Case studies in energy storage systems for refrigeration

Live Webinar

July 18, 2022

slipstream

Agenda

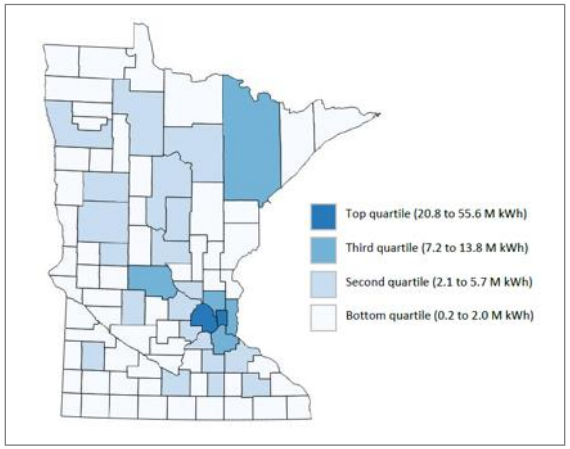
- Introduction
- Case studies
  - Viking Cold
  - Axiom Cloud
  - CrossnoKaye
- Current pilot programs
- Q&A

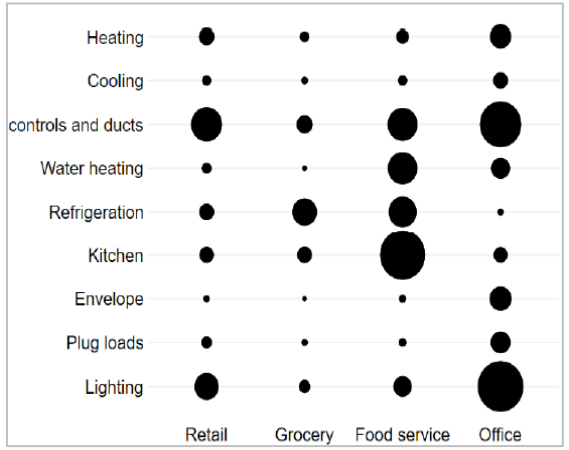
Sponsors

Thanks to our sponsors!

- ComEd Energy Efficiency Program
- Minnesota Department of Commerce, Conservation Applied Research and Development (CARD) grant program

Slipstream
Emerging Technology Research, Testing, Evaluation





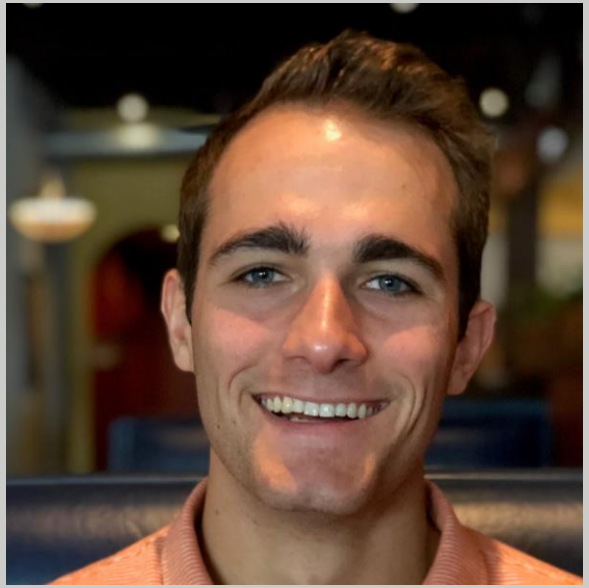
FIELD / LAB STUDY AND ANALYSIS

ANALYSIS, SCOPE, AND EXPERIMENTAL DESIGN

MARKET CHARACTERIZATION

Residential and commercial buildings

slipstream



AXIOM CLOUD

Turner Anderson

Axiom Cloud
Apps for Commercial Refrigeration
AXIOM CLOUD

As a leader in refrigeration, what keeps you awake at night?

INCREASINGLY LARGE ENERGY BILLS?

- Refrigeration is 40-60% of electricity use & often operates inefficiently
- Demand charges are increasing everywhere

HIGH MAINTENANCE COSTS?

- Repeated truck rolls and overtime visits due to inexperienced technicians
- Unplanned equipment outages (causing demerchandising events)

ALARM OVERLOAD?

- Hours spent manually processing refrigeration system information
- Facility managers are often required to be refrigeration technicians

REFRIGERANT MANAGEMENT?

- Leaks lead to inefficient operation & high GHG emissions
- Regulations are forcing the transition to lower GWP options

SOMETHING ELSE?

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Axiom Cloud's apps help solve commercial refrigeration's biggest energy, maintenance, and sustainability challenges

Facilities Analyzer™ (Required)

Predictively identify refrigeration problems before you receive a flood of alarms. See multi-site refrigeration & energy data in a single dashboard.

Virtual Technician™

Autonomously solve refrigeration maintenance and energy problems using software, instead of rolling a truck every time.

Virtual Battery™

Effortlessly save on your energy bill and get paid by your utility by transforming your refrigeration system into an intelligent battery.

AXIOM CLOUD

Supercharge your existing systems

Axiom's apps supercharge existing Micro Thermo, Emerson, Logic, and other controllers with new capabilities:

	Refrigeration Control	Reactive Threshold Alarming	Alarms via phone/email	Multi-site Visibility and Analytics	Predictive work orders with root cause	Multi-site Setpoint Standardization	Refrigerant Leak Detection	Autonomous Fixes	Active Energy Optimization
Existing Controller	✔	✔							
Traditional Alarm Monitoring		✔	✔	(optional)					
Axiom Cloud Apps		(optional)	(optional)	✔	✔	✔	✔	✔	✔

Installation is simple, requires < 1 day, and oftentimes there is *no new hardware required*.

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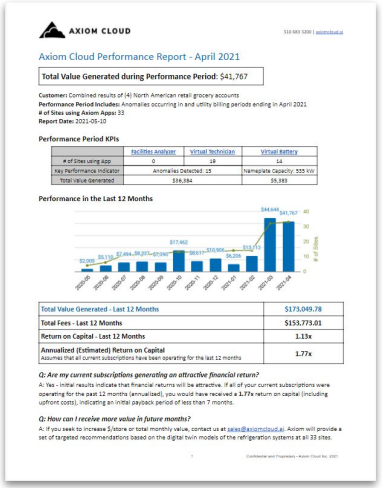
See measurable benefits - *without additional work for your team*

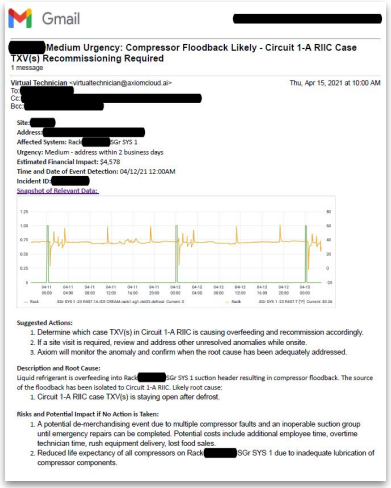
Customer Web Portal

Multi-site dashboard (available 24/7)



Performance Reports

Quantifies benefits and ROI (delivered monthly)



Anomaly Notifications

Sent when urgent problems or opportunities are identified

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Distribution Center Case Study - HelloFresh

Axiom Cloud's apps are active at a HelloFresh fulfillment center in Northern California, where energy costs, sustainability, and refrigeration uptime are large concerns.

Benefit	Description	Annual Value
Continuous Commissioning	Continuous optimization and monitoring of refrigeration system setpoints and control strategies	$31,573
Energy Bill Optimization	Predictive pre-cooling and intelligent load-shedding to reduce energy bills	$21,271
Demand Response (Capacity Bidding Program)	Safely leveraging refrigeration loads to reduce energy consumption on demand and generate new revenue	$8,547

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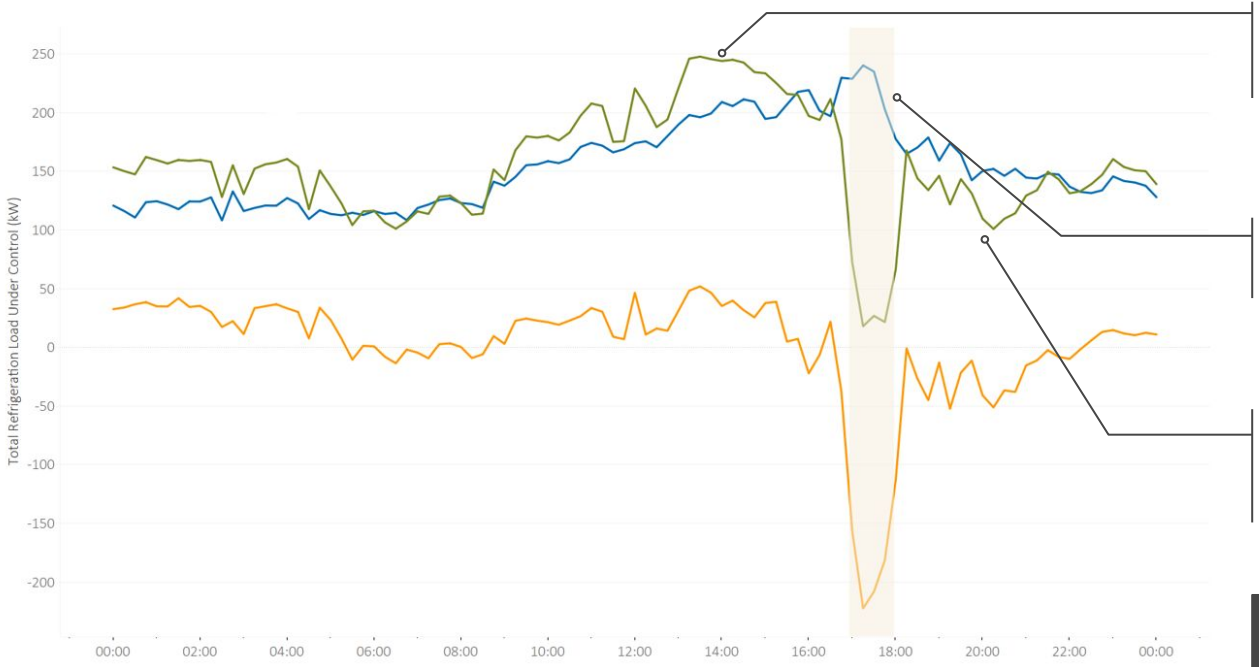
Virtual Battery - Demand Response



Total Baseline Refrigeration Power | Total Actual Refrigeration Power

Total Virtual Battery Offsets

Intelligent Precooling

- Lowers the temperatures of specified spaces prior to an event
- System capacity and food safety requirements are never violated

DR Event (Load Shedding)

- Compressors and EPRs modulated individually to reduce energy use
- Case temperatures gradually come back up to setpoints

Recovery

- Compressors run harder than usual to allow system to fully recover

Results

- 193kW of flexible capacity that is valuable to the utility

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Retail Grocery Case Study - Grocery Outlet

Grocery Outlet has recently expanded from a 2-store pilot to ~80 stores, partially funded by Demand Response incentives. Benefits include:

- Demand response revenue through refrigeration thermal energy storage
- Continuous commissioning
- Refrigerant leak detection
- Utility rate plan recommendations

"Without Virtual Technician's early notification of the leak, this store would've experienced unplanned downtime and a big maintenance bill in the coming weeks."

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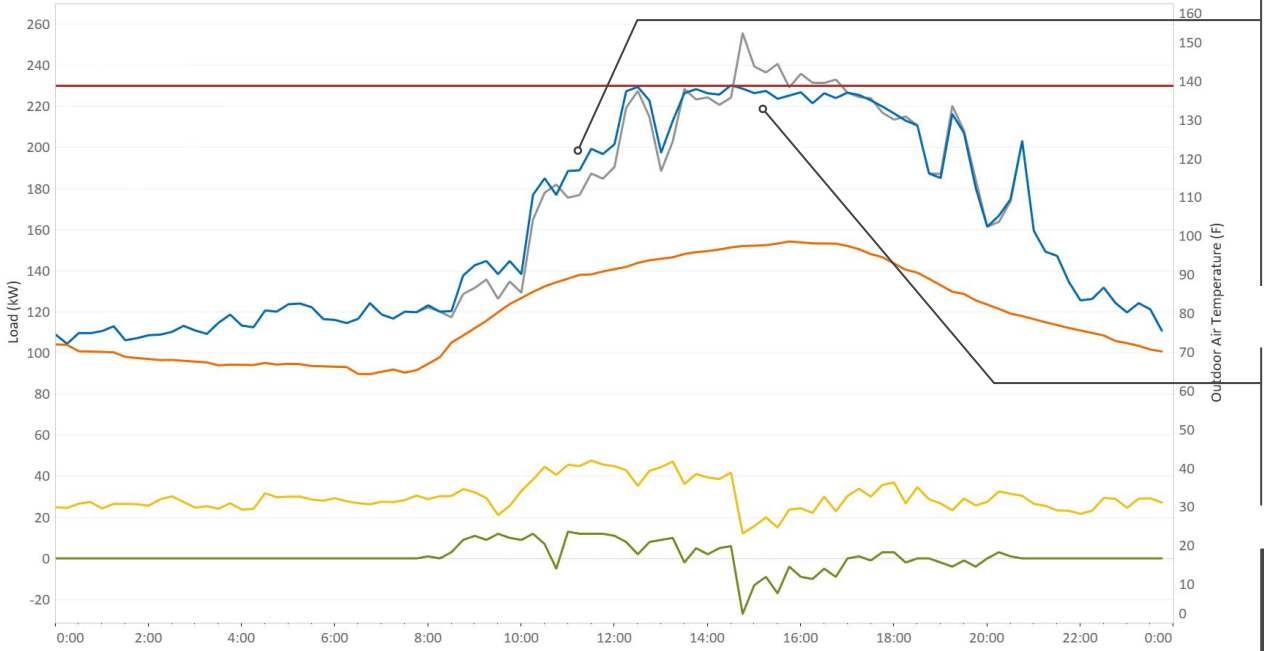
Virtual Battery - Energy Bill Management



Building Actual Power | Building Baseline Power | Refrigeration Power
Virtual Battery Offset | OAT (°F) | Daily Building Target

Intelligent Precooling

- Lowers the temperature of the specified cases
- Increases the load on the refrigeration system
- Does not exceed system capacity or demand thresholds

Load Shedding

- Modulates compressors and EPRs to lower the building's load
- Case temperatures gradually come back up to setpoints

Results

- 28 kW peak demand reduction
- 55 kWh of flexible capacity
- $1,322 total benefit for the month

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THANK YOU

VIKING COLD™ SOLUTIONS
THERMAL ENERGY STORAGE

Stan Nabozny

VIKING COLD™ SOLUTIONS

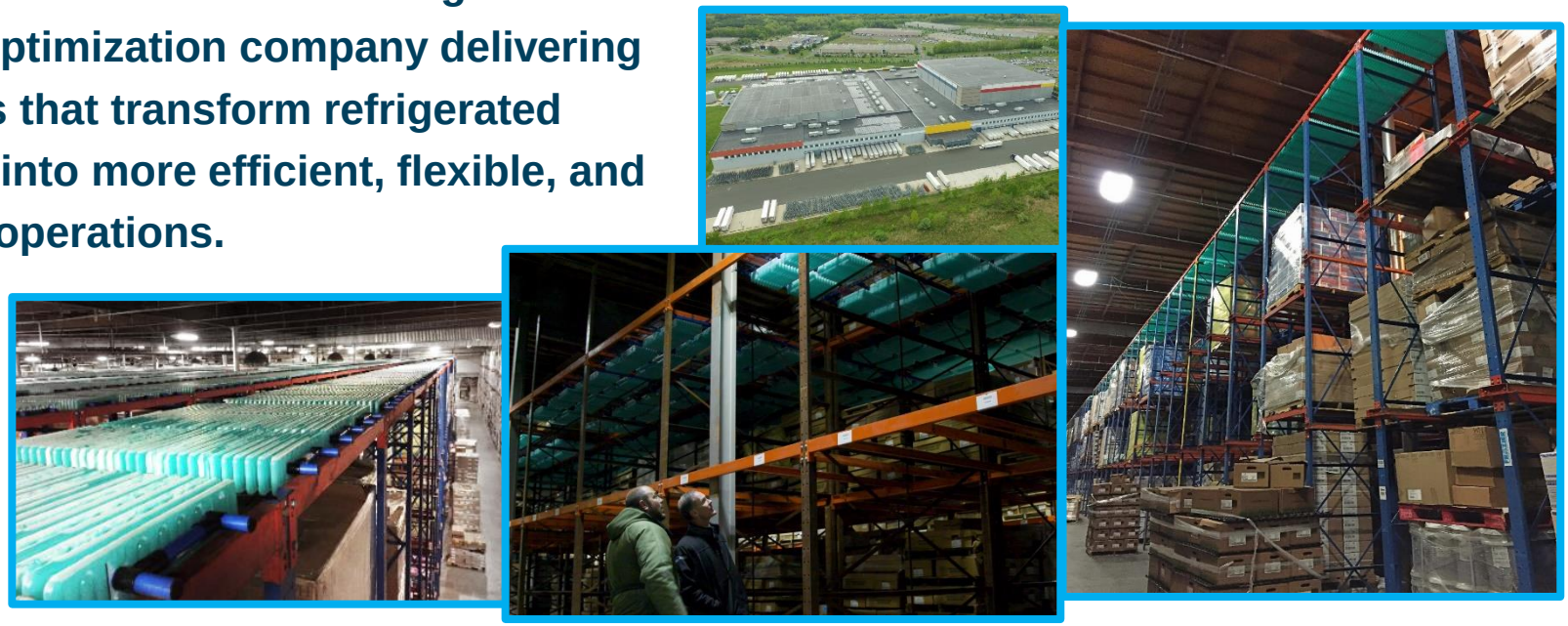
CJ

Healthy Happy Convenient

Introduction to Thermal Energy Storage at CJ Foods Fullerton, CA

Who is Viking Cold Solutions

Viking Cold Solutions is a refrigeration energy optimization company delivering solutions that transform refrigerated facilities into more efficient, flexible, and resilient operations.



Our business solutions:

- Digitize and manage the assets of your business while reducing your cost of operation and improving your sustainability.
- Reduce operational risk by managing heat infiltration and maintaining more stable temperatures in refrigeration.
- Deliver real-time business data that helps you manage your assets and operations.

Watch the video to understand:
Why We Do What We Do

EXECUTIVE SUMMARY

Industrial refrigeration consumes more energy per cubic foot than any other utility load.

We leverage green technology to reduce that energy by 25% or more while better protecting that food.

Our patented, passive system protects food and reduces spoilage, saves energy, and reduces carbon footprint without the need to modify or replace refrigeration equipment.

Viking Cold provides customers numerous valuable and unique benefits:

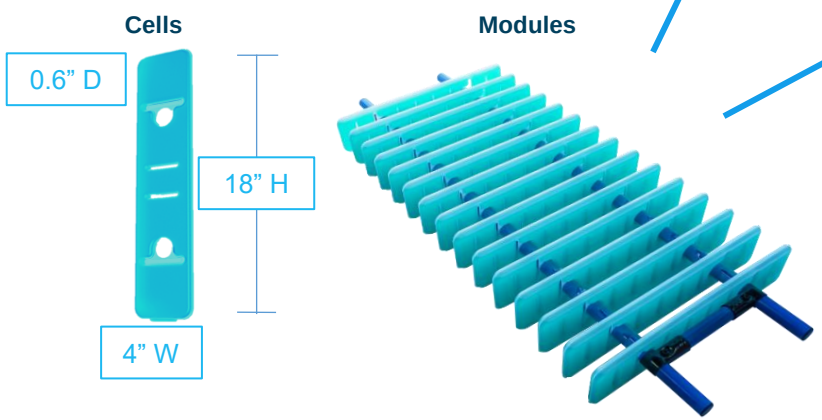
- Reduced energy costs of 25% or greater
- Utility peak load management, load shedding or shifting
- Storage of renewable energy within the freezer
- Thermal backup in the event of a mechanical failure or power outage
- Real time control, monitoring, and reporting
- Over 20-year useful life
- No capital required up front, can be paid for out of savings using our Service Financing

WHAT IS THERMAL ENERGY STORAGE

Combining Chemistry, Software, and Controls to Optimize Energy Usage

- Cloud-based IoT: facility digitization and 24/7 real-time analysis that intelligently optimizes temperatures and refrigeration equipment to decrease energy usage and reduce demand
- Proprietary Phase Change Material (PCM) formulations attract, absorb, and store 300x more heat per pound than frozen food
- 8x heat transfer rate of frozen food
- Systems contain no mechanical energy-consuming components and last 20+ years with minimal to no maintenance
- Integrates with any existing refrigeration or controls system
- Installs quickly with minimal business interruption
- Does not reduce usable storage space inside facilities

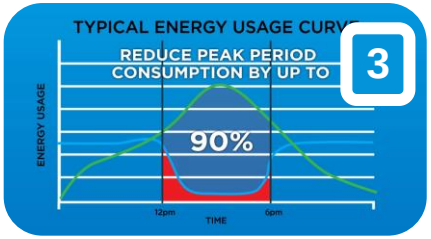
Thermal Energy Storage (TES)



How Thermal Energy Storage Optimizes Refrigeration Energy Use and Protects Food

- Existing refrigeration equipment runs fully loaded and more efficiently during cooler hours when energy costs are low to freeze TES and store energy in the form of cold

- Refrigeration equipment can then be idled up to 13 hour per day, usually when energy costs are high
- TES maintains stable temperatures within the freezer by absorbing up to 85% of the heat infiltration until the optimal time to remove the stored heat



By storing energy in the TES rather than the food:

- Efficiency is improved: Refrigeration run time and total energy consumption reduced ~25%
- Up to 90% of peak period consumption reduced and demand risk is reduced

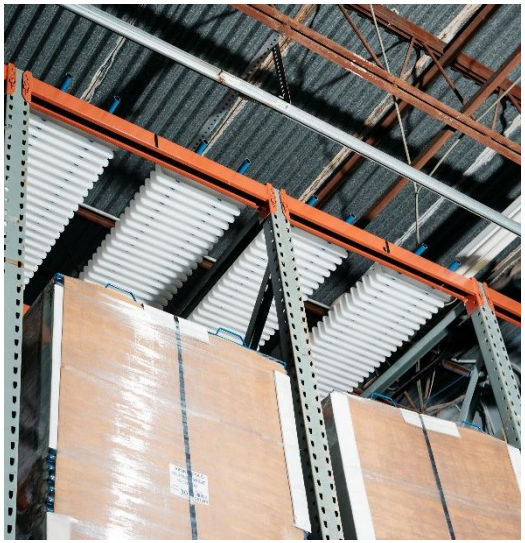
Watch the video:
How TES Works

FLEXIBLE MODULAR INSTALLATIONS

Wire-deck PCM modules

Rack extension lay-down PCM modules

Grocery reach-in freezer



Lay-down PCM modules

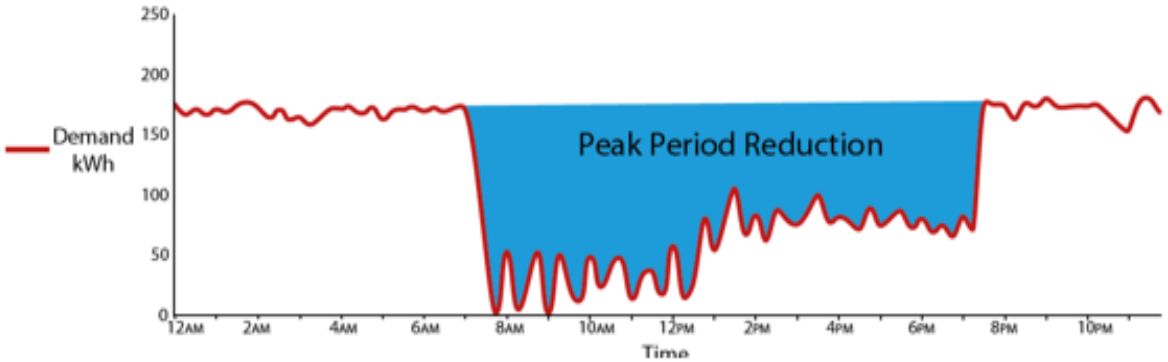
Ceiling mount PCM modules

PCM Baskets

MULTIPLE OPERATING MODES

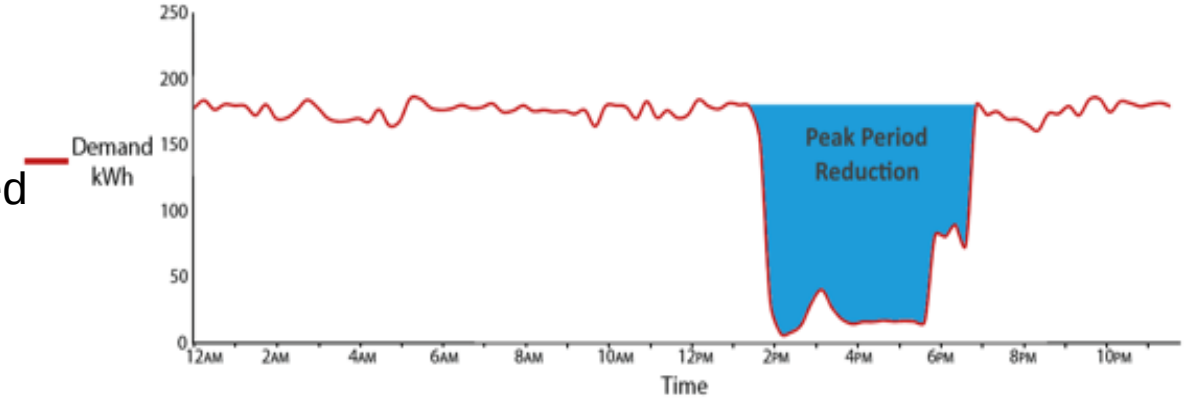
1. Efficiency Savings

Optimize refrigeration performance and use stored thermal energy during the day



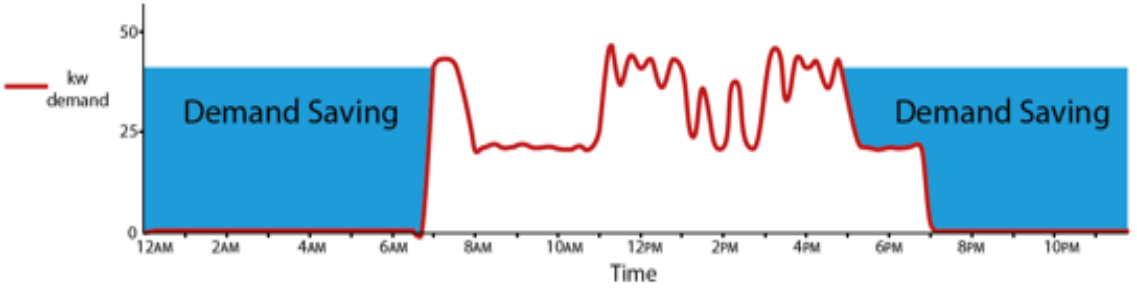
2. Permanent Load Shift

Permanently shift load to avoid peak demand during designated periods



3. Nighttime Savings with PV

Utilize PV during the day and thermal energy during the night



THERMAL ENERGY STORAGE BENEFITS

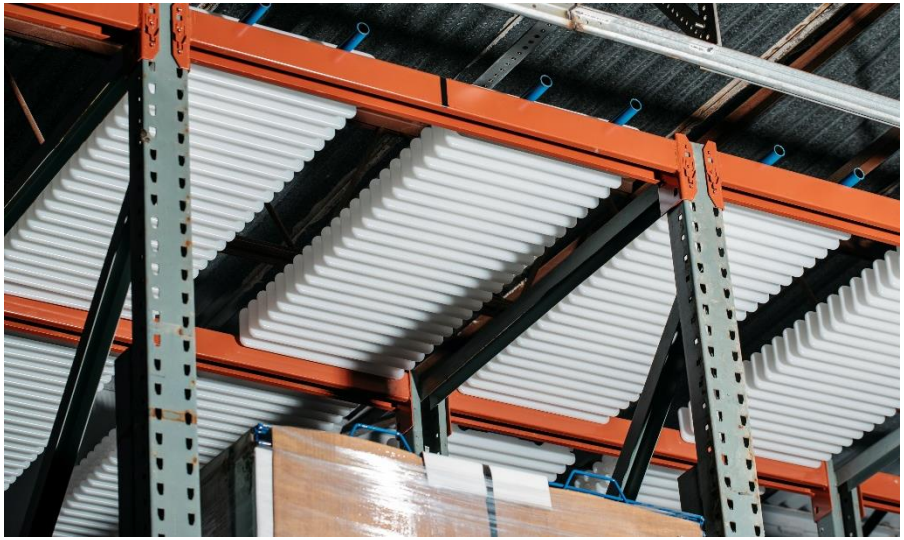
Saves Energy.
Increasing operational efficiency.

Shifts Utility Load.
Operaters can choose *when* to purchase power.

Preserves Food Products.
Protecting quality and ensuring safety.

Reduces Carbon Footprint.
Our system is sustainably manufactured, installed, and operated.

Is Driven By Phase Change Thermodynamics and Technology.
A large amount of energy is transferred when changing a liquid to a solid and back. We manage the energy that is transferred during these changes to keep temperatures stable.



CJ FOODS FULLERTON FACILITY

CJ Foods

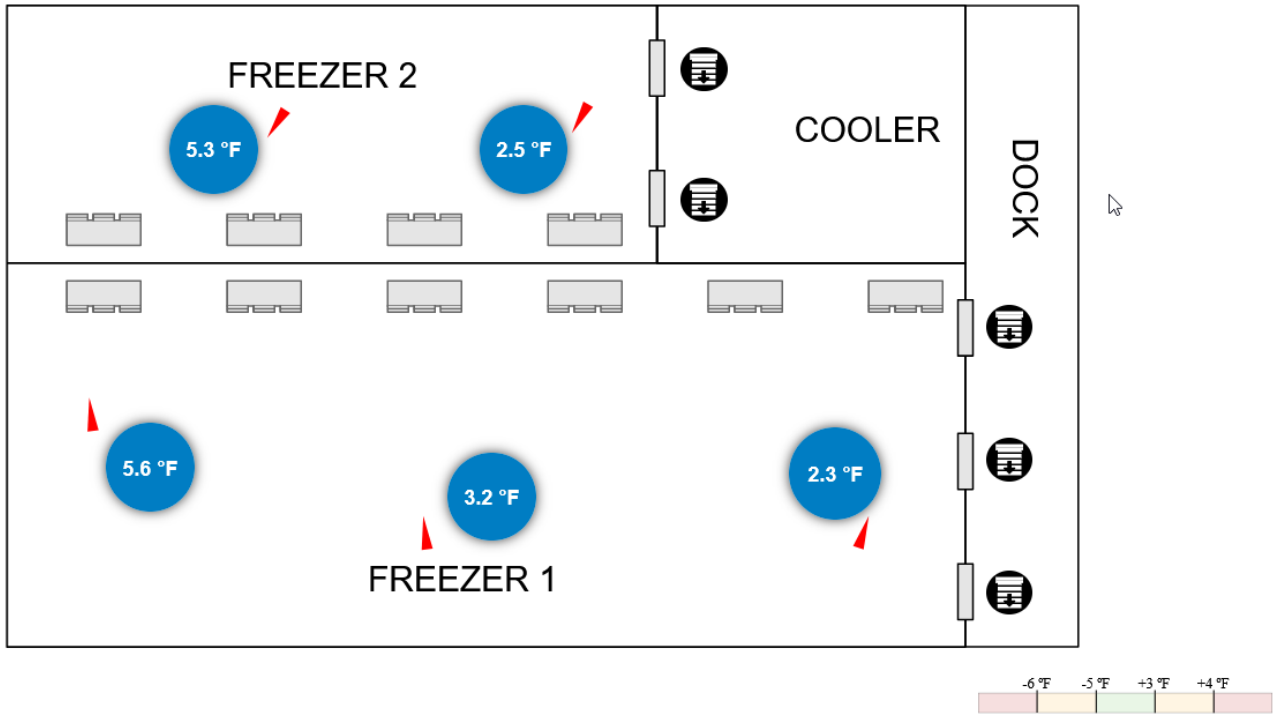
- No. 1 Korean Food Company
- Creating New Culture for Healthy, Happy and Convenient Lifestyles
- CJ's mission today is to introduce the delicious, convenient and nutritious Korean and Asian food globally

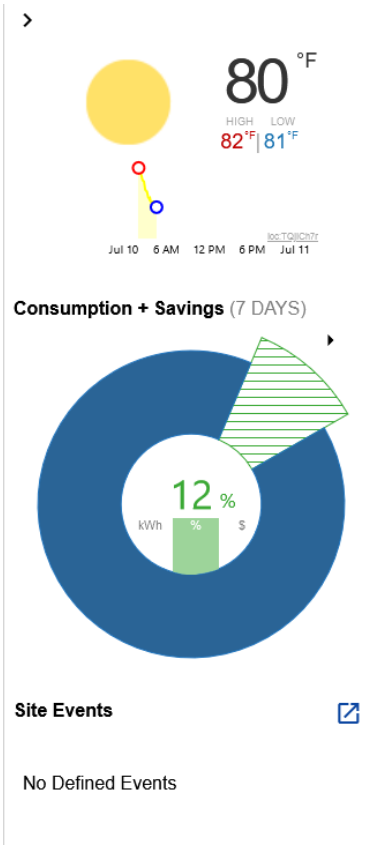
Fullerton Distribution Warehouse

- 127,000 sq. ft. distribution facility in Fullerton, California
- Utility Partner: SCE
- Summer Peak Pricing: $34/kW between 4pm and 9pm
- Peak period consumption and demand charges comprise over 50% of the annual energy bill

CJ FOODS FULLERTON FACILITY

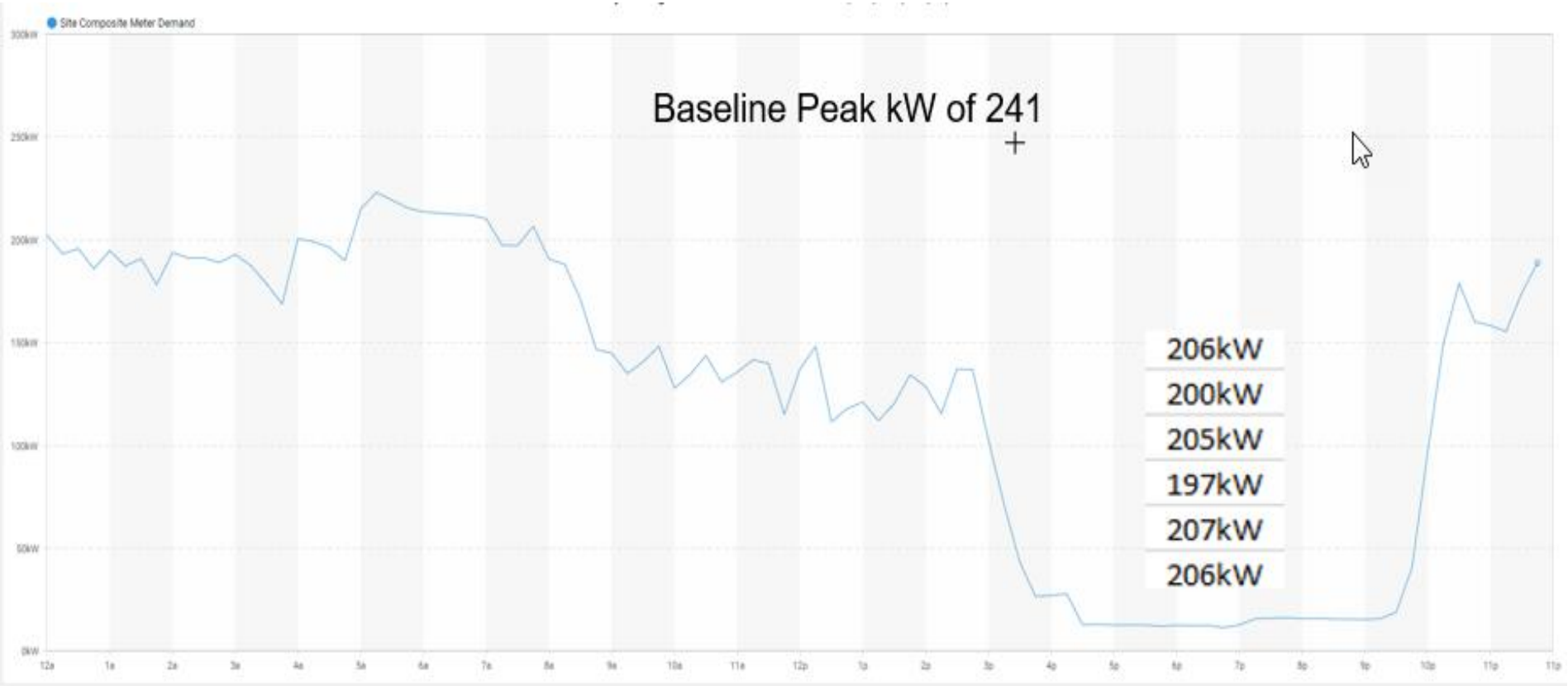
- Site map of Fullerton using the Viking Cold Chain Portal software
- 30,000 sq ft of frozen distribution warehouse
- 10 evaporators, 5 temperature zones and 5 doors
- All monitored and alarmed





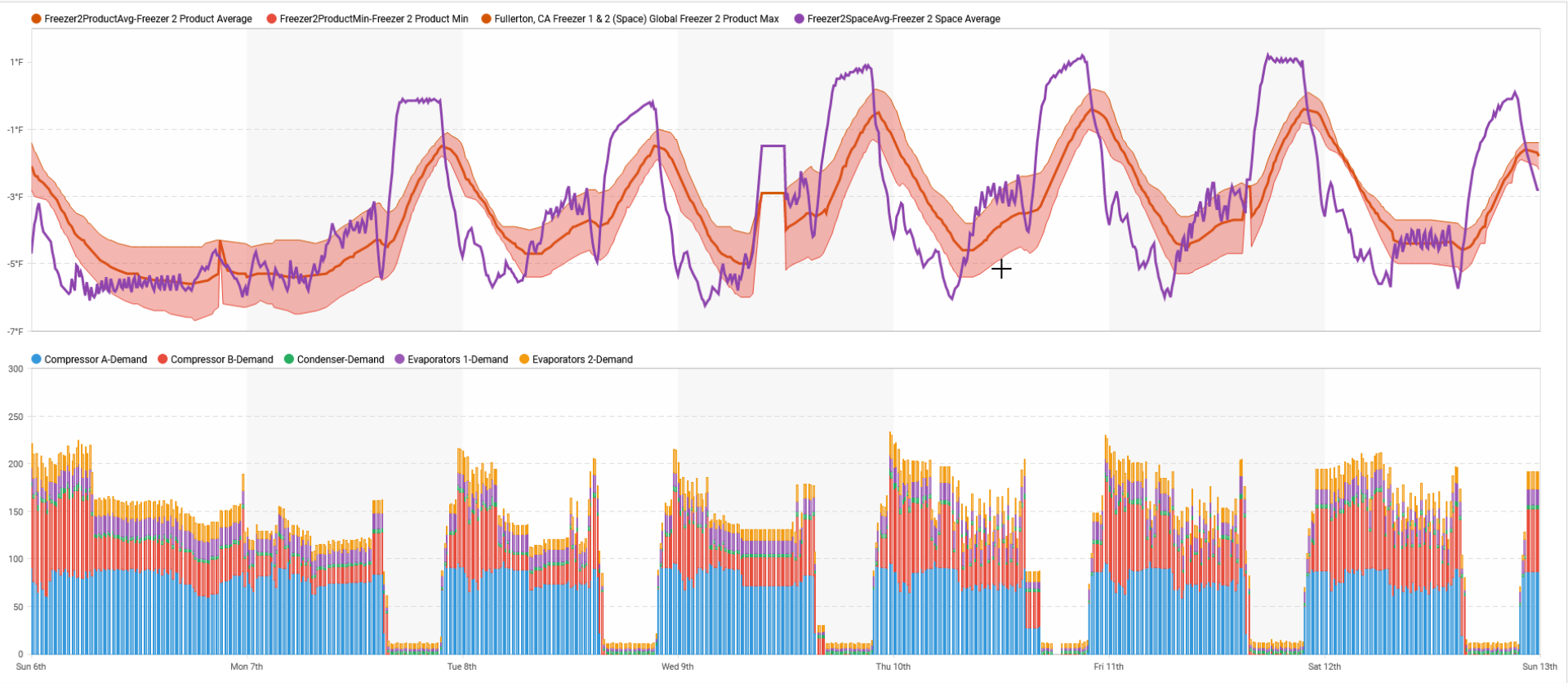
FULLERTON RESULTS

- Demand Reduction – An average of 200kW/Day - SGIP Promise of 160kW/Day
- Refrigeration Efficiency Improvement – Annual savings of 14% of consumption



FULLERTON RESULTS

- Weekly temperature and demand chart demonstrating demand reduction and temperature stability using the Viking Cold zero-degree PCM formula
- Rate of rise is reduced 70% with the use of Viking Cold PCM



INDUSTRY AWARDS

Sustainability Award

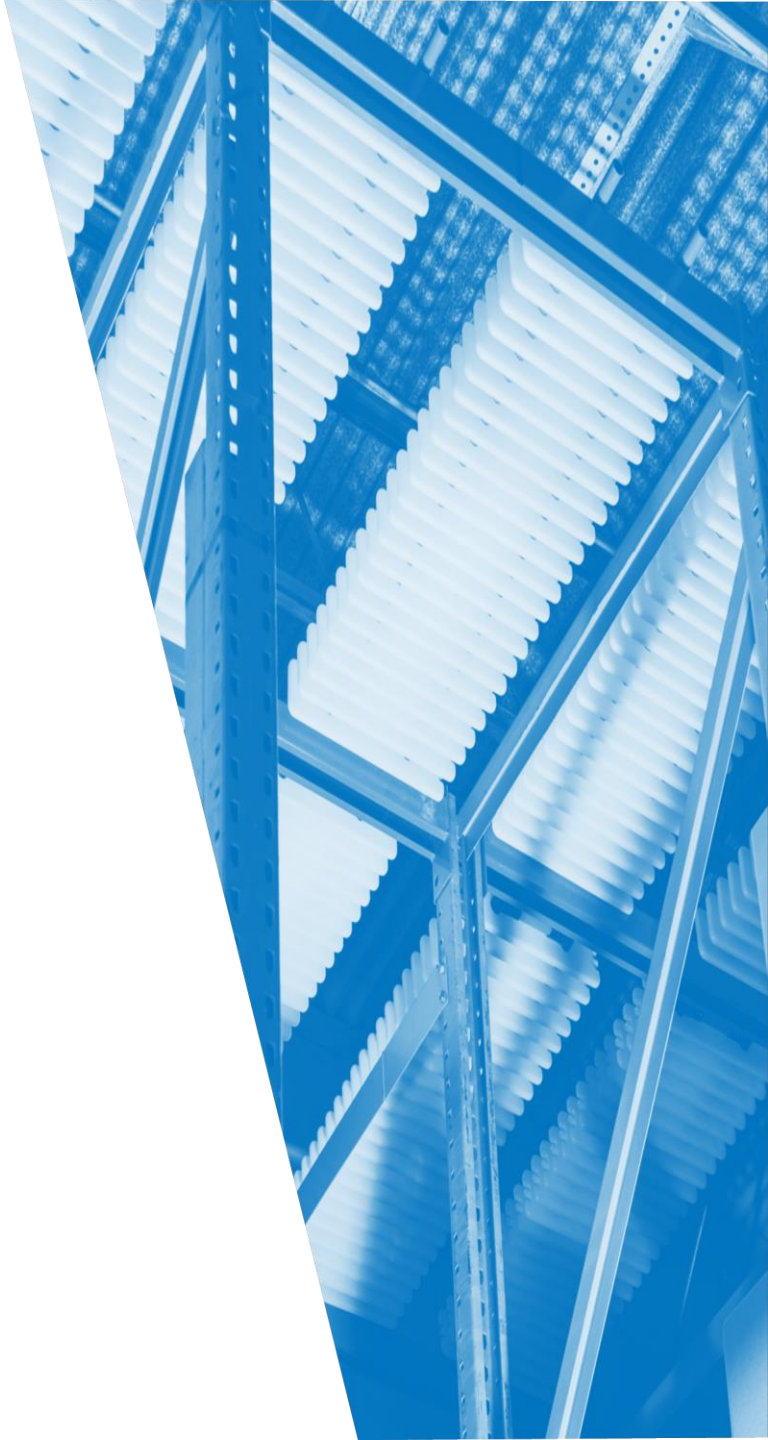
Top Green Provider

Top Software & Technology Provider

Green Supply Chain Award

Money-Saving Products Award

Thank You



CROSSNOKAYE

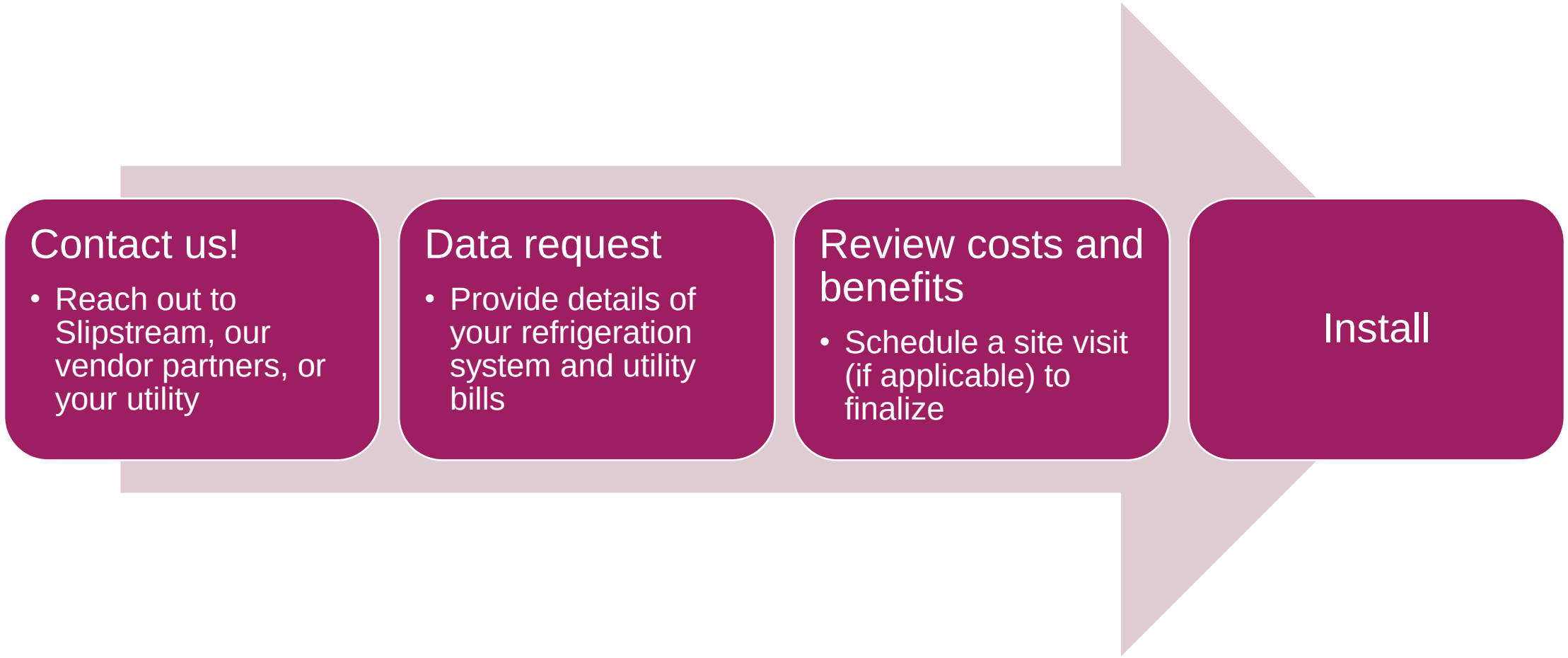
Jesse Crossno

To request CrossnoKaye's presentation slides, please email contact@CrossnoKaye.com

Pilot Study Details

Sponsor	Territories	Incentive	Other Benefits
MN Dept of Commerce	• Minnesota • Wisconsin • North Dakota • South Dakota • Northern Iowa	• $5,000 flat incentive from MN CARD grant • Slipstream will coordinate with your utility to determine eligibility for additional incentives or rebates	• Comparison and analysis of vendor offerings • 3rd party measurement and verification • Publicity in final report and case study (optional)
ComEd	• ComEd service territory (Chicago and Northern Illinois)	• Custom incentive based on kWh savings	

Participate in a Pilot Study



Q&A