

Axiom Cloud: Apps for Commercial Refrigeration

Virtual Battery™ Case Study - Multi-site Demand Response Event



OPPORTUNITY

California's Demand Response Auction Mechanism (DRAM) allows customers of the state's three largest utilities (Southern California Edison, San Diego Gas & Electric, and Pacific Gas & Electric) to bid flexible capacity directly into the CAISO day-ahead energy market. Through this program, businesses are able to generate revenue year-round based on the power (kW) and energy (kWh) they can reliably offset during periods of high grid-wide demand.

This customer was looking for a lightweight way to add power flexibility to their fleet of buildings in PG&E territory to reduce their demand charges (based on the highest power consumption at each facility during each month) and generate revenue from the DRAM program.

SOLUTION

Axiom Cloud implemented its Virtual Battery app at three grocery stores, which unlocked the built-in flexibility of the low-temperature refrigeration systems, effectively turning them into a battery. In addition, Axiom's Refrigeration Battery was previously installed at one of those stores to add even more power flexibility from the medium-temperature refrigeration system. Virtual Battery intelligently operates these refrigeration systems to minimize utility bills while maximizing revenue generated from programs such as DRAM.

Through a partnership between Axiom Cloud and Leapfrog Power, this customer is able to aggregate flexible capacity at all three sites to participate in DRAM and other grid services programs. In conjunction with Leap, Axiom takes care of all performance validation and qualification requirements set forth by the program administrators.

RESULTS

During an average summer month, Virtual Battery generates revenue by leveraging 193 kW of combined flexible capacity during a DRAM event. Over the course of a year, this service generates tens of thousands of dollars of demand response revenue while also reducing the customers utility bills and operating their refrigeration systems more efficiently.

For more details on the implementation of Axiom's solution and to see what operation looks like during a demand response event looks like, refer to the next page.

Customer type

Retail grocery, 3 stores

Location

Northern California, USA



Apps provided

- Facilities Analyzer
- Virtual Technician
- Virtual Battery

Feature in this case study

Grid Services with a multi-site demand response event

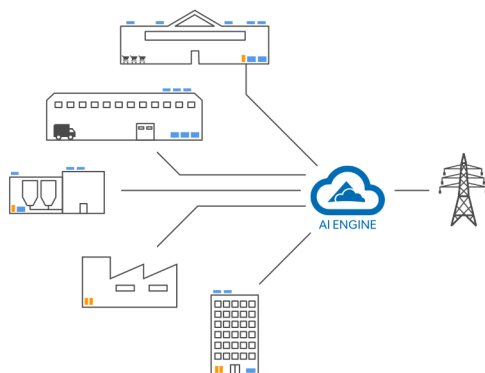
Refrigeration system architecture

Average low temperature system size: 222 MBH, 56 HP

Average medium temperature system size: 1512 MBH, 210 HP

Demonstrated DR capacity

193 kW across 3 sites



Virtual Battery unlocks the power flexibility of refrigeration systems to generate grid services revenue.



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How Virtual Battery Generates DR Revenue



Quantified available flexible loads including Virtual Battery and Refrigeration Battery capacities at multiple sites



Intelligently stored cooling based on optimal efficiencies, available refrigeration capacities, and building loads



Co-optimized multiple value streams to maximize demand response (DR) revenue without compromising energy bill savings

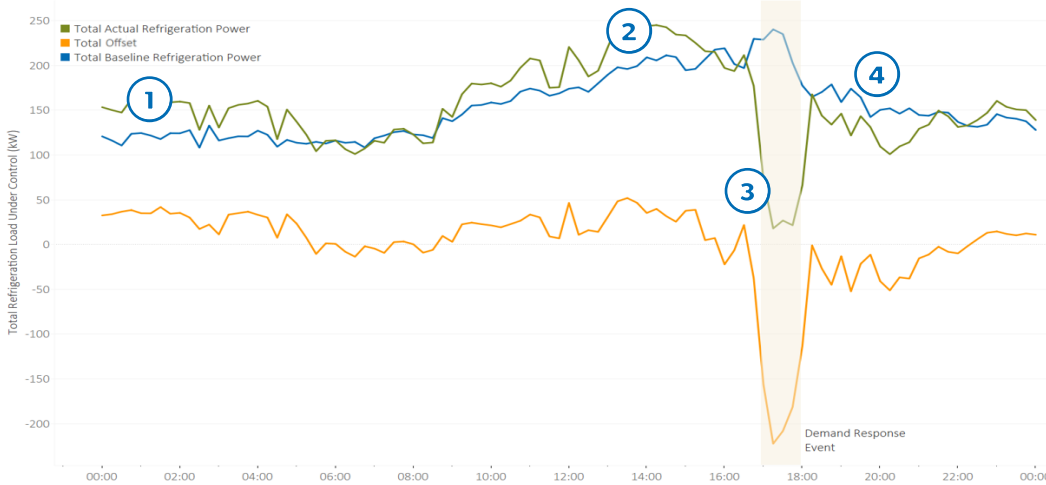


Measured and verified the DR offsets for each site for reporting purposes



Received payments on behalf of the customer from a third-party aggregator

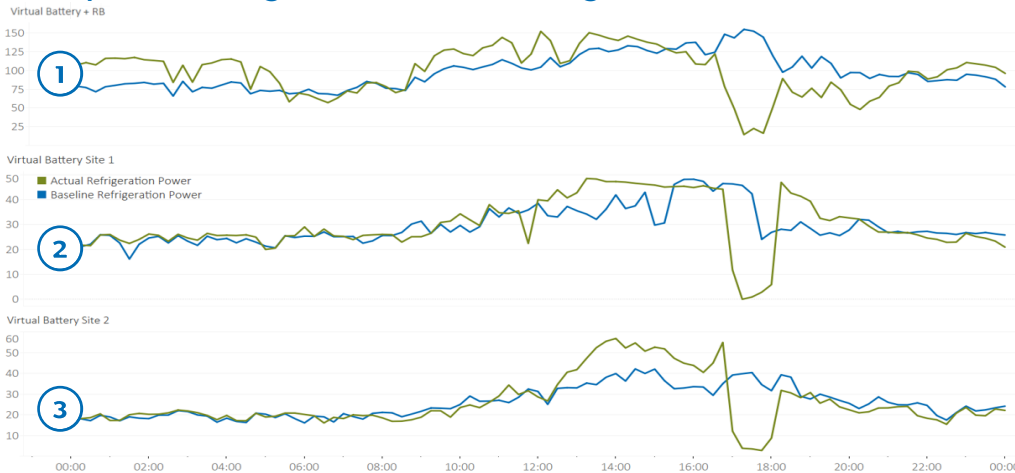
Aggregated building loads



Aggregate results

1. The Refrigeration Battery charges at night, increasing energy consumption.
2. Virtual Battery pre-cools the low temperature refrigeration system prior to the DR event.
3. During the hour-long DR event, an offset of 193kW was generated across the three stores.
4. After the event, the Refrigeration Battery continued discharging for Energy Bill Management (a separate benefit stream).

Store-specific refrigeration loads during the DR event



Store-specific results

1. This store includes both a Refrigeration Battery (medium temperature) and Virtual Battery (low temperature), resulting in ~125 kW of offset during the DR event.
2. With Virtual Battery, intelligent pre-cooling kept the load threshold below the monthly demand threshold prior to the event.
3. With Virtual Battery, peak demand for the month was not as much of a factor in pre-cooling. This allowed actual loads to exceed the baseline loads by a larger amount prior to the DR event.

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Axiom Cloud's mission is to use software and automation to transform how the world's cooling systems are powered, operated, and maintained. To learn more more about our Facilities Analyzer, Virtual Technician, or Virtual Battery apps, send us an email or visit our website.



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