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Powernet: Behind-the-Meter Resource Management System for Farms

Researchers at Stanford have developed a cloud-based behind-the-meter (BTM) system that can cut energy costs and reduce reliance on the grid close to 93% respectively. The system is capable of data-driven management and coordination of battery storage, rooftop solar PV, and motor loads in a challenging agricultural environment. Coordinating BTM distributed energy resources is critical to ensure efficiency and reliability for consumers facing an increasingly variable grid supply. But such coordination at scale remains difficult due to limitations in sensing, communications and modeling in field settings. The Stanford team reports the first field deployment of such a system in a California Central Valley dairy farm to manage ventilation loads. The system, called Powernet, manages resources by forecasting loads and solar based on data from a weather sensor network and utilizing a model predictive control to minimize electricity costs while accounting for livestock well-being specific constraints. Powernet could enable the management of other types of agricultural and industrial BTM resources at scale.

Stage of Development
The researchers have demonstrated that their BTM system is able to reduce costs between 40.75% to 92.20% depending on available capabilities, and decreases reliance on grid energy by up to 92.68%.

Applications

- HVAC market
- Fans and ventilation
- Refrigeration

- Solar and energy storage
- Agriculture and aquaculture

Advantages

- Coordination and consolidation of temperature, humidity, wind and solar sensors that are connected to the cloud-based Powernet Hub
- Empowers users to proactively predict and monitor electricity system operation, energy consumption, and services on the grid.
- Unlike existing BTM systems, the farm environment presents unique challenges.

Patents

- Published Application: 20220321664
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