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Mercury DERMS load forecasting

A forecasting tool for the grid edge

Typical utility load forecasts are developed at the system-level, but their resolution is limited to feeder load – providing coarse visibility into system-wide load and a lack of clarity surrounding the activity of distributed energy resources at the grid edge and behind the meter. These forecasts also rely on conventional regression- or rolling average-based methods, calibrated infrequently and designed to be backwards-looking rather than predictive. In order to effectively equip distribution operators for the rapid proliferation of DERs, the modern utility needs a tool that is suitably designed to accurately forecast DER activity from the grid edge.

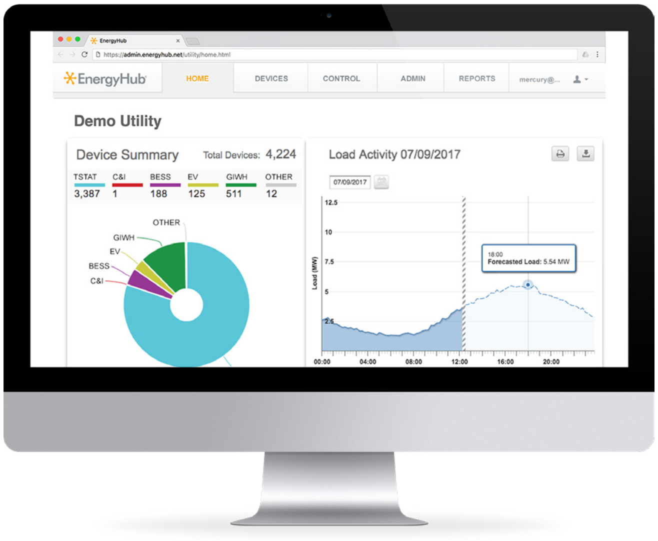
EnergyHub's Mercury Distributed Energy Resource Management System (DERMS) includes a forecasting capability that utilizes advanced machine learning techniques to predict the complex behavior of fleets of connected DERs, aggregating data from each grid-edge device. The result is program-specific models that are continually optimized, providing consistently accurate forecasts at 15-minute intervals. Mercury produces forecasts with **greater than 95 percent accuracy** of fleet-level loads across DERs[1].

Delivering insights across the organization

Utilities rely on Mercury for data-driven grid operations with day-ahead and real-time load forecasting capabilities to:

Evaluate DER load activity bundled from the grid edge

Working in conjunction with distribution network operations' recurring load assessments and power flow simulations, utility operators can assess expected peak load from DERs under control by the utility. To better understand load dynamics throughout the network, forecasts can be viewed from the system to the sub-feeder level and sliced by program or asset type.



Better inform utility demand-side management decisions

Program managers can view program-wide forecasts to inform decisions on when to dispatch DERs for grid services, from optimally targeting DER and system peak, to preventing acute feeder congestion, to shifting load to better align with renewable generation.

[1] Based on comparison of EnergyHub's forecast versus actual fleet-level load during summer 2017.

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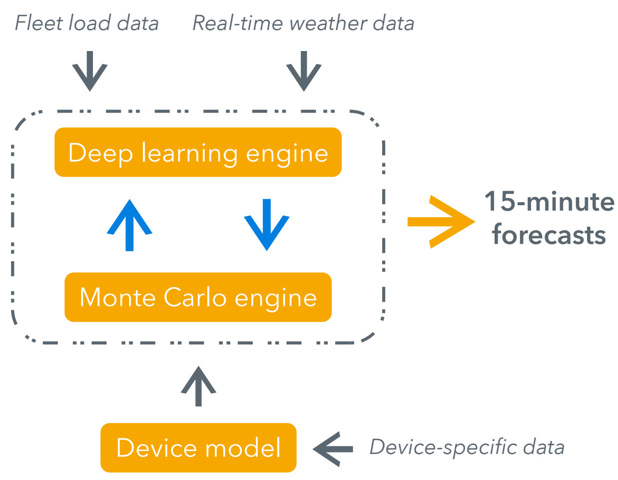
The anatomy of a forecast

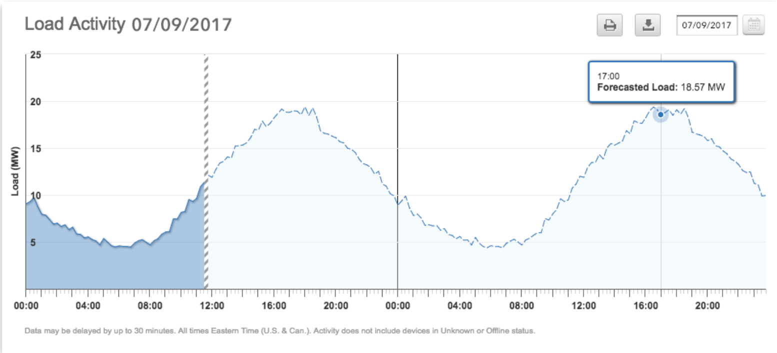
EnergyHub's forecasting calculations rely on three key components:

- **Daily & seasonal variation:** Changes in weather, temperature, occupancy and usage profiles – both in near real-time and over longer time periods
- **Detailed load profiles:** Large volumes of historical energy consumption data, gathered at high temporal resolution and aggregated from the individual device level
- **DER operational characteristics:** The types, specifications, and operating characteristics of DERs under management

Leveraging granular data and machine learning for accurate forecasts

EnergyHub utilizes both top-down and bottom-up modeling techniques to generate forecasts within Mercury. Leveraging the same intelligence used to optimize performance during demand response events, device-specific data is used to develop device-specific models of equipment state and energy consumption from the bottom-up. From learning charging patterns of electric vehicles to identifying thermal characteristics of a home based on HVAC usage, these models use Monte Carlo methods to simulate context-specific, individual load curves. From the top-down, a deep learning engine regularly ingests historical aggregate load data across a population of connected DERs and real-time weather data to fine tune model parameters. Both the bottom-up and top-down models then interact to predict fleet-level load directly, resulting in a forecast. Day-ahead and real-time forecasts are updated on a 15-minute basis, continually providing utility operators with an up-to-date forecast that simultaneously captures collective and device-level dynamics.





An example of a multi-day fleet-level load forecast

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