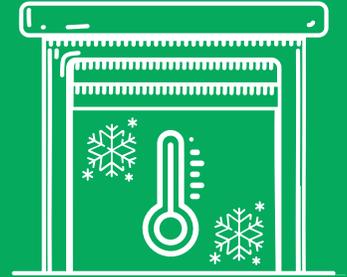


Energy Audits for Refrigeration-Heavy Facilities



Turning Constant Load into Strategic Advantage



MichaelsEnergy

Minimize Waste, Maximize Value

White Paper

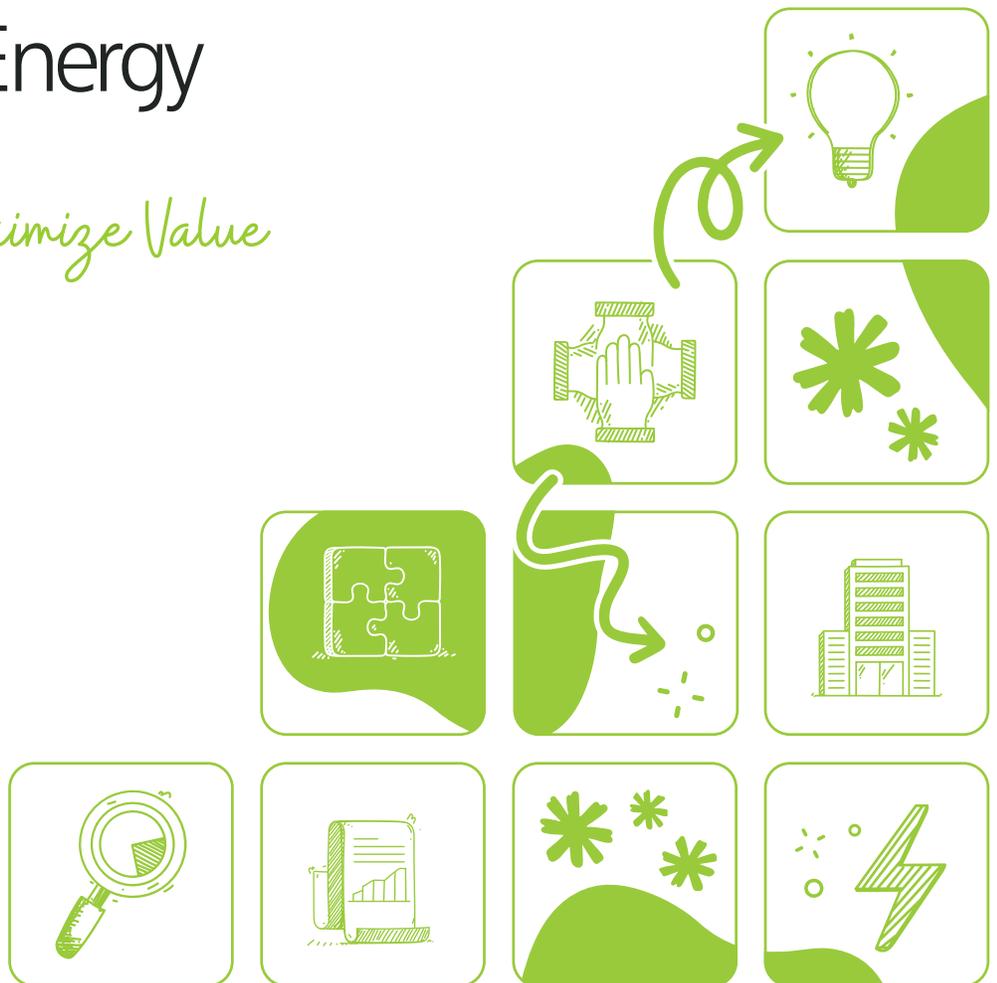


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How Much is Refrigeration Energy

Eating Your Budget?

Refrigeration is mission-critical across the cold food chain. It protects food safety, product quality, and uptime in cold storage, food processing, and refrigerated distribution facilities. It also dominates your energy costs.

Data from the U.S. Energy Information Administration shows that refrigeration systems can account for 40–60 percent (or more!) of total electricity use in these facilities, far exceeding lighting, HVAC, or auxiliary loads. Unlike most building systems, refrigeration runs continuously, creating a high and persistent electrical demand profile.

That constant demand would be easily manageable if electricity prices were stable. They are not.

Modern utility rate structures increasingly charge customers based on when electricity is used, not just how much. Demand charges, time-of-use pricing, and capacity-based rates disproportionately affect refrigeration-heavy facilities because their largest loads often coincide with electrical grid peaks.

As a result, many facilities invest in efficient compressors, upgraded controls, and strong maintenance programs, yet still experience rising energy costs. The issue is rarely a lack of efficiency. It is a lack of visibility into what's really affecting your energy bill.



Why Kilowatts Matter

More Than Kilowatt-Hours

in Refrigeration-Heavy Facilities

Electric utility bills are typically composed of two major components:

 **Energy charges**, based on total consumption (kWh)

 **Demand charges**, based on the highest measured power draw (kW) during a billing period

In refrigeration-heavy facilities, electricity use is steady. Compressors, condensers, and evaporators run continuously to protect products, so total energy consumption does not swing dramatically from hour to hour. Because of this, reducing kilowatt-hours often delivers incremental savings, but it rarely changes the overall cost structure of the bill.

What does change costs significantly is **peak demand**.

What is Peak Demand

Utilities usually calculate demand charges based on the highest 15 or 30 minute interval in a billing period. In cold storage and food processing facilities, that peak is often set by short-duration events such as multiple compressors starting at once, load recovery after door openings, coincident defrost cycles, or increased condenser pressure during hot afternoons.

These events may last only minutes, but they can determine the demand charge applied to the entire month.

From a technical standpoint, refrigeration-heavy facilities tend to have high load factors, meaning average demand stays close to peak demand. This indicates efficient use of equipment, but it also means there is very little buffer when short spikes occur. As a result, even brief increases in kW can drive a disproportionate share of total electricity cost.

This is why, in refrigeration-heavy facilities, managing **how high demand peaks** often matters more financially than reducing total energy consumption alone. Controlling kilowatts—through better visibility, control strategies, and load-shifting options—can deliver outsized impact without changing how the facility operates or compromising food safety.

According to the U.S. Department of Energy, demand charges can represent **30–70 percent of a refrigeration facility's monthly electric bill**.

To address the true cost of cold, facilities need insight into **how refrigeration systems behave when energy is most expensive**, and options that allow them to respond without compromising reliability or food safety.



Energy Audits:

The Underrated Power Tool

Energy audits are often misunderstood in refrigeration-heavy facilities. They are viewed as compliance exercises or backward-looking reports that explain past consumption rather than enable better decisions.

That framing misses the point.

When done correctly, an energy audit functions like a **control room dashboard** for energy costs. It provides operators and decision-makers with visibility into what is happening and where action will have the greatest impact.

Refrigeration systems operate continuously, quietly stacking demand in the background. Without detailed analysis, peak drivers remain hidden. A refrigeration-focused audit brings three critical signals into view:

Peak demand drivers

By analyzing interval utility data alongside equipment operation, audits identify which assets and operating conditions are responsible for demand spikes.

System behavior under pressure

Audits reveal how compressors are staged, how controls respond to load changes, and where conservative practices unintentionally amplify demand charges.

The boundary between efficiency and flexibility

Efficiency improvements matter, but audits often expose a ceiling. Beyond that point, meaningful cost reduction depends on flexibility, not further reductions in energy use.

Like a dashboard, the value of an audit is not hindsight but foresight. It also serves as a **forecast**, helping facilities anticipate rising rates, tighter grid capacity, and increasing exposure to peak pricing.

What a “Good” Refrigeration Audit

Looks Like

A high-quality refrigeration audit is a structured engineering process grounded in ASHRAE's tiered audit framework.

-  **Level 1 audits** provide high-level insights and quick operational opportunities.
-  **Level 2 audits** combine detailed load analysis, equipment evaluation, and preliminary financial modeling.
-  **Level 3 audits** rigorous analysis of high-cost energy efficiency upgrades, focusing on return on investment (ROI).

For most refrigeration-heavy facilities, a **Level 2 audit** provides the optimal balance of rigor and cost. It correlates load profiles with refrigeration system behavior to identify operational and strategic opportunities.

A robust Level 2 audit includes:

- Multi-year utility bill and interval data analysis
- Modeling of peak demand reduction strategies
- On-site measurements and diagnostics
- Equipment and controls inventory



Energy audits often find no-cost opportunities that can save money right away.

This technical foundation ensures recommendations are credible to engineers and actionable for leadership.



Ice Isn't Just for Drinks: *Thermal Storage as Strategy*

Thermal energy storage (TES) enables refrigeration-heavy facilities to shift load without sacrificing operational integrity.

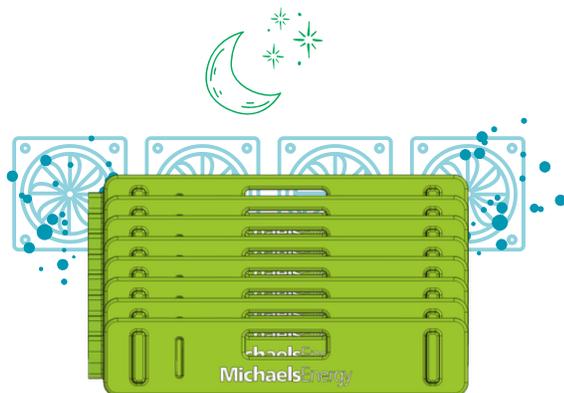
Cold thermal storage systems freeze water during off-peak hours and discharge that stored cooling capacity during peak periods. This allows facilities to reduce power when demand charges are highest.

Modern TES systems are modular, compact, and highly efficient, with round-trip efficiencies exceeding 85 to 90 percent in many HVAC applications. Advanced controls integrate with existing refrigeration systems and dispatch storage based on price signals, load forecasts, and operational constraints.

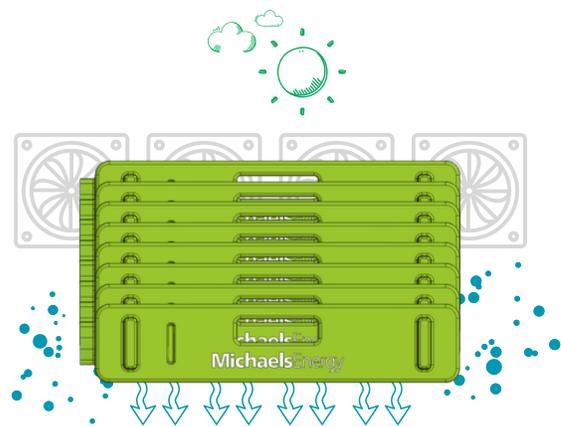
Rather than replace refrigeration assets, TES expands their flexibility, acting as a behind-the-meter buffer that smooths load profiles and reduces cost volatility.



Off-Peak Charging



Peak Hour Cooling



IceRack™ stores cooling energy during off-peak hours (overnight) and discharges it during high-cost peak periods.

Michaels IceRack™ system has 100% round trip efficiency.



How Much is it Going to Cost?

Will it Really Save Money?

Illustrative Example — Refrigeration-Heavy Cold Storage Facility

This example shows how energy audits and thermal energy storage can work together to deliver measurable financial impact in a refrigeration-dominated operation. Figures shown are illustrative and will vary by facility, rate structure, and operating conditions.

Baseline Energy Profile

An audit will start with reviewing your facility's current energy profile. Despite efficient equipment and strong maintenance practices, peak demand could still be high due to compressor staging, defrost cycles, and recovery during afternoon peak periods.

Savings Identified Through an Energy Audit

A refrigeration-focused energy audit evaluates utility data, equipment operation, and control strategies.

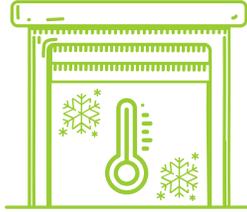
Typical audit findings include:

- Reduced coincident compressor operation
- Improved control sequencing
- Operational refinements during peak periods
- Impacts of adding Thermal Energy Storage and or solar PV system
- Potential incentives and tax credits
- Other energy efficiency opportunities such as: install EC motors in evaporators, install high speed roll up doors, lighting and sensor changes

Paying for Upgrades

While grant programs may change, two mechanisms often strengthen project economics:

- Utility incentives for demand-reducing equipment or load-shifting technologies
- Federal tax credits applicable to qualifying energy equipment or U.S. manufacturing investment



Sample 125,000 sq ft Cold Storage Facility	
Annual Electric Bill Total	\$550,000
Refrigeration Equipment Portion of Bill (79%)	\$434,500
Audit Cost	\$18,000
Implementation Costs (not including TES)	\$400,000
TES Project Cost	\$1,000,000
Federal Tax Credits (40% of TES Project Cost)	\$400,000
Utility Incentives - TES Project	\$100,000
Accelerated Depreciation (21% of TES Project)	\$210,000
Utility Incentives - Other Implementation Projects	\$75,000
Annual Bill Savings	\$165,000
Total Costs	\$1,400,000
Total Credits & Incentives	\$785,000
ROI (years)	3.7

Additional benefits:

- Resiliency in case of brown-outs or power outages
- No compromise to refrigeration reliability or food safety
- Reduced exposure to rate volatility
- Improved budget predictability

Bottom Line

For refrigeration-heavy facilities, the strongest financial returns come from controlling peak demand, not just reducing total energy use. Energy audits provide the insight to identify those opportunities. Thermal energy storage provides a practical way to capture them.

Together, they transform energy from a volatile expense into a manageable operating cost.

Conclusion

In refrigeration-heavy facilities, energy costs are driven by peak behavior, not total consumption. A well-executed energy audit provides the visibility needed to understand those peaks and the forecast-level insight required to plan for what comes next.

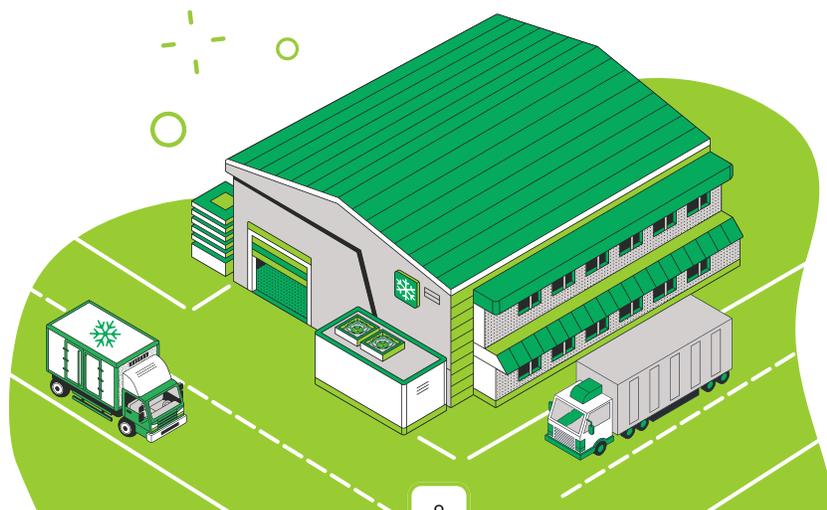
By pairing audit intelligence with flexible solutions like thermal energy storage, facilities can move beyond efficiency toward resilience, predictability, and control—without compromising the cold chain.

Control what you can't shut off.

**Discover smarter energy strategies
for the cold food chain.**



Scan for more



References

Statistics and examples presented are based on publicly available sources and industry experience; actual results will vary by facility, utility rate structure, and operating conditions.

- **American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).**

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Used for audit framework definitions, refrigeration system design principles, and engineering best practices.

- **U.S. Energy Information Administration (EIA).**

Commercial Buildings Energy Consumption Survey (CBECS); electricity pricing and demand charge data.

Used for statistics on refrigeration energy share and utility cost drivers in commercial and industrial facilities.

- **ENERGY STAR®, U.S. Environmental Protection Agency.**

Portfolio Manager® benchmarking resources; Energy Use Intensity (EUI) and load factor guidance.

Used for benchmarking concepts and characterization of refrigeration-heavy facilities.

- **U.S. Department of Energy (DOE).**

Better Buildings Initiative; industrial energy management and demand charge guidance.

Used for context on demand charges, peak pricing impacts, and industrial energy management strategies.

- **Nostramo Energy.**

Public technical materials on ice-based thermal energy storage systems and cloud-based optimization.

Used for modern thermal energy storage concepts, system efficiency, and load-shifting capabilities.

- **Trane Technologies.**

Published materials on thermal energy storage, load shifting, and commercial HVAC integration.

Used for industry context on TES applications and operational integration.

- **Industry Engineering Practice.**

Observed refrigeration load behavior in cold storage, food processing, and refrigerated distribution facilities.

Used to inform practical insights related to compressor staging, defrost cycles, and peak demand formation.

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ICE RACK™

Resiliency for Refrigeration

