



Business Case for Natural Refrigerants

June 12-14, 2018 – Long Beach



Applying Packaged Low Charge Ammonia Systems To A High Rise Freezer

Kurt Liebendorfer – Evapco



Jeff Buxton - PermaCold



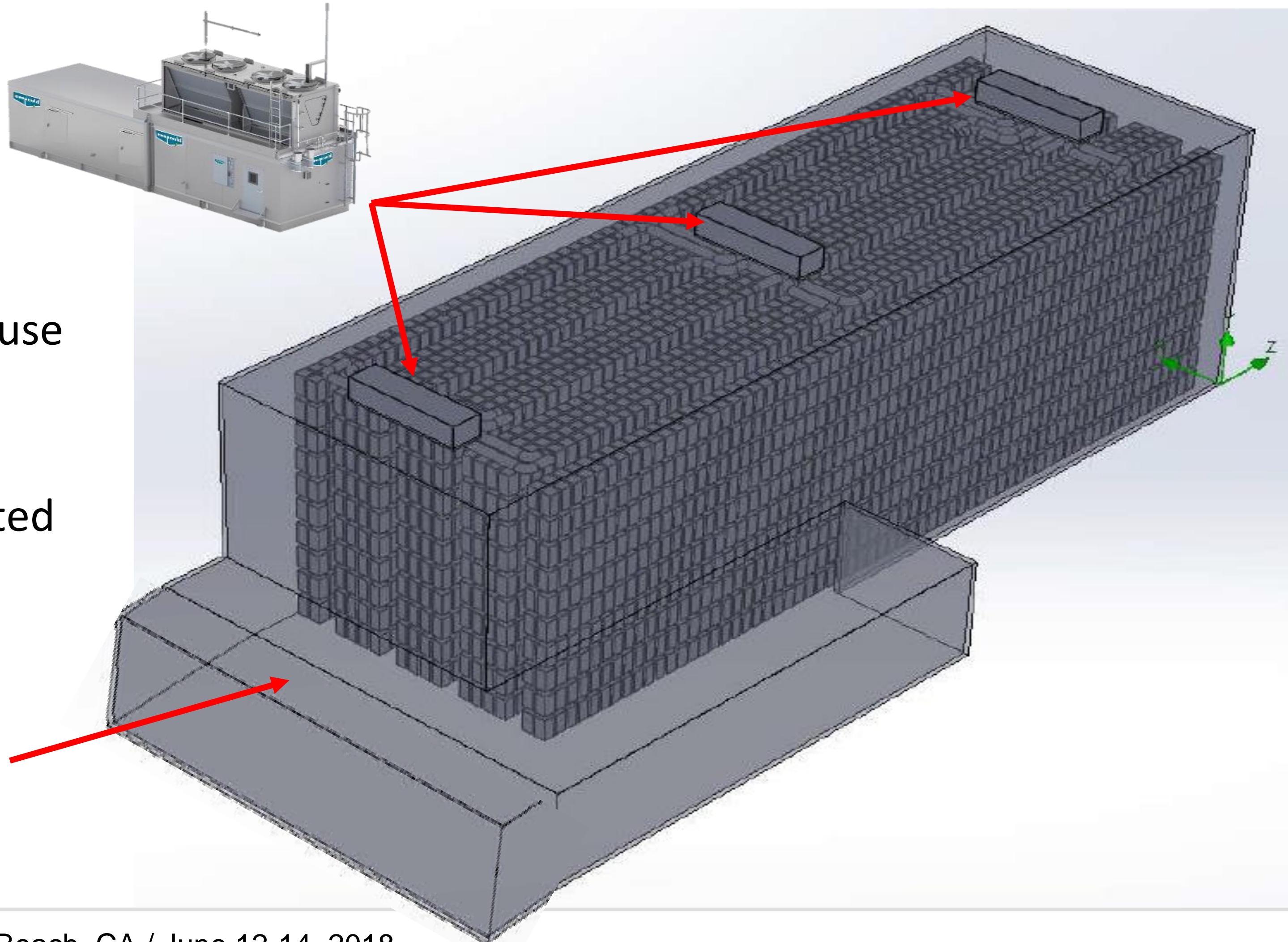


High Rise Cold Storage – PermaCold is the design-build refrigeration contactor and Evapco is a primary refrigeration equipment supplier for this 110 ft. tall rack supported (-)10°F freezer

(3) - Evapcold LCR-P
Air Cooled
Low Charge Ammonia
Penthouse Packages

Model LCR-P-AC

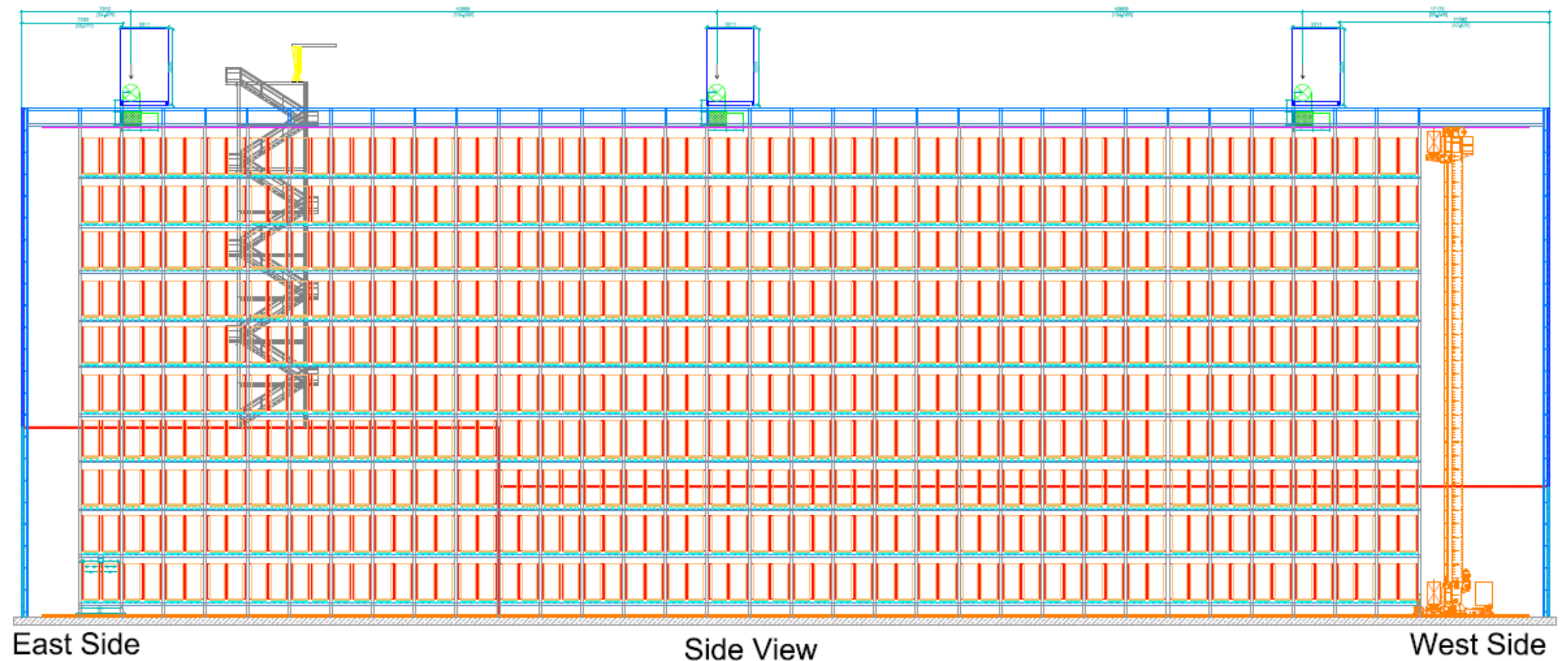
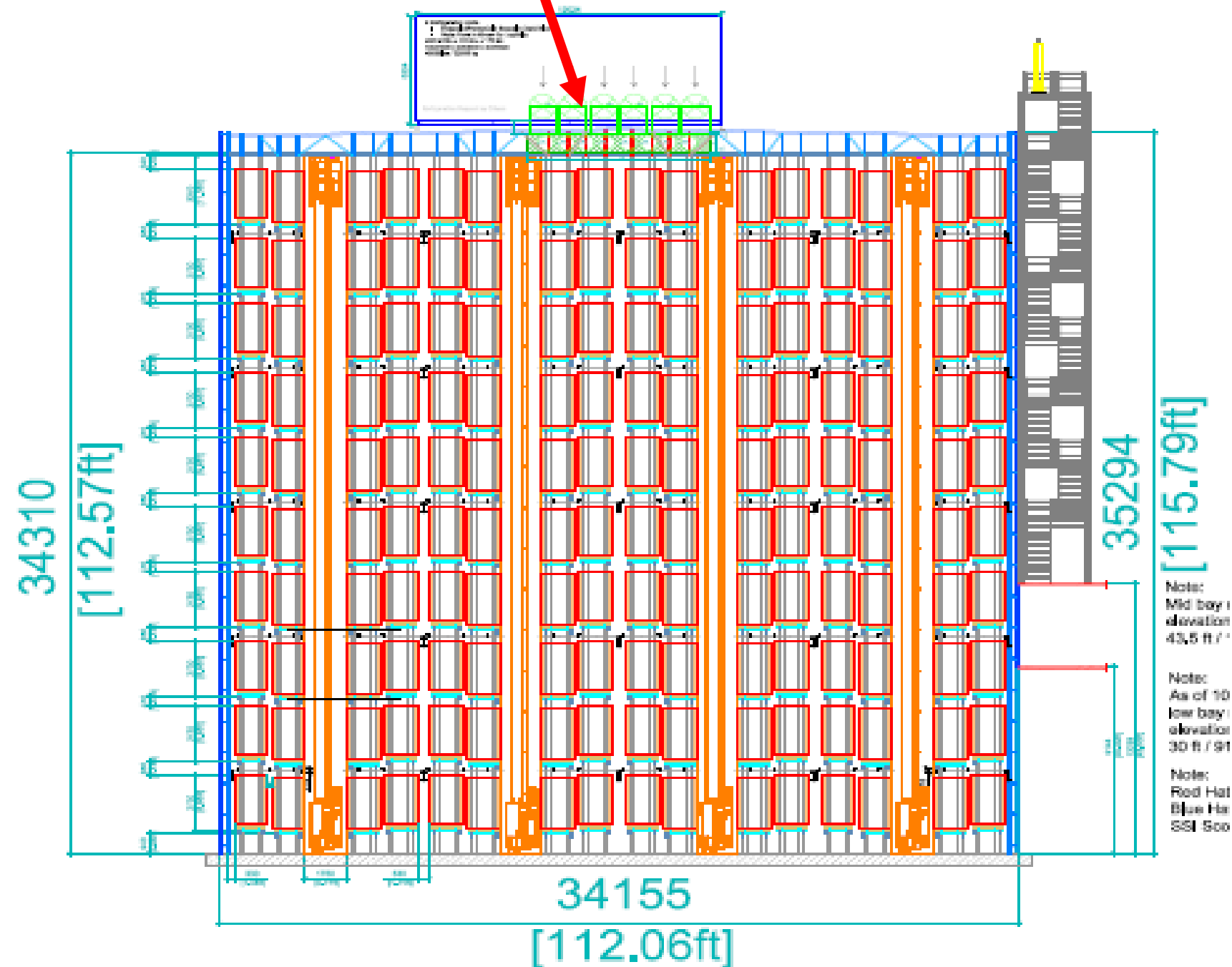
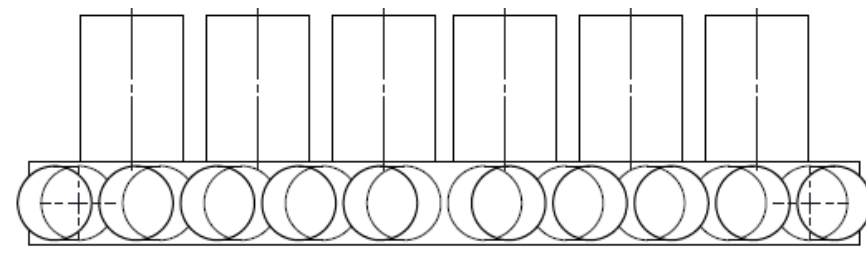
- Air-Cooled Penthouse design perfect for application
- (1) - Unit also located on Shipping Dock



CSA, CRN & CUL
Approval &
Certifications

Building Application:

- Latest technology with Automated Storage & Retrieval System (ASRS)
- Weight of units (48,000 lb. ea.) easily handled by structure of racking system
- Penthouse evaporators provide much easier access than ceiling hung units
- Supply air effectively distributed via duct/plenum under each unit

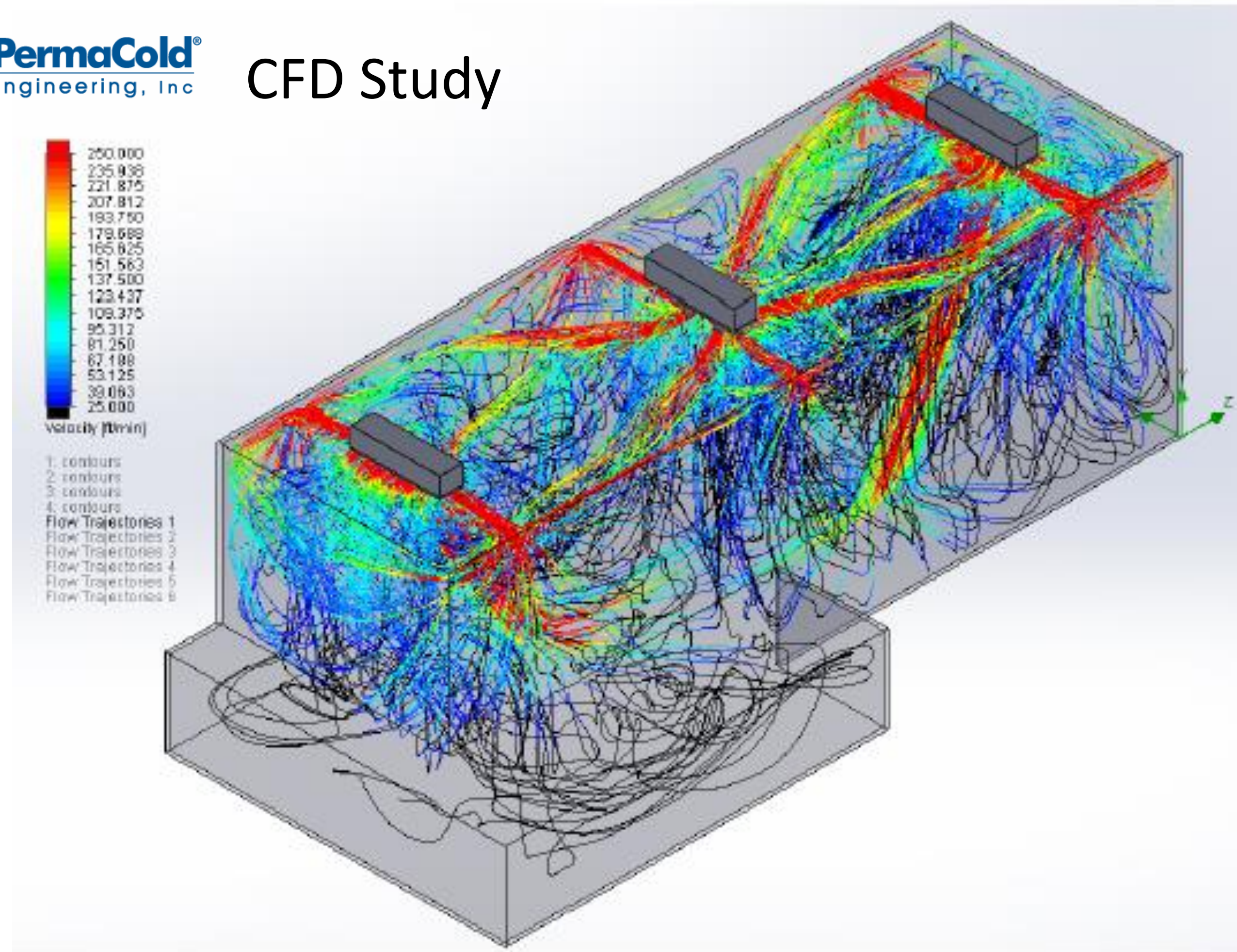


PermaCold Analysis:

- PermaCold Utilizes SolidWorks Fluid Flow Analysis Software
- Analyzed to avoid short circuiting air flow & determine optimum air distribution
- Structural steel provided additional challenges
- The target is to keep up air velocity & cover freezer



CFD Study





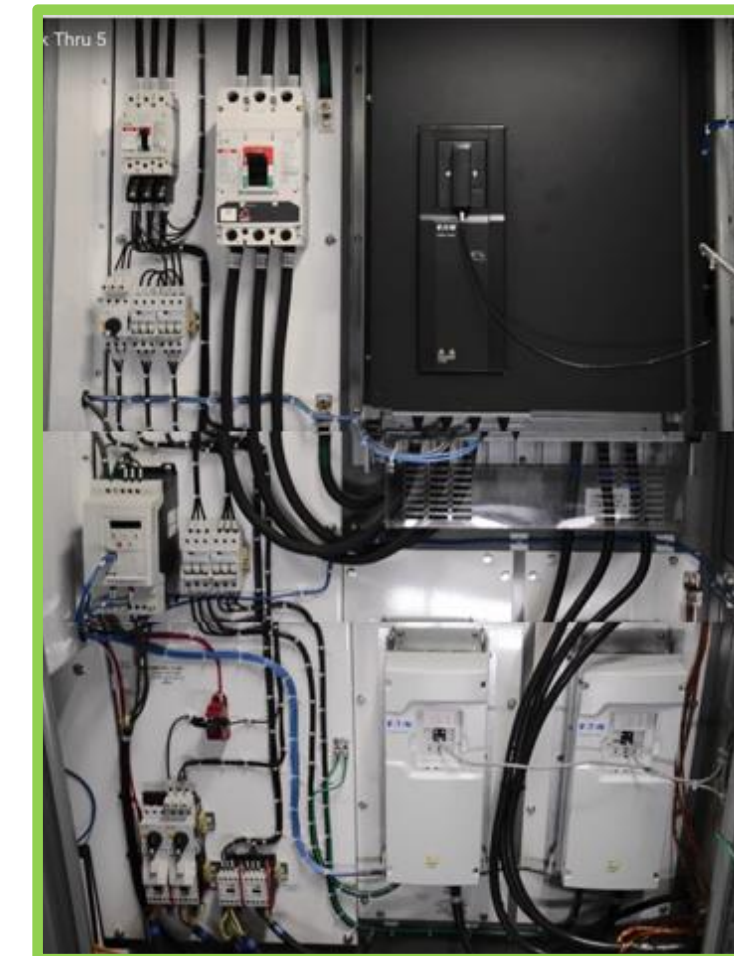
Evapcold Performance:

- 65 TR x 3 = 195 TR
- @ -10.5°F SST & 0°F Room Temp
- 95°F Max DB & 111°F CT
- 158 BHP & 2.4 BHP/TR
 - Peak design case – all annual operation at lower ambient temps. & even better efficiency
- 1:2 : 1 Pumped Liq. Recirc. for very efficient performance
- Hot Gas Defrost
- 490 lb NH3 each unit = 1,470 lb tot.

Evapcold Unit Technical Data		
Project Name: Permacold - CA		
MODEL NUMBER	LCR-060P-L10-2H-A	LCR-070P-M25-2H-A
Unit Qty.	3	1
Unit Tag	High Bay Freezer	Dock
LCR DESIGN CONDITIONS		
Total Cooling Capacity, Tons- Per Unit	65	71
Room Temp DB, °F	0	35
Max Outdoor Temp DB, °F	95	95
Outdoor Temp WB, °F	64	64
Altitude, Feet	2900	2900
Evaporating Temp, °F	-10.5	22.7
Recirculation Rate	1.2 : 1.0	1.2 : 1.0
Defrost Type	Hot Gas Defrost	Hot Gas Defrost
Airflow, CFM	86,496	80,400
Compressor Type	Screw	Screw
Comp. Sat. Suct. Temp Comp.	-10.5	22.7
Sat. Disch. Temp. Compressor	111.6	111.5
Shaft BHP, HP	158	107
BHP/Ton at Design Conditions	2.4	1.5
Total Ammonia Charge	490	490

Evapcold systems Reduce Energy Consumption because they:

- Eliminate refrigerant piping pressure drops
- Eliminate “house suction levels” – each room has its own suction level
- Have more VFD’s
- Supervisory control system can provide superior energy management



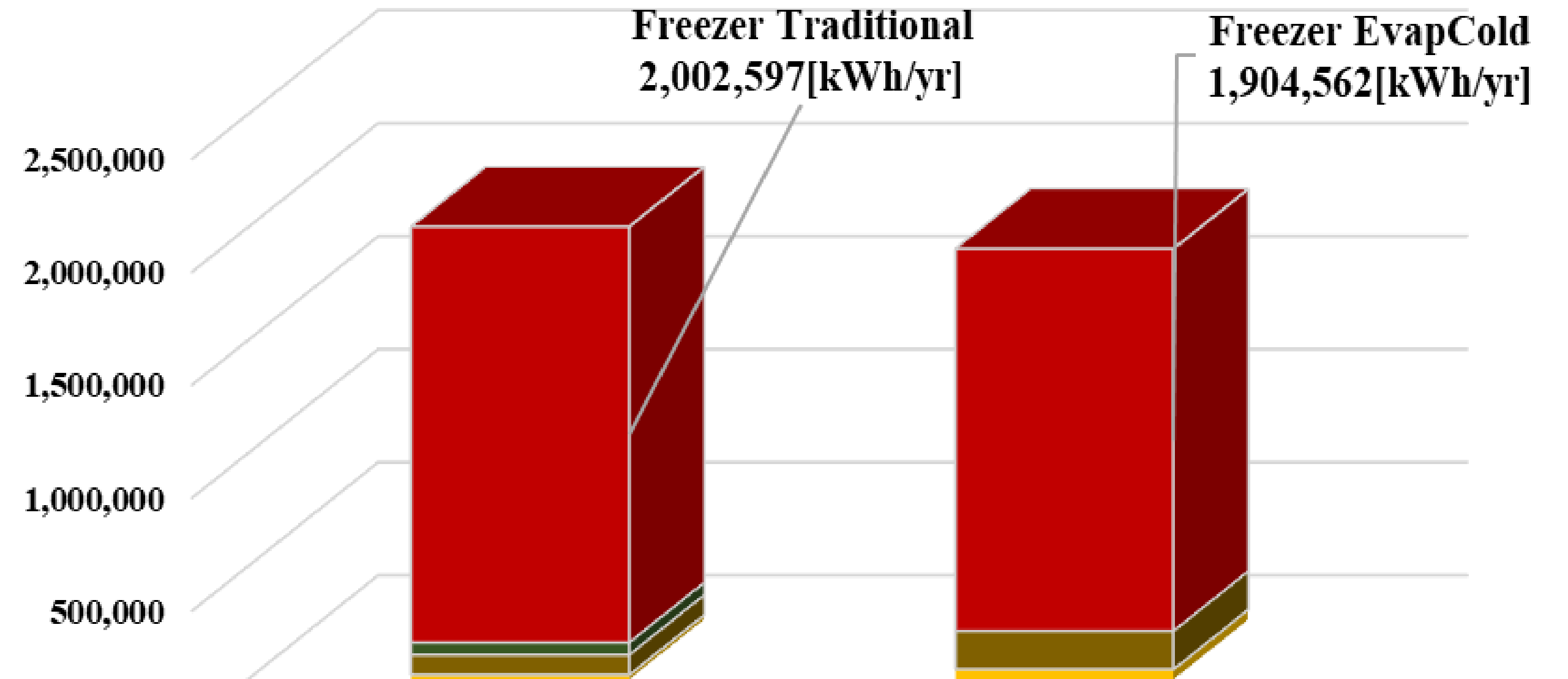
Lower Energy Consumption Compared to Central Plant System



Assumptions

- PermaCold Compared Evapcold System to Base Central Plant Refrigeration System
- BASE: VFD Compressors, VFD Condenser Fan, VFD Evap Fans, Remote Sump

Power Use Breakdown [kWh/yr]



	Freezer Traditional	Freezer EvapCold
■ Compressor Power [kWh/yr]	1,839,261	1,690,138
■ Condenser Pump Power [kWh/yr]	54,507	0
■ Condenser Fan Power [kWh/yr]	88,840	169,841
■ LPR Pump Power [kWh/yr]	19,989	44,583

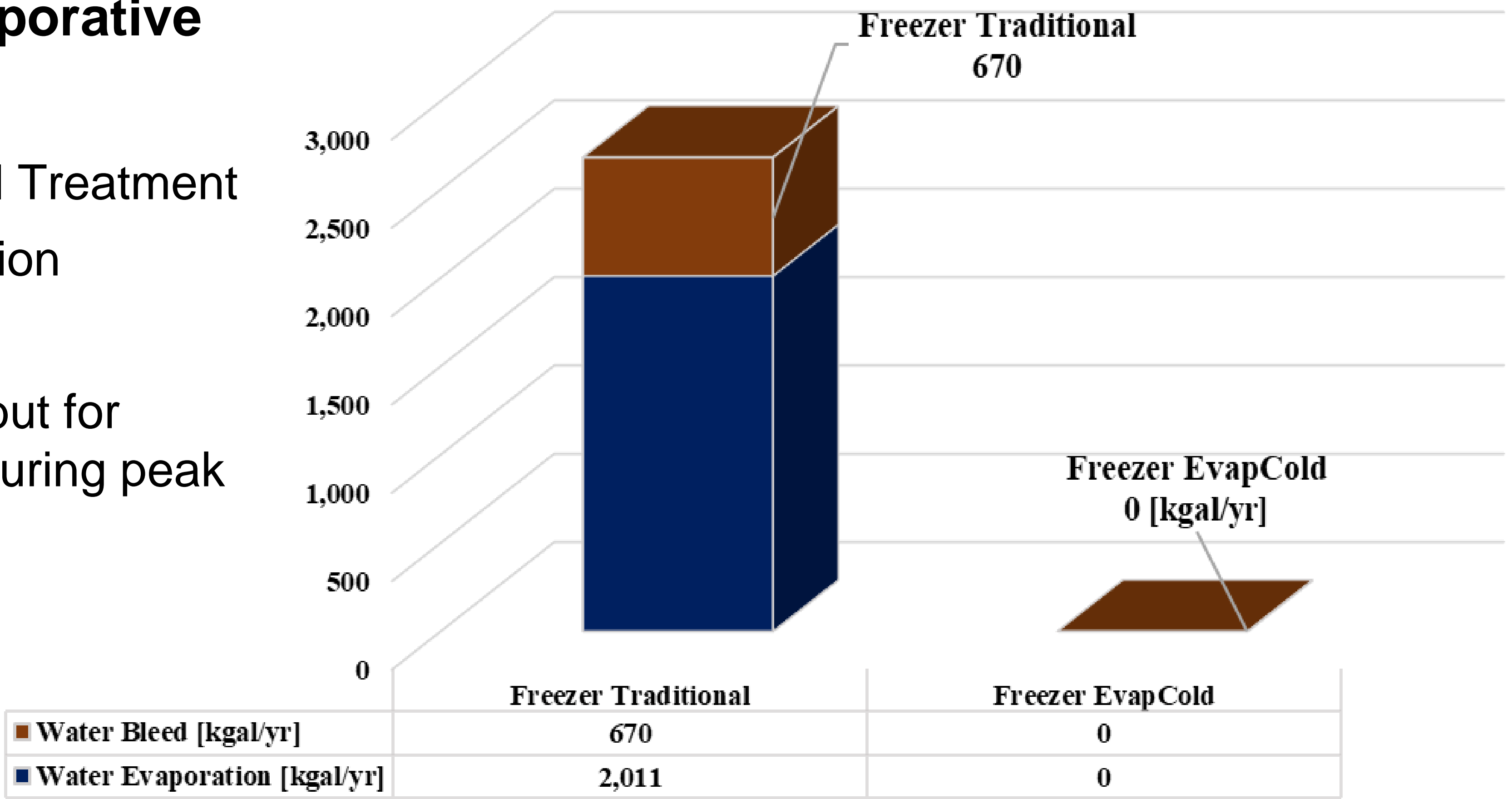
Air-cooled units eliminate all piping & piping losses to the roof and create **SIGNIFICANT ENERGY SAVINGS** & better mechanical integrity

Lower Water Consumption vs. Central Plant System

Air Cooled Ammonia vs. Central Plant w/ Traditional Evaporative Condensers:

- Eliminate Water Chemical Treatment
- Eliminate Water Evaporation
- Eliminate Water Bleed
- Sacrifice head pressure, but for limited times of the year during peak summer conditions.

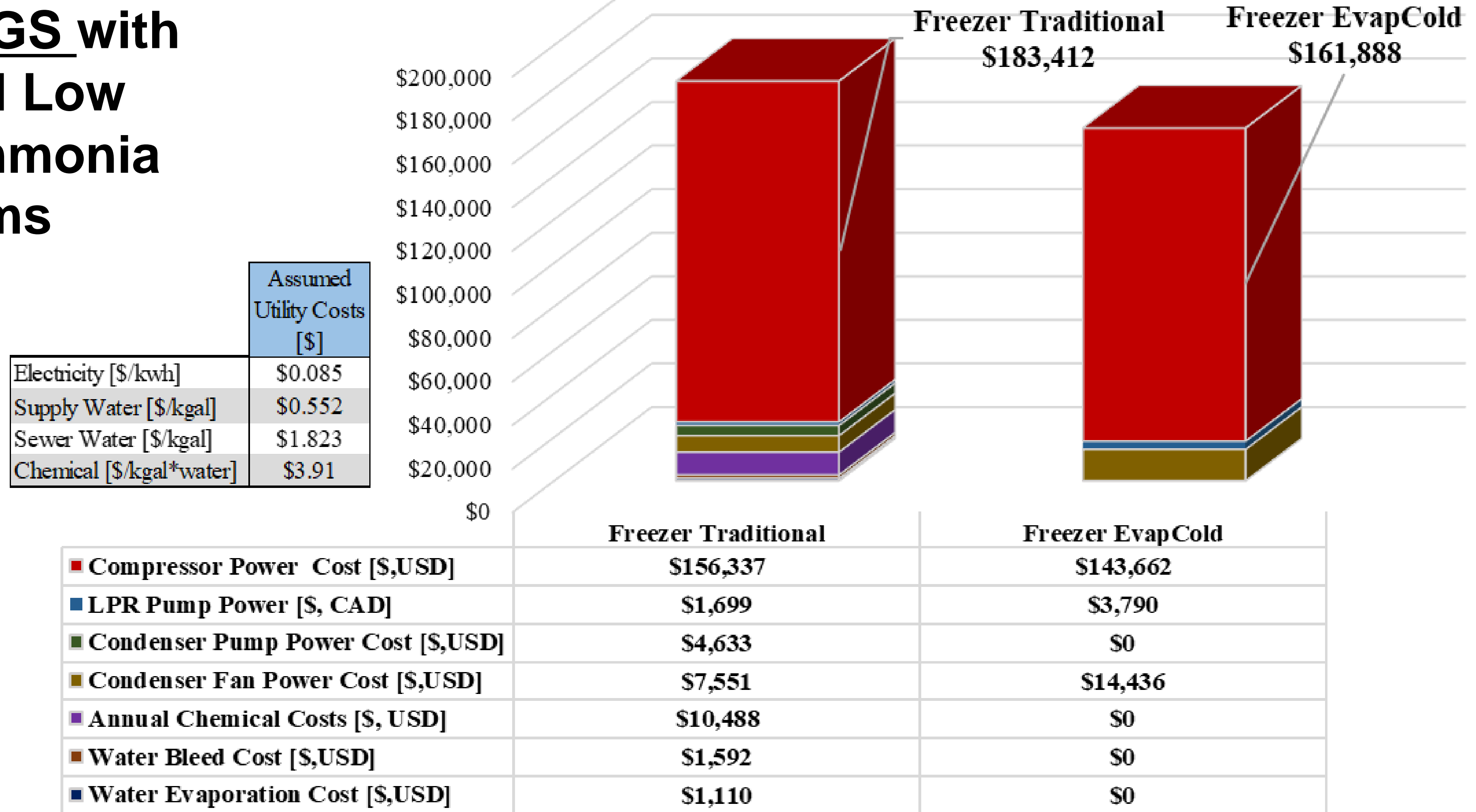
Water Use Breakdown [kgal/yr]



Numbers Speak

14% SAVINGS with Packaged Low Charge Ammonia Systems

Approximate Annual System Cost Comparison [\$]



The Ammonia is all on the Roof

- Relief will discharge @ approx. 130'
- Can work on one system without affecting the others
- Reduced Charge by 10,000 lbs+
- Eliminated the need for difficult piping installation



Owner & Contractor Benefits

THESE BENEFITS HELP ALL STAKEHOLDERS

- 1. Inherently Safer Technology**
- 2. Significantly Lower Regulatory Burden**
- 3. Lower Energy Usage**
- 4. Eliminate Central Machine Room**
- 5. Faster Installation & Customer Use**
- 6. Competitive Cost**
- 7. Reduce Tax Burden**
- 8. Lower Life Cycle Costs**
- 9. Latest Technology**
- 10. Single Source Design & Manufacturing**



OWNERS



GENERAL CONTRACTORS



REFRIGERATION CONTRACTORS





ATMO
sphere

Business Case for
Natural Refrigerants

June 12-14, 2018 – Long Beach

Thank you very much!

