VEIC Training Series

Refrigeration: Programs that Deliver Environmental, Economic and Health Benefits

May 15, 2020
We’re on a mission to generate the energy solutions the world needs.

VEIC works with organizations across the energy landscape to create immediate and lasting change. Since 1986, we’ve served as an objective partner for our clients as they navigate complex energy challenges. With expertise in energy efficiency, building and transportation electrification, and new approaches for a clean and flexible grid, we bring new solutions to the market that meet goals and make change.
Together with our clients, we’ve been delivering customized trainings to the market to build expertise and drive value with end-use customers.
Our experts

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What we’ll cover

Why Refrigeration?
What are the Benefits?

Energy Efficiency Measures
How do you build resiliency?

Equipment Maintenance
How do you deliver continued environmental, economic and health benefits?
Intro to Refrigeration
What are refrigerants?
Refrigerants are responsible for the miracles of modern life
Where refrigerants are found: commercial
Where refrigerants are found: residential
Refrigeration accounts for 17% of energy consumption worldwide.

- Grocery Stores: 60%
- Convenience Stores: 55%
- Hospitality: 16%
- Restaurants: 6%
Why do we focus on refrigeration?

• Address top climate change issues
  • High-GWP refrigerants
  • Food waste
• Impact
  • Significant energy and non-energy CO2e savings
  • VEIC’s true north

Per Capita Food Losses And Waste

Kg/year (Gustavsson et. al., 2011)
Why should you focus on refrigeration?

- Large energy savings
- Low incremental costs
- High measure volume
- Untapped market
- Climate change
- Resiliency
Why should your customers focus on refrigeration?
Refrigeration is cheap compared to the product it is storing
Good place for businesses to put their money (if done appropriately)

Source: ACEEE estimates for energy efficiency; other estimates adapted from the Vanguard Group.
Customer benefits: new refrigeration equipment

Reduce Energy Costs
Buying new efficient refrigeration equipment can pay for itself with energy savings.

Increase Reliability
New equipment can be both more efficient and reliable.
Reduction in food waste, greater margins.

Short Pay-Back
Typically ~1 year payback when looking at incremental cost and utility incentives.
Energy Efficiency Measures
Market & Opportunities

• All customers with commercial refrigeration equipment
• Customer and contractor engagement
• Focus on technologies
• Retrofit or new equipment
• Energy savings, peak reduction, cost savings
Refrigeration Measures

Rx / Midstream Measures

• Evaporator Fan Motors / Controls
• HECUs
• HEEvaps
• Anti-sweat Heater (ASH) Controls
• LED Case Lights / Controls
• Night Covers
• Zero Energy Doors
• Refrigeration Add Doors
• Self-Contained Equipment
• CoolBots
• Refrigerant Leak Detection/Repair

Custom Measures

• Condenser Fan Motors / Controls
• Floating Head Pressure Controls
• Floating Suction Pressure Controls
• Outdoor Air Economizers
• Insulation or Air Sealing (walk-ins)
• Efficient Compressors
• Compressor Heat Recovery
• Refrigerant Leak Detection/Repair
• Consolidate/Downsize Equipment
• Intelligent Freezer Defrost Controls
• Microchannel/Oversized Condenser
Markets & Technologies
Walk-Ins
Walk-ins: Equipment

**RACKS**

**CONDENSING UNITS**

**EVAPORATORS**
Walk-ins: Efficiency Measures

• Condensing Units
  • HECUs
    • Scroll compressor
    • EC condenser fan motors
    • Floating head pressure controls
  • Benefits
    • Maintenance savings
    • Equipment reliability
• Evaporators (retrofit)
  • EC evaporator fan motors
  • Benefits
    • Temperature Stability
    • Quick payback
Walk-ins: Efficiency Measures cont.

- Evaporators (new equipment)
  - HEEVaps
    - EC fan motors & controls
    - Smart defrost
  - Benefits
    - Product quality
    - Reduced maintenance/install costs
    - Quick payback
- Racks
  - Floating head/suction pressure controls
  - Compressor VFDs
  - Benefits
    - Low cost
    - Load matching
Remote Reach-in Cases
Remote Reach-in Cases: Equipment

• Reach-in cases
  • Evaporator fan motors
  • Evaporator coils
  • Lights
  • Doors (closed cases)
  • Door/frame heaters (closed cases)
• New DOE-compliant or Energy Star cases
• Retrofit existing cases
Remote Reach-in Cases: Efficiency Measures

- Anti-sweat Heater Controls
  - Cycles controls on-demand
  - Reduced heat gain to case
  - Involve refrigeration contractor for savings persistence

- LED Case Lights
  - Improved light and product quality
  - Reduced heat gain to case
  - Opportunity for controls
Remote Reach-in Cases: Efficiency Measures cont.

- Night covers okay, **adding doors** much better
  - Increased case efficiency by 70%
  - Increased customer comfort
  - Better light and product quality
  - **Resiliency**
  - More stable case temperatures
  - Involve refrigeration contractor!!!
Self-contained merchandisers
Self-Contained Merchandisers

OVER 85% OF PRODUCT SOLD AVAILABLE IN HYDROCARBON (R290)
Self-Contained: Efficiency Measures

• Owned vs rented merchandisers
  • Same measures, slightly different approach
  • Many vendors spec high-efficiency units

• Natural Refrigerant Technologies

• Claiming Energy Savings
  • EnergySTAR
  • DOE vs Energy Code
Self-Contained: Key Benefits

- Energy savings can justify retrofit
  - 30-50%
- Refrigerant Management/Proper Disposal
- New equipment or retrofit
  - Great for expansion/remodels
- Placement Flexibility
- Great opportunity for general stores and convenience stores
- Reduced Waste Heat
Preventative Maintenance Measures
Why preventative maintenance?

- Energy Savings
  - Although historically difficult to claim
- Gain contractor trust by understanding importance of and advocating for PM
- Customers often don’t see value
- Allows for planned equipment upgrades, rather than emergencies

Preventive Maintenance

- Avoid the consequences of component or system failure
- Clean and restore components before performance degrades
- Replace worn components before they fail
- Improve reliability and predictability
- Train experts on proper procedure and techniques
What is preventative maintenance?

- Door seals
- Filters
- Gaskets
- Air sealing
- Insulate suction lines
- Strip curtains
- Auto door closers
- Refrigerant Leak Repair

...not an exhaustive list!
Insulate suction lines

- Low side/“inside” piping
- Condensate control
  - Safety issues
  - Product quality issues
  - Significant energy savings
Coiling Cleaning

• “Biggest thing you can do for energy efficiency” – Kurt Matzke

• Scale/Dirt on coils reduces heat transfer significantly
  • 1/10” scale = 30% efficiency reduction

• Coils inside store
  • Case evaporators
  • Self-contained

• Coils outside store
  • Condensers/Condensing Units
Coiling Cleaning

• Often done by store staff
  • Need to empty cases
• Equipment makes it faster/easier
  • Kaivac Case Cleaner
  • Pressure washer/wet vac
• Benefits
  • Reduced service calls
  • Food safety and quality
  • Case longevity
  • Resiliency
Refrigerant Leak Detection and Repair
Energy Efficiency Impact of Leaks

- Varies by system type/configuration, but low refrigerant charge can result in:
  - Increased compressor and condenser duty cycle
  - More annual run hours = more kWh used
  - Some studies estimate 1:1 correlation

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Energy Efficiency Impact of Leaks

For smaller systems, we have estimated:

• 5 HP Condensing Unit = $250/year in savings
• SMB customer with (4) condensing units ranging from 3-5 HP = $800/year in energy savings
• Relatively small, but small cost ($500-$3,000/project)
Refrigerant Cost

Industry

$5,000 annual refrigerant replacement cost per store

25% average emissions rate

GreenChill Partners

$2,600 annual refrigerant replacement cost per store

12.9% average emissions rate
Low refrigerant charges can lead to:

- Compressor short cycling
- More frequent service calls
- Equipment failures

Which leads to...

- Product quality concerns
- Unexpected expenses
- Decreased system/customer resiliency
Customer Benefits of Leak Repair

- O&M Cost Reduction
- Energy Savings
- Compliance
- Marketing
  - EPA GreenChill Program
  - Utility Programs
- Equipment reliability
- Product quality
- Environmental Stewardship
• Refrigeration systems are serving a critical need and they are still using significantly more energy than is necessary to do so!
• Technical assistance and utility efficiency program funding are more important than ever
• Traditional efficiency projects are still possible
  • Start with low-risk measures
  • Work up to more complex systems
• Preventative maintenance is essential to human, environmental, and economic health
• Refrigeration contractors are strongest allies
Questions
More Free Trainings....

May 15, 10 am EDT
REFRIGERATION.
Programs that deliver environmental, economic and health benefits.

May 22, 10 am EDT
RESIDENTIAL.
Energy-smart spring cleaning

May 29, 10 am EDT
HVAC.
Unlocking opportunities to maximize energy savings.
Thank you!

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