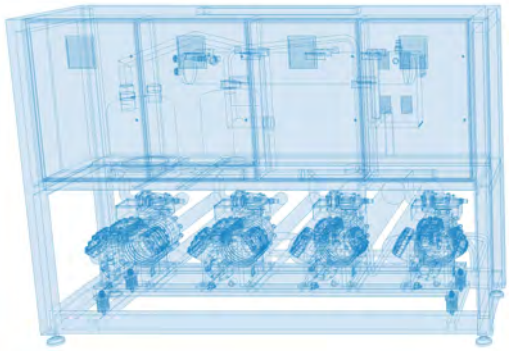
Axiom Cloud Case Study

Worry less, make more.

Whole Foods Market expects to **save $29,427 annually per store**. By treating refrigeration systems as an asset instead of a necessary evil, Whole Foods **improved cash flow and reduced maintenance headaches** from day one.

AXIOM CLOUD

Now up and running in 13 stores across Northern California and Tulsa, Oklahoma, expansion is underway in another 18 stores. With payback in less than one year, Whole Foods' refrigeration systems are adding to the bottom line for the first time.



Challenge

Whole Foods Market began its journey to making its existing refrigeration better than new in Northern California with deployment of the Virtual Battery™ app in 12 stores. At the time, management of the refrigeration systems was manual and economically inefficient.

Adding artificial intelligence to refrigeration controls, including Emerson and Micro Thermo controllers, and gaining real-time visibility into system performance generated measurable benefits from day one.

The next step was to install Virtual Technician™, a second intelligent app from Axiom Cloud. To do this, Whole Foods teamed with SEER2, an HVAC and commercial refrigeration expert, to start the app in a store in Tulsa, Oklahoma. The result was an immediate reduction in alarm-triggered visits from refrigeration technicians and improved energy efficiency.

By focusing on the biggest consumer of electricity at the store level – refrigeration systems – Whole Foods is now experiencing the impact of lower energy spend on the store's bottom line.

At the same time, Axiom's apps enable the stores to get paid by their utility via participation in utility-provided demand response programs, drop energy and maintenance costs, and eliminate common headaches like case temperature alarms.

> "Axiom's Virtual Technician app surprised us by predicting a compressor failure that would have caused a refrigeration outage if it had gone unnoticed. Now, we are deploying Virtual Technician in as many stores as we can."
>
> Brad Person, SEER2 President

Virtual Battery

Virtual Technician

Solution

PHASE I

In the grocery industry, refrigeration is often perceived as a necessary evil. The systems play a dominant role in determining both store electricity consumption and greenhouse gas emissions (GHG). Working closely with Axiom Cloud, Whole Foods Market identified 12 stores in Northern California that would benefit from Axiom's Virtual Battery.

Virtual Battery is an app that unlocks the power flexibility in existing refrigeration systems. It predictively pre-cools low-temperature cases using the power of artificial intelligence, followed by load shedding of compressors and condensers at the optimal times. In this way, the Virtual Battery acts like a traditional lithium-ion backup battery without the high upfront cost.

The result is less money spent on electricity bills, new revenue streams through demand response, and zero impact on food safety and quality.

In each store, the Virtual Battery app uses a four-step process to automatically optimize the entire building's energy consumption by modulating power consumption of the freezer systems: 1. Forecast; 2. Optimize; 3. Pre-cool; 4. Load shed.

In the forecasting stage, real-time and historical data are used to generate a forward-looking weekly estimate of both refrigeration and overall building loads.

Combining the load forecasts with the utility rate plan allows the app to create a tentative schedule for pre-cooling and load-shedding. The timing of these operations is optimized and updated in real-time to generate the greatest possible value for Whole Foods.

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In stage three, Virtual Battery "charges" the refrigeration systems by turning on additional compressors and opening individual evaporator pressure regulator valves (EPRs) to lower the temperatures in reach-in and walk-in freezers throughout the store.

After the freezers are precooled, the fourth stage (load-shedding) involves turning off or unloading compressors, and then duty-cycling EPRs in order to precisely regulate cooling delivered to each individual freezer case group. During load-shed mode, refrigeration power consumption is adaptively reduced in order to reduce the monthly peak electrical load of the entire building. The reach-in and walk-in freezers are individually controlled to allow them to return safely to their original temperature setpoints.

> The Whole Foods Market locations in Northern California experienced something new during a 90-day period in fall 2020: their refrigeration systems generated $23,120 in new revenue and measurable energy bill savings for the first time. They are on track for a 9-month payback."
>
> Amrit Robbins, Axiom Cloud CEO

Virtual Battery

Virtual Technician

PHASE II

While running Axiom's Virtual Battery app in Northern California, Whole Foods Market also decided to pilot Axiom's other app, Virtual Technician, at their store in Tulsa, Oklahoma. Virtual Technician was installed in partnership with SEER2, an industry leader in installing and recommissioning high-performing refrigeration systems.

Beyond installing new projects for their clients, SEER2 also provides expert maintenance support remotely for hundreds of stores when store employees or local contractors need support to solve problems.

By comparing the refrigeration system's real-time data streams to a digital twin that models expected performance, Virtual Technician identifies "leading indicators" for problems before they cause cooling outages. Virtual Technician predicts and addresses refrigeration failures before they occur, leading to fewer alarms, fewer emergency service calls, fewer demerchandizing events, and better system performance.

Virtual Technician enables the best technicians to serve more stores and focus only on the hardest problems. This is especially valuable given the nationwide shortage of qualified technicians for commercial refrigeration today. The app is like having a dedicated technician in every store who is skilled in data science and can work to optimize the refrigeration system 24/7.

The Virtual Technician app uses a four-step process to enhance store operations: 1. Predict; 2. Diagnose; 3. Remedy; 4. Confirm.

Using intelligent forecasting, Virtual Technician predicts failures like compressor malfunctions or frozen evaporators before they cause major cooling outages or business interruptions. After recognizing an issue, the app is then able to identify the root cause of the issue, quantify its financial impact, and facilitate proper remediation the first time.

In many cases, the app can fix problems without human intervention by autonomously adjusting setpoints, temporarily overriding control of components, or commanding extra defrosts. In other cases, the app helps to avoid service calls by notifying store personnel to take actions such as closing walk-in doors or unblocking the air flow in reach-in coolers.

When service calls are required, the app informs the technician of the root cause of the problem and its location within the store. The app also helps technicians to determine the urgency and ROI of each problem to help "batch" multiple problems into a single visit during normal business hours (often, avoiding multiple emergency service calls during overtime hours on nights and weekends).

After an anomaly is fixed autonomously or manually, the solution is validated by the app to confirm that the root cause of the problem was corrected (rather than putting a "band aid" on the problem).

Example

Axiom's Virtual Technician app identified three predictive maintenance and continuous commissioning opportunities over its first 90 days at this store, including an undetected compressor floodback event that could have resulted in a store-wide refrigeration outage.

In partnership with SEER2, Virtual Technician resolved three of the anomalies autonomously over a 60 day period in October and November 2020. The energy and maintenance value generated from these events totaled $10,349.

The fourth anomaly detected by the app was a non-operational floating suction controller. Left undiscovered, this would have cost Whole Foods an additional estimated $547 on their energy bills each year. The app alerted SEER2 to the issue so they could quickly and efficiently resolve it.

Results

Based on the successful deployments in 13 Northern California and Oklahoma stores, Whole Foods Market is now rolling out the Axiom Cloud apps to 18 additional stores in the coming months. 16 of these 18 stores are subscribing to Virtual Technician, and 7 are also subscribing to Virtual Battery due to the high demand charges from their utilities.

When all 31 stores are operational, the Axiom Cloud apps are projected to generate approximately $517,351 in benefits per year for Whole Foods with a payback of approximately 9 months.

Looking ahead, Whole Foods Market anticipates continuing to expand the Axiom Cloud apps to additional locations in its 500+ store fleet.

	Demonstrated Value per store (annualized $/year)	Total Subscriptions contracted (including deployments in progress)	Expected Benefits (entire fleet, $/year)
Virtual Technician	$20,546	17	$354,977
Virtual Battery	$8,546	19	$162,374
Total	$29,427	36	$517,351

Conclusion

Whole Foods Market has realized significant value from its deployment of Axiom Cloud's apps, Virtual Battery and Virtual Technician. Direct savings from lower electricity bills and maintenance expenses, along with demand response revenue and the reduction of common maintenance headaches, has improved cash flow and boosted margins from day one. Payback was less than one year per store.

Thanks to Axiom Cloud, refrigeration, formerly considered a cost center at the stores, has been transformed into a value-creating engine. The next phase of deployment is underway so that Whole Foods can increase the scale of the impacts across its fleet of over 500 stores in the United States.