

How Does It work?

How does it work?

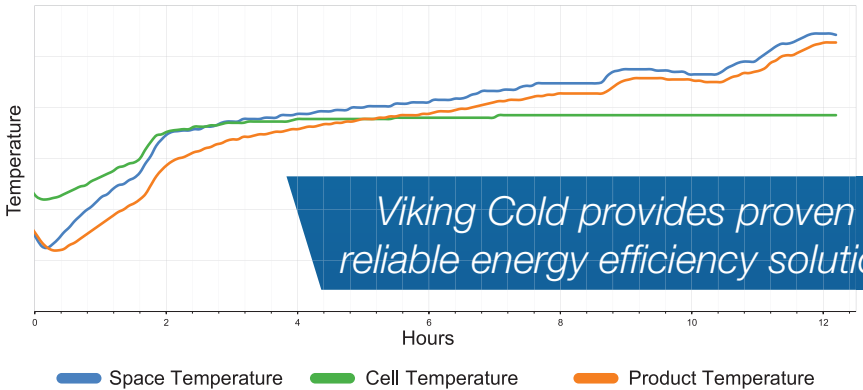
Viking Cold's patented Thermal Energy Storage Cells are designed with proprietary Phase Change Material to absorb infiltrated heat, so your products remain at their target temperature. The cells

are engineered to your specific installation facility and require no power to operate. When used in conjunction with our control platform, you'll achieve unmatched freezer efficiency and performance.

Reduce your energy consumption by 20-35%

Viking Cold provides an innovative, integrated solution that lowers energy consumption and shifts demand to reduce energy costs in industrial and commercial freezer applications. The patented system removes heat more

effectively from the Thermal Energy Storage Cells than the frozen food. This reduces equipment runtime and energy consumption while extending the life of your equipment.



Customer Testimonial - Plaza Provision Company

"After extensive research and evaluation of the Viking Cold technology, we decided to install our first facility in 2010. Without question, the Viking team delivered. We've experienced month over month reliable and consistent savings. In 2014 we completed our third installation and the total consumption reduction has surpassed our expectation.

Having real-time monitoring has been invaluable and has helped us recognize and address numerous equipment issues before they became costly problems. Great product and great service."

Robert A. Cimino - CEO
Plaza Provision Company is installing its 5th and 6th Viking Cold systems in 2016

PCM Storage Cells



Energy management system (EMS)

- Location specific or enterprise-wide energy control empowers customers to intelligently shift electricity load, reduce electricity consumption and associated electricity costs to take full advantage of:
 1. On-Peak/Off-Peak rate structures
 2. Ratcheted demand charges
 3. Demand response programs
 4. Intelligent and proprietary energy management software optimizes thermal energy storage for more efficient heat removal in industrial freezer applications
- System monitoring and daily performance reporting provide total system visibility:
 1. Daily energy savings in kWh and dollars
 2. Consumption and demand measurements on a daily and weekly basis
 3. Product, Cell, and Freezer Space maximum, minimum, and average temperatures
 4. Mechanical/unit operation and runtime status
 5. Door openings and closurese

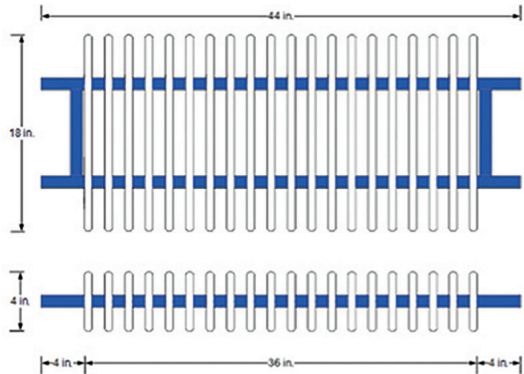
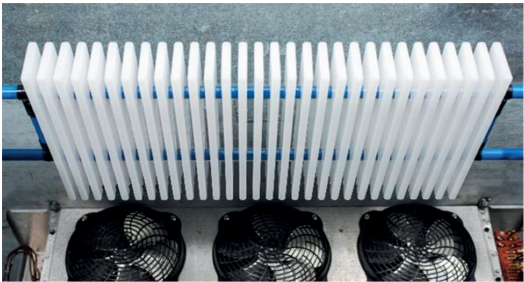
PCM Storage Cells

- The Viking Cold system utilizes proprietary Phase Change Material (PCM) Storage Cells to store thermal energy
- PCM is a custom formulated inorganic salt solution which has over 300 times the thermal capacity as the food items commonly found in cold storage facilities
- The storage cells are passive, standalone, and zero-maintenance. They require no power and easily transfer and store thermal energy to maintain optimal inventory temperatures

How Does It Work?

PCM Storage Cells

See why Viking Cold is an innovative leader in temperature controlled freezer environments. Learn more by visiting VikingCold.com or by calling 832-781-COLD (2653).



VikingCold.com
10335 Landsbury Drive, Suite 350
Houston, TX 77099
832-781-COLD (2653)

The following example illustrates the energy benefits of using Phase Change Material (PCM) for thermal storage as compared to using the thermal mass of the frozen food product.

Thermal Energy Storage Comparison

- **84% of heat infiltration will be absorbed by the TES modules**
- **Refrigeration system will remove the heat from the TES modules 5 times faster than frozen product alone**

Typical analysis for a 930 square meter frozen storage warehouse

	Thermal Energy	Frozen Product
Thermal Mass	350 Cell Modules 46x112x10 cm module size; 1 module per 2.8m ² 11 kg PCM per cell module 3,850 kg total PCM	900 Pallet Positions 107x122x122 cm pallet size; 90% occupied 680 kg product per pallet 550,000 kg total product
	PCM is <1% of the total thermal mass in the room	
Thermal Capacity	300 kJ/kg (Latent heat)	1.674kJ/kg/K (Specific heat)
	PCM has 325 times the thermal capacity per kg per 0.5°C	
Thermal Energy Storage (of 0.5°C temp delta)	1,155,000 kJ	506,380 kJ
	PCM can store 2.3 times more thermal energy	
Thermal Resistance (Surface)	0.10 m ² -K/W (see figure A below)	0.944 m ² -K/W (see figure B below)
	Thermal Energy Cells have 1/10th the R-value	
Surface Area	678 m ²	6,132 m ²
	TES modules have 15 times the surface area per kg	
Heat transfer rate (Q)	18.5 kW	3.5 kW
	TES modules are 5 times more heat absorbent	
Equipment Runtime Time required to change the total thermal mass by 0.5°C with an evaporator outlet ΔT of 5.5°C	Combined Product and PCM 8.7 hrs	Product Thermal Mass Only 39 hrs

Figure A – The total R Value for the Thermal Energy Storage Cell is only R1, the convective boundary layer resistance.

Figure B – The total R Value for typical frozen food product, where R1,R3, & R4 are convective boundary layer resistances, and R2 is the resistance of corrugated cardboard.

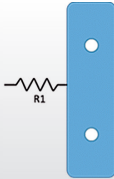


Figure A – TES Cell

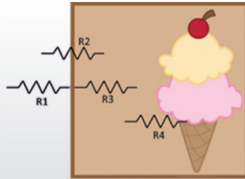


Figure B – Frozen Food in packaging

Thermal Energy Storage Comparison



- **Innovative leader in Cold Storage**
- **Up to 35% efficiency gains**
- **Loss Prevention**

832-781-COLD (2653)
www.VikingCold.com