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New Commercial Refrigeration Savings Opportunities

August 2022



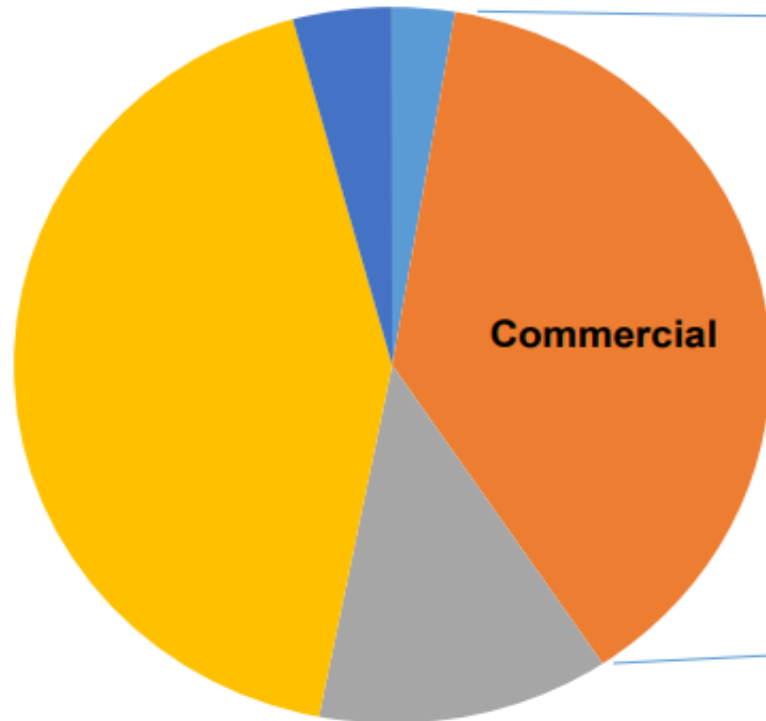
Why Commercial Refrigeration?

- Currently an underserved market
- Systems comprised of standardized design and equipment components making it easier to achieve savings
- Opportunity to leverage a number of new UES measures and tools including Controls and Doors
- New partnerships help implement solutions in PNW

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Commercial Refrigeration Energy Savings

Results: Cost-effective 20-year Potential



Commercial End-Use Category	aMW in 2035
Compressed Air	17
Electronics	392
Food Preparation	64
HVAC	407
Lighting	692
Motors/Drives	35
Process Loads	47
Refrigeration	69
Water Heating	10
Total	1732

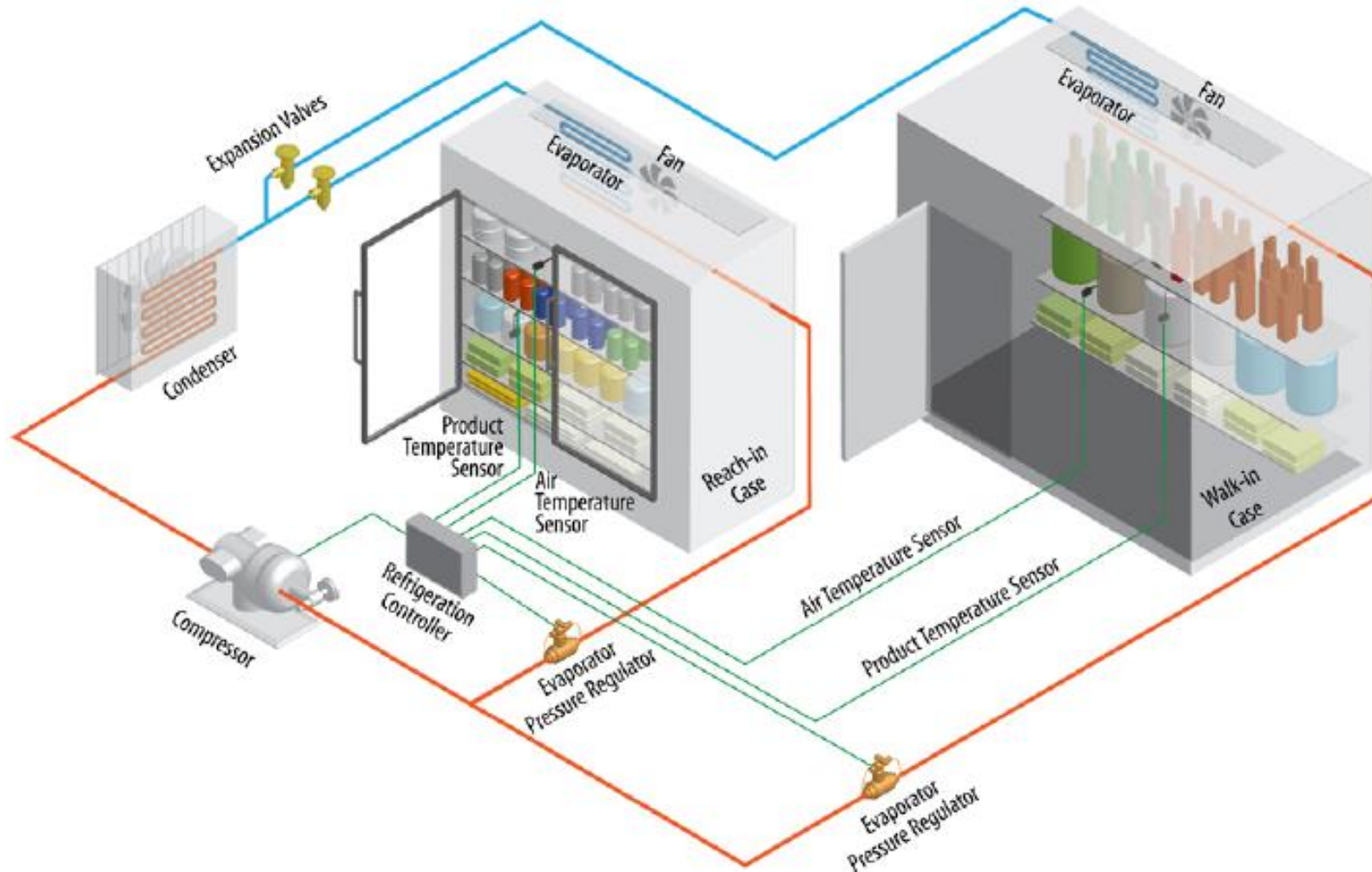
Featured Commercial Refrigeration Measures

- Floating Head Pressure Control
- Floating Suction Pressure Control
- Variable Frequency Drives on Condenser Fans
- Adding doors to
 - Open cases
 - Open reach-in Walk-ins
- Replace Existing Cases with New Cases

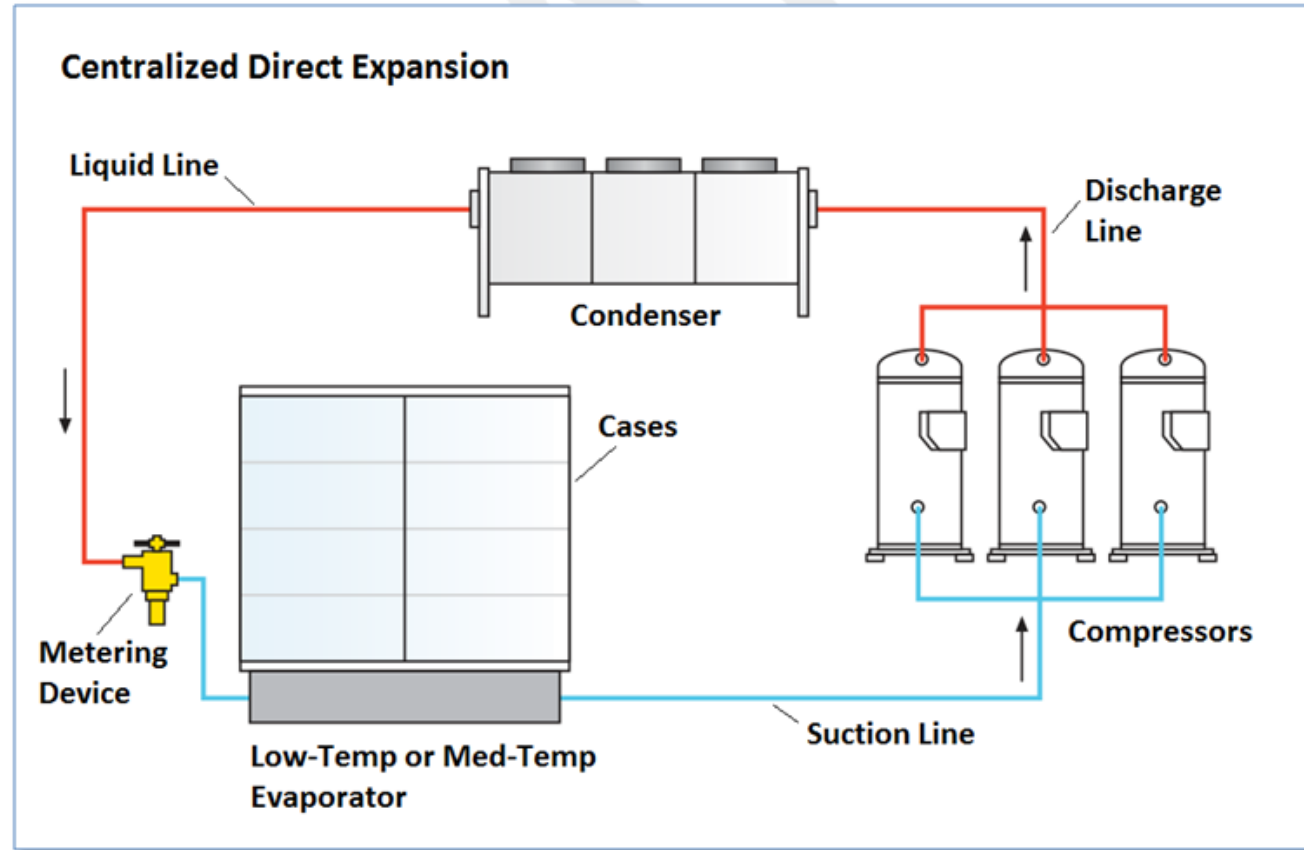
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Total 20 year technical potential for grocery bundle = 69 aMWs

Refrigeration System Diagram



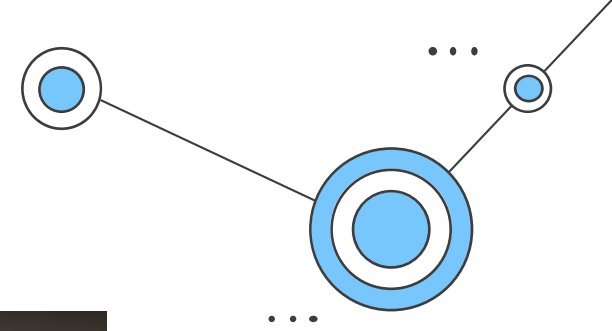
Simplified Schematic



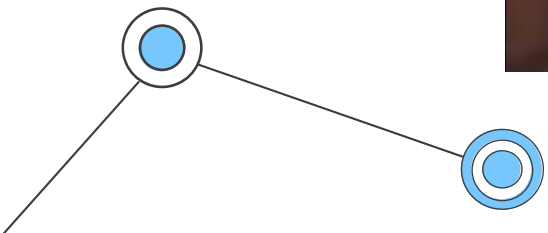
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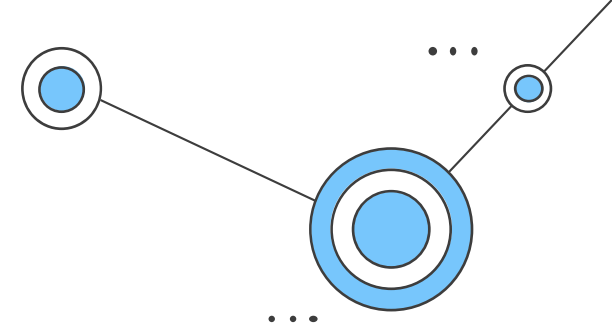
Condenser Fan Variable Frequency Drive



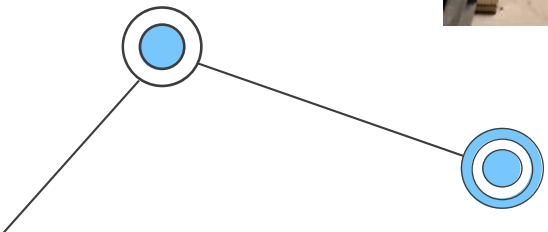


Refrigeration Control System





Project Measurement & Verification



Streamlined Custom Project Process for Grocery Refrigeration

- A streamlined process has been developed by the BPA Engineering Commercial team – led by Jamie Anthony
- Utilities and their end users can work with BPA Customer Service Engineer to coordinate with refrigeration contractors to claim incentives and EE savings
- The process has a savings calculator, project information template, and a standardized custom project C1 form to make it easier
- Project tools will be updated with BEETS transition

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Streamlined Custom Project Process

- After utility approval, CSE works with contractor to collect system information using standardized form
- CSE inputs information into NREL calculator to estimate energy savings
 - CSE provides savings information to the utility to approve the project for incentives
- CSE completes the standard C-1 form (BEETS in the future) and provides to utility
 - These projects can be reported as a completion report only project if the utility chooses

Information Collected in Standardized Form (provided by contractor)

The anticipated or already occurred project start and stop dates.

The name and contact info of the manager at the store, or the regional energy manager

Site Location (State, City, Address)

Rack or System ID from RS

Refrigerant

Minimum Condensing Temperature (°F) (Pre Project)

Compressor Type

Saturated Suction Temperature (°F) (Pre project)

Rated Evaporator Load (BTU/h)

Condenser Type (air cooled, evap cooled, hybrid?)

Recommended Condenser Degredation Factor (0.8, 0.9,. 0.95, 1)

Minimum Condensing Temperature (°F) (Post Project)

Estimated Average Saturated Suction Temperature (°F) (Post project)

Does the Pre Project have a VFD?

Does the Post Project have a VFD?

If the project is complete, an invoice showing that the work and materials have been paid for and the cost

BPA utilizes the NREL Refrigeration Calculator to Determine Energy Savings

- NREL (National Renewable Energy Laboratory), a DOE facility based in Golden, Colorado supported the development of a new refrigeration calculator to make it easier to quantify commercial refrigeration energy savings
- Developed in conjunction with CTA Engineering Refrigeration Designers and NREL Refrigeration Modeling Experts
- BPA engineers have reviewed and analyzed the calculator for use in the PNW

[National Renewable Energy Laboratory \(NREL\) Home Page | NREL](http://www.nrel.gov)

[www.NREL.gov](http://www.nrel.gov)

Calculator Screen shot

Primary System Inputs Section	
<i><u>NOTE:</u> CLICK ON INPUT DESCRIPTIONS FOR LINKS TO DETAILED INPUT INFORMATION.</i>	
Site Location	CZ4C - Seattle, WA
Primary System Inputs	
Refrigerant	R404A
Minimum Condensing Temperature (°F)	80.0°F
Number of Suction Groups	1
Primary System Suction Group 1 Inputs	
Refrigeration Method	Direct Expansion
Connected Secondary Loop(s)	No Secondary Loop
Compressor Type	Reciprocating
Saturated Suction Temperature (°F)	20°F
Evaporator Superheat (°F)	10°F
Return Gas Temperature (°F)	50°F
Rated Evaporator Capacity (BTU/h)	100,000
Rated Runtime Ratio	0.85

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Current Grocer Refrigeration Projects in PNW

- 30 PNW Albertson and Safeway projects in BPA customer's territory
- Company hoping to expand to other grocery chains in the future
- Opportunity to spend EEI dollars and claim EE Savings to meet targets
- Streamlined Custom Project process makes it easier than ever to claim savings for these types of projects in your territory

BPA has reviewed several projects using this approach to validate the process and energy savings calculations and encourage utilities to utilize them to benefit their end-use customers

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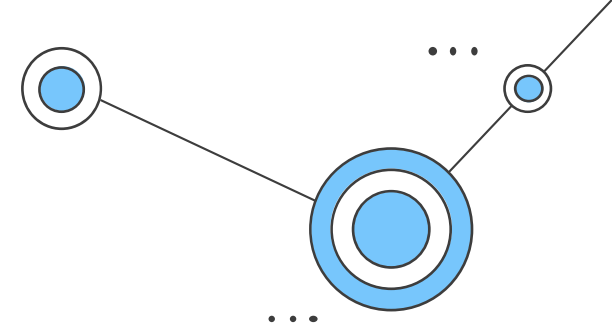
Savings Overview

- Typical project description
 - Floating Head Pressure Controls
 - Floating Suction Pressure Controls
 - Variable Frequency Drive on Condenser Fans
 - Average Project Costs: \$70,000 to \$100,000

Measure	Small Store	Large Store
Refrigeration Controls	30,000 kWh	200,000 kWh
VFD on Condenser Fans	6,000 kWh	39,000 kWh

Savings could be even higher on older, inefficient systems

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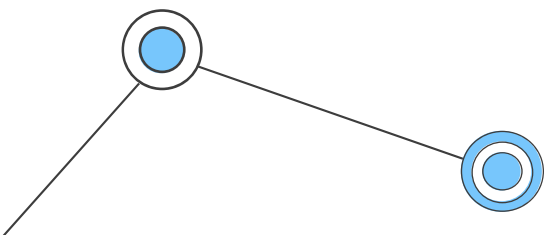
Other Grocery EE Opportunities



Upgrade Case Lighting



Add Refrigerated Case Doors



Other Grocery Store Efficiency Opportunities

Variable Frequency Drive on
HVAC Air Handler Unit
(UES Measure)

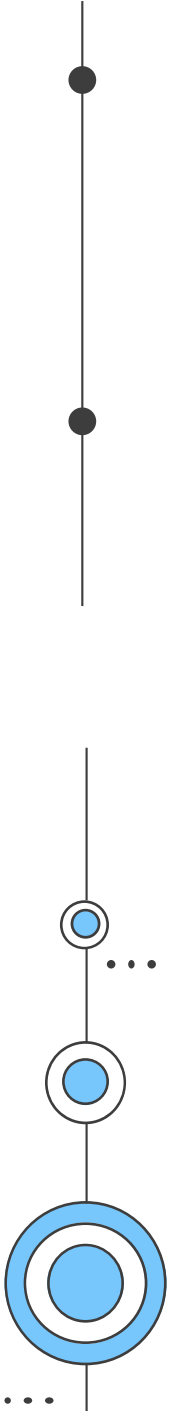
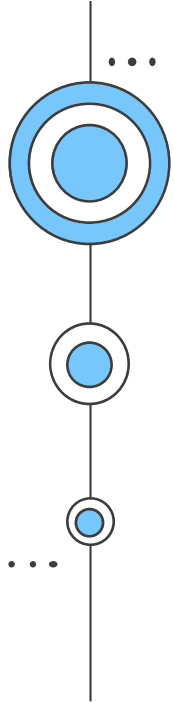


Grocery Store Sales Floor
Lighting Upgrade
(BPA Lighting Calculator)

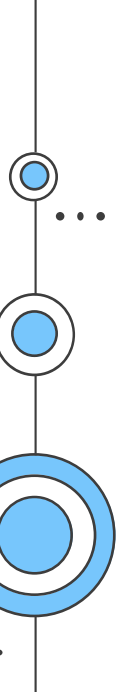
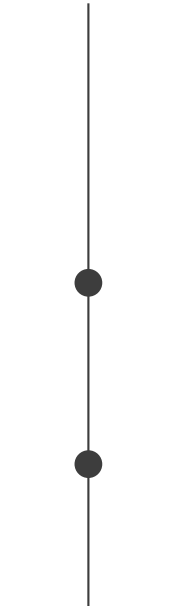
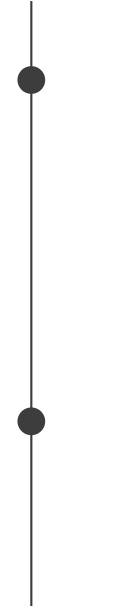
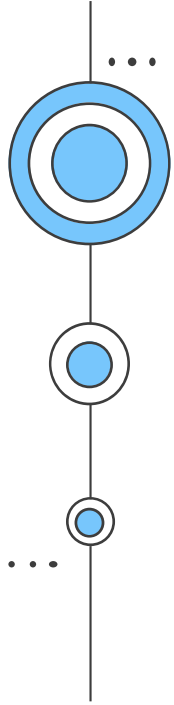


Questions?
**THANK YOU
FOR
ATTENDING**

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Appendices



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M&V Plan

- Collect site specific information from vendor on the system
 - BPA Customer Service Engineer estimates savings with NREL Calc
 - Under 200,000 kWh, site specific calculator is sufficient
 - Over 200,000 kWh, end use metering may be required
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- Post project compressor and condenser hourly energy use (3 months)
 - Used to calibrate pre and post calculator consumption calculations
 - Whole Building Utility data could be used

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