

Refrigeration Optimization and Water Conservation Lorentz Meats

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UNIVERSITY OF MINNESOTA

Driven to DiscoverSM

Financial Support from Dakota Electric

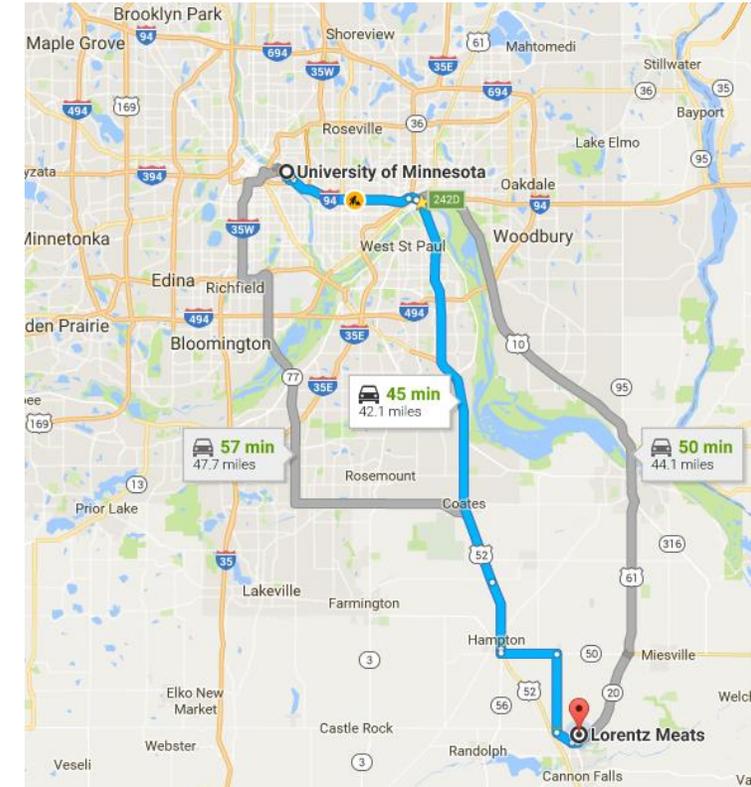
Company Background

- Located in Cannon Falls, Minnesota
- Founded in 1968 by Ed and Mary Lorentz
- Sons Rob and Mike purchased company in 1997
- Built new facility in 2000
 - Expanded in 2013
- Humane slaughter to retail-ready meat processing
 - Serves small to medium producers

HOME MADE QUALITY FOR THREE DECADES
Lorentz



Fine Meats Packed In The Cannon River Valley



Incentives for Change

- **Money spent on utilities**
 - Large portion spent on refrigeration
- **Dedication to community**
- **Dedication to the environment**



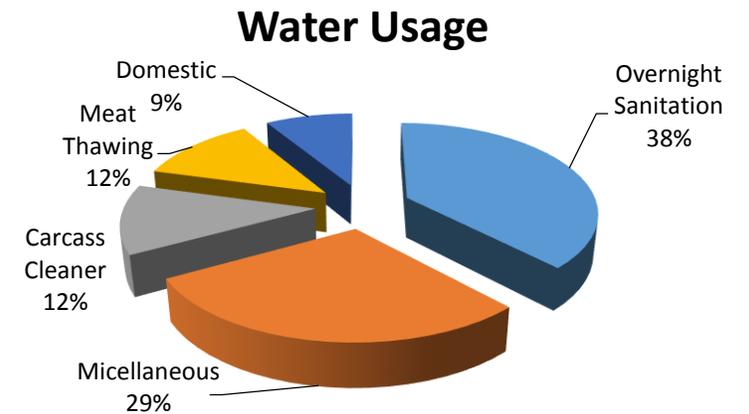
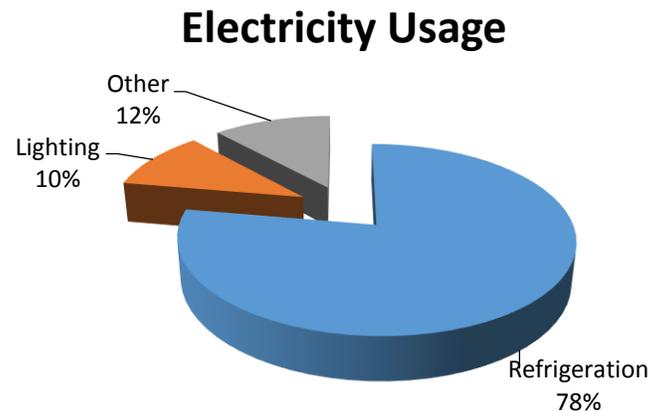
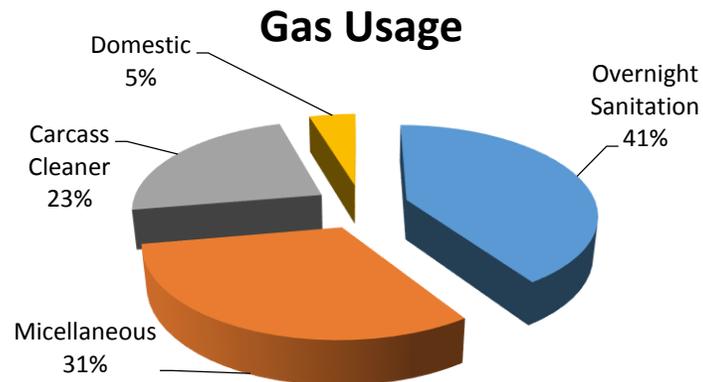
getsatisfaction.com



www.acssmartbuildings.com

Reasons for Seeking MnTAP Assistance

- **Determine where utilities are used most often**
 - Electricity
 - Water and sewage
 - Gas
- **Fresh Eyes**
- **Great Reputation**



Approach to the Project

- Learn about the facility and processes
 - Learning why for everything
 - Map out important equipment
- Talk to operators, managers, and contractors
- Identify areas for efficiency improvement and source reduction



Approach to the Project

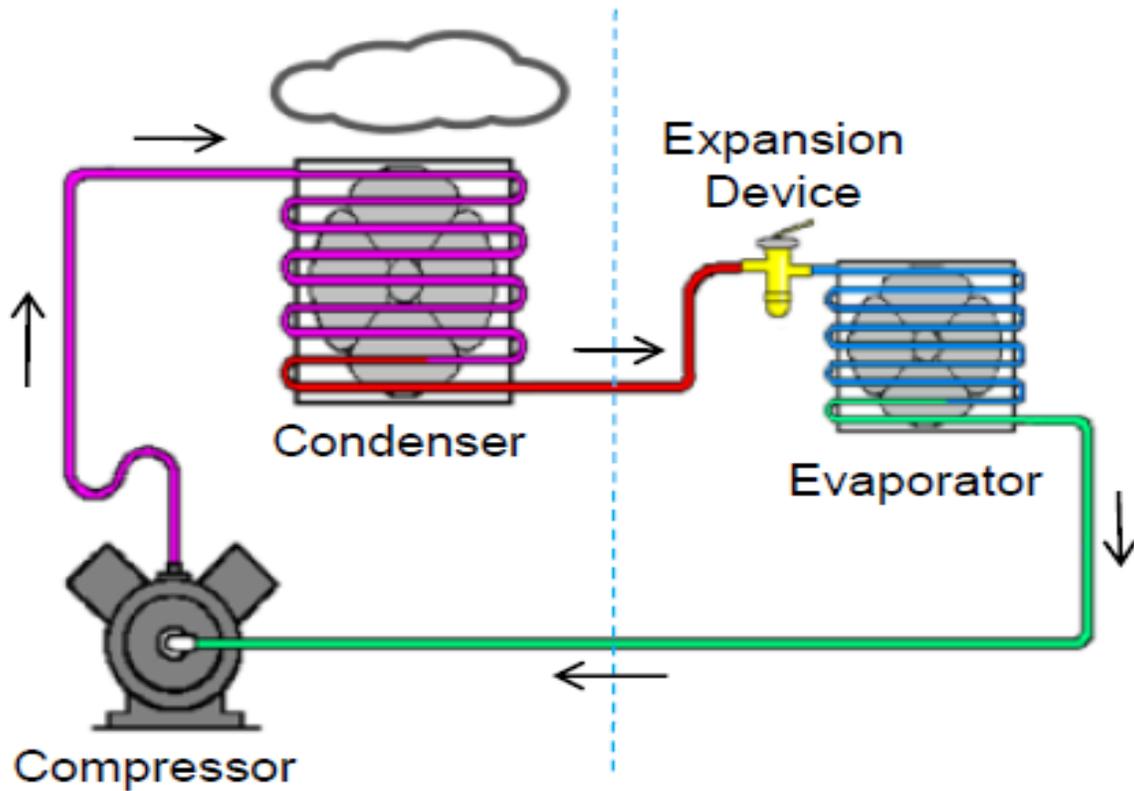
- **Quantify**
 - Measure the utilities allocation throughout the facility
 - Create water, energy, and gas balances
- **Contact vendors and technical support for pricing**



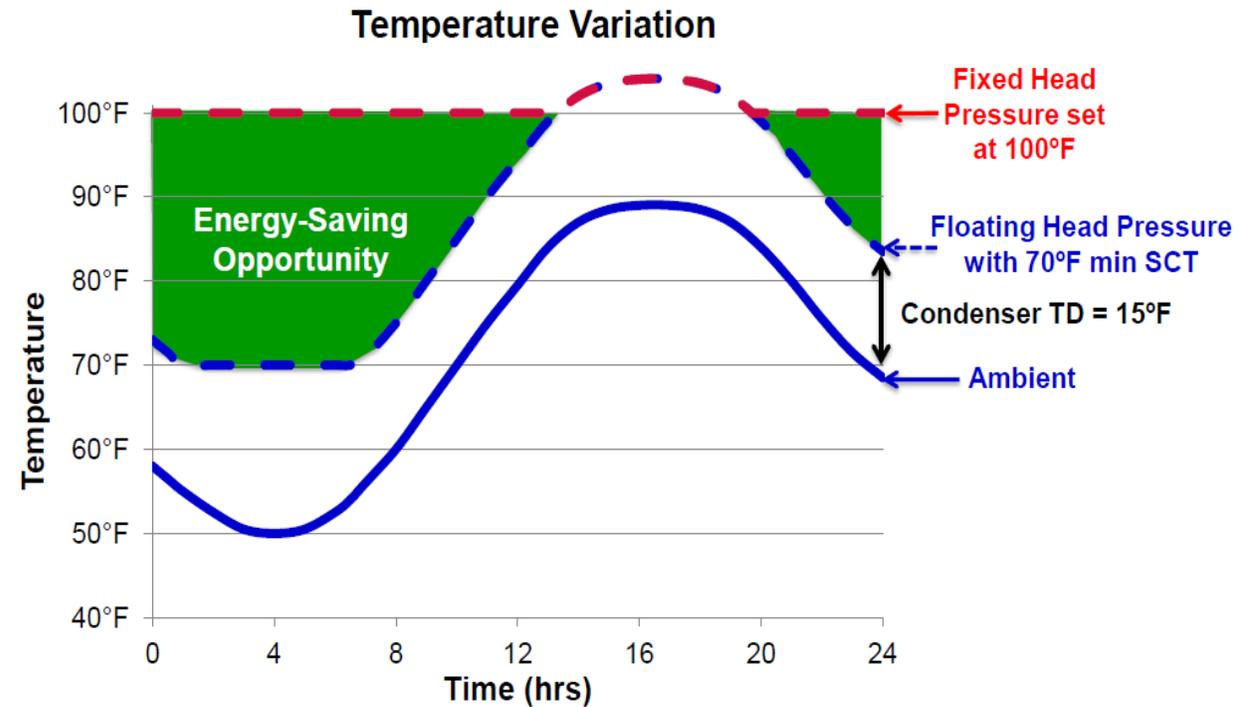
Background and Solutions

Industrial Refrigeration Management

- Refrigeration cycle



- Floating Head Pressure



http://www.emersonclimate.com/en-us/About_Us/industry_stewardship/E360/Documents/Webinar-Presentations/02-Implementation-of-Low-Condensing-Refrigeration.pdf

New Rack-Lower Minimum Condensing Head Pressure

- Leave hardware “as is”
- Lower set-point gradually until reliability wavers
- Go from 97°F minimum condensing to 90°F
- Emerson Climate Technologies Annual Energy Analysis

Old Rack-Lower Minimum Condensing Head Pressure

- Same idea as new rack
- Difference:
 - Go from 92°F minimum condensing to 90°F
- Emerson Climate Technologies Annual Energy Analysis

Lower Minimum Condensing Head Pressure

Waste Reduction Option	Waste Reduced (Annually)	Implementation Cost	Cost Savings (Annually)	Payback Period	Status
New Rack	76,000 kWh	\$100	\$7,900	5 days	Recommended
Old Rack	13,000 kWh	\$100	\$1,400	27 days	Recommended

New Rack- Lower Minimum Condensing Head Pressure Further

- Replace Thermostatic Expansion Valves with Electronic Expansion Valves
- Go from 97°F minimum condensing to 50°F
- Many other requirements already in place
 - Still some other minor adjustments
- Emerson Climate Technologies Annual Energy Analysis



Old Rack- Lower Minimum Condensing Head Pressure Further

- Same idea as in new rack
 - Replace Thermostatic Expansion Valves with Electronic Expansion Valves
- Go from 92°F minimum condensing to 70°F
 - Compressors on rack are older
 - Range of Reliable Operation smaller
- Emerson Climate Technologies Annual Energy Analysis

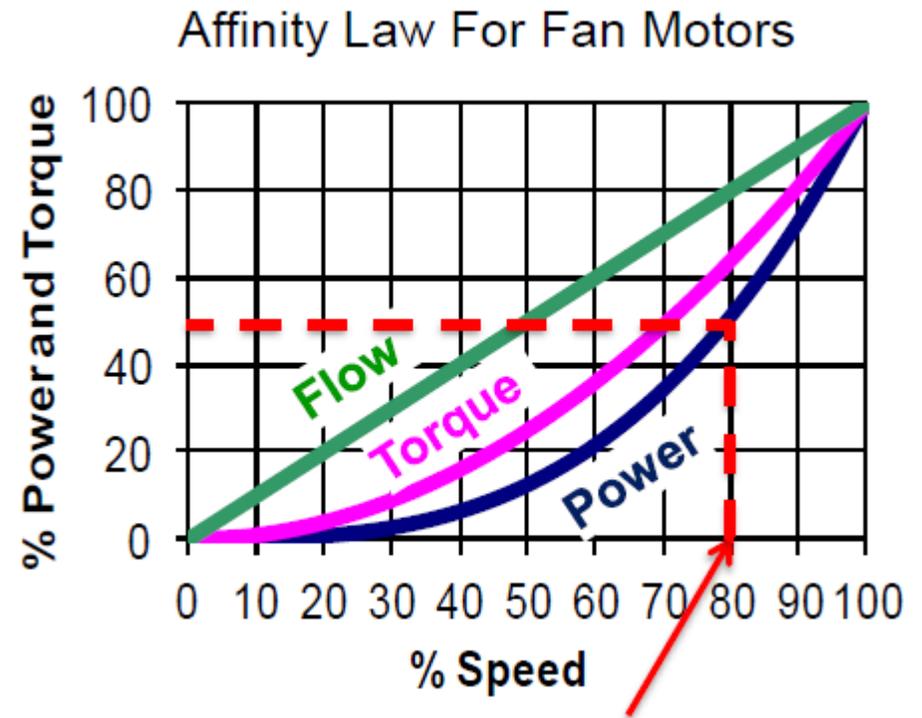


Lower Minimum Condensing Head Pressure Further with EXV

Waste Reduction Option	Waste Reduced (Annually)	Implementation Cost	Cost Savings (Annually)	Payback Period	Status
New Rack	314,000 kWh	\$40,800	\$32,400	1.3 years	Recommended
Old Rack	114,000 kWh	\$36,000	\$11,700	3.1 years	Recommended

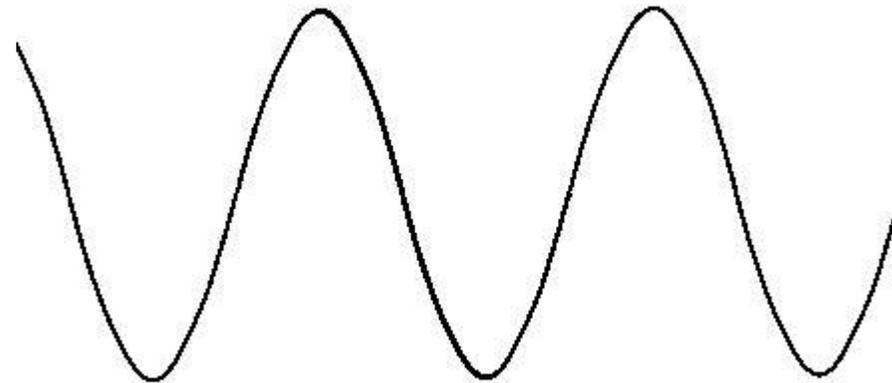
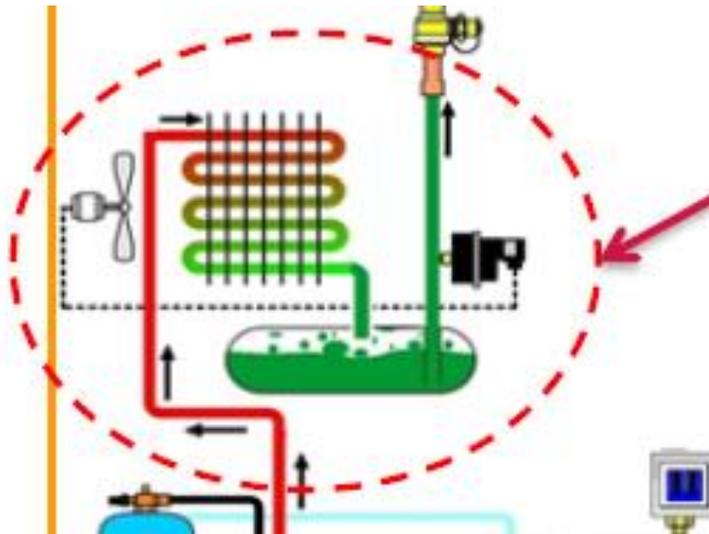
Electronic Refrigeration Controls

- **Fan Motor Affinity Law**
 - 80% speed equates to 50% power draw
 - Shared condenser load more efficient than cycling fans on/off
- **Energy efficient fan motors**



VFD on Condenser Fans

- Variable Frequency Drive (VFD)
- Share the cooling load on the condenser between multiple fans
- Tighter head pressure control



www.chrisronk.net

VFD on Condenser Fans

Waste Reduction Option	Waste Reduced (Annually)	Implementation Cost	Cost Savings (Annually)	Payback Period	Status
New Rack	40,700 kWh	\$2,400	\$4,200	7 months	Recommended
Old Rack	14,800 kWh	\$2,400	\$1,500	1.6 years	Recommended

Sterilization of Carcasses

- 190°F water used just before fresh carcass is cooled
- Important to kill bacteria and other pathogens
- Large wash cabinet used
- 11 rows per side with many nozzles
 - Not all water hits carcass



Install Shut-off Valves on Carcass Cleaner

- Bottom two rows rarely need to be used
- Installing shut-off valves would give an option to use when needed
- Save water and gas
- Potential for automation



www.dhj-cn.cn



thrifthq.com



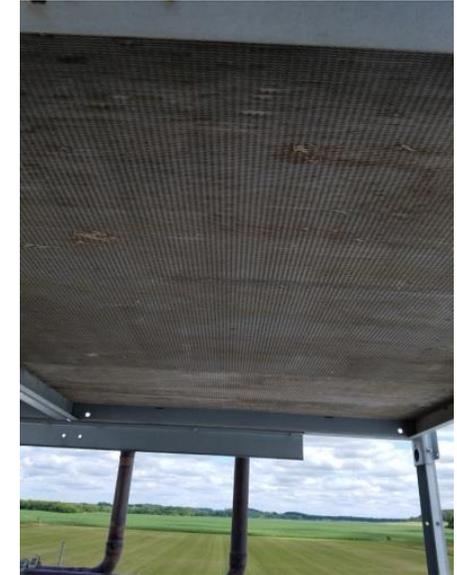
Install Shut-off Valves on Carcass Cleaner

Waste Reduction Option	Waste Reduced (Annually)	Implementation Cost	Cost Savings (Annually)	Payback Period	Status
Shut-off Valves	119,000 gallons	\$900	\$2,300	3 months	Recommended
	1,400 therms		\$1,100		

Additional Solutions

Clean Condenser and Evaporator Coils

- Increase cooling capacity
- Run entire HVAC system more efficiently
- Condenser coils quantified
 - Overall Fan usage
- Evaporator Coils harder to quantify
 - Qualitative positive results seen
 - No changed settings
 - Cooler room temperatures observed



Clean Condenser and Evaporator Coils

Waste Reduction Option	Waste Reduced (Annually)	Implementation Cost	Cost Savings (Annually)	Payback Period	Status
Condensers	9,400 kWh	Labor = \$800	\$900	10 months	Implemented
Evaporators	Undetermined	Labor = \$3,600	Undetermined		Implemented

Summary Table of Recommendations

Waste Reduction Option	Waste Reduced (Annually)	Implementation Cost	Cost Savings (Annually)	Payback Period	Status
New Rack	76,000 kWh	\$100	\$7,900	5 days	Recommended
Old Rack	13,000 kWh	\$100	\$1,400	27 days	Recommended
New Rack EXV	314,000 kWh	\$40,800	\$32,400	1.3 years	Recommended
Old Rack EXV	114,000 kWh	\$36,000	\$11,700	3.1 years	Recommended
New Rack VFD	40,700 kWh	\$2,400	\$4,200	7 months	Recommended
Old Rack VFD	14,800 kWh	\$2,400	\$1,500	1.6 years	Recommended
Shut-off Valves	119,000 gallons	\$900	\$2,300	3 months	Recommended
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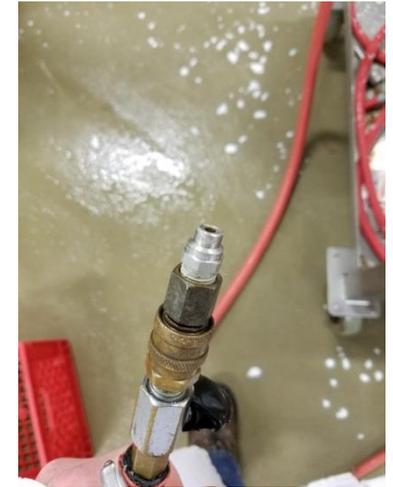
Regarding Lighting

- Change to LED Lighting
- Occupancy Sensors

Waste Reduction Option	Waste Reduced (Annually)	Implementation Cost	Cost Savings (Annually)	Payback Period	Status
Install LED Lighting	47,800 kWh	\$10,300	Utilities = \$4,900	1.6 years	In Progress
			Maintenance = \$1,400		
Install Motion Sensors	24,900 kWh	\$1,800	\$2,600	1.4 years	Recommended

Potential Future Projects

- **Install Electronically Commutated Motors on evaporators**
 - Favorable if implemented on a replace-upon-failure basis
- **Reduction in sanitation water usage**
 - Still looking to meet in the middle with contractor
- **Reduction of water used in thawing frozen meat**
 - Study being done in house to determine necessity



Personal Benefit as a Result of MnTAP Experience

- **Bridged the gap between academic studies and technical education**
- **Guided me out of the student thought process**
 - Value in talking to managers and operators in addition to observation
 - Asking why a process was done a certain way
- **Helped me realize the value of quantifying changes**
 - From measurements of utilities savings to equipment and contractor pricing

Questions?



This project was sponsored in part by Dakota Electric