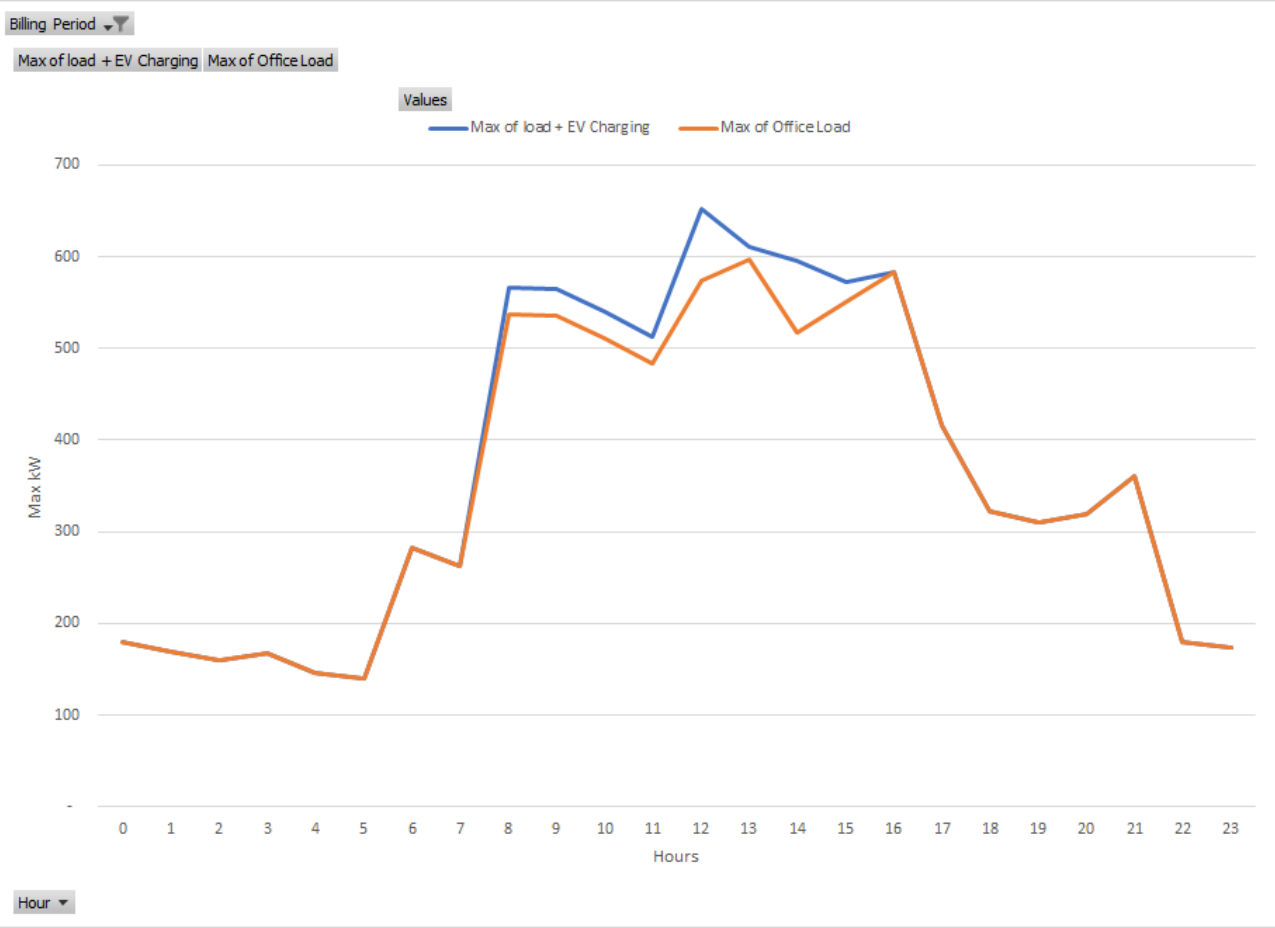
- Rising electricity costs
- Growth in energy demand from new energy technologies

Additional benefit is cutting down the number of dashboards one has to monitor

Chiller Operations



Additional Demand from EV Charging



Additional potential demand from:

- 5-10 Level 2 EV Charging stations
- Charging between 8 AM and 4 PM

AI-Driven Whole Building Energy Management

We are bringing both **predictability and diversity** of energy devices (on the energy usage, generation and storage side) to manage our building load

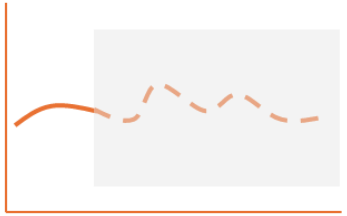
- Serves as a master controller
- Single-pane-of-glass

Can scale back on normal operations if it makes more economic sense to participate in wholesale energy markets or utility demand response programs

- Allows for revenue value stacking

Technical Product Architecture: Software + Hardware Controls

VYBE Inputs



Predictive modeling of building / campus load based on weather and stochastic modeling of building loads (heating, cooling, occupancy, lighting etc), EV charging

Predictive modeling of on-site generation (wind, solar, chp etc) based on weather conditions, predicted insolation

Tariff DB

User interface to enter schedule of events per day DB

Forecasted Solar Data

Weather Data

Patented Grid Optimizer Platform

Vybe Site Controller

market signals

Third party device (utility / market aggregator)

VYBE Outputs

Real-time energy cost management through coordinating both storage and energy consumption response to demand spikes through single controller, thereby increasing battery duration.

Revenue Stacking

1. Maximize demand (kW) savings
2. Maximize energy (kWh) savings
3. Optimize revenues from demand response / ancillary services participation

Other benefits:

1. Increase reliability / resilience
2. Reduce GHG while preserving functionality
3. Increase accessibility of RE, EV, and electrification

Continuous updates in response to real-time changing conditions and market signals

- AI driven, expanded load management
- Integrated with RE generation
- Integrated with energy storage
- Integrated with EVSE / managed charging
- Integrated with third party software to enable market participation

Technical Architecture: AI Software

- We are demonstrating our chiller optimizer at Oklahoma Panhandle State University (OPSU)
- We built a predictive model to forecast chiller kWh usage
- The software embeds a continuous feedback loop to train and improve the model

- Snapshot of other ML algorithms that we are working on are for:
  - Predictive analytics on solar production so we know how much of the site load we can meet with solar
  - EV utilization rates for various times of the day
  - Optimal use of battery to reduce peaks and/or reserve for wholesale market participation

Questions

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