Low-GWP Refrigeration Programs and Research: A California Perspective

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International Institute of Refrigeration (IIR)
Meeting of the Working Party on LCCP Evaluation
January 27, 2015
Chicago, IL
CA Agencies With Regulatory Oversight Over Commercial Refrigeration

**California Environmental Protection Agency** (ARB)

- Tasked with reducing CA greenhouse gas (GHG) emissions
- Assembly Bill 32 (2006) requires reduction of GHG emissions to 1990 levels by 2020

**California Energy Commission** (CEC)

- Primary CA energy policy and planning agency
- Sets state’s appliance and building energy efficiency standards
San Francisco State University
School of Engineering

- **Industrial Assessment Center** provides energy-efficiency audits for small- to medium-sized manufacturing facilities

- Industry-focused education in HVAC engineering, building energy simulation; life cycle assessment (LCA) experience with bio-derived transportation fuels

- ARB contractor for project: “*Low-GWP Commercial Refrigeration Feasibility and Cost-Benefit Engineering Evaluation*” (2-year project, started September 2014)

Subcontractors:

[Logos for VaCom Technologies and Life Cycle Associates]
CA Regulatory Focus Is On Supermarket Refrigeration

Supermarket electricity consumption

Commercial refrigeration energy usage

(data from UNEP Technology and Economic Assessment Panel Task Force)
CA Title 24, Part 6: Building Energy Efficiency Standards

• Section 120.6, subsection (b): Mandatory Requirements for Commercial Refrigeration

• Applies to “retail food stores” > 8,000 sq. ft.
  o Minimum specific efficiency for condensers; variable-speed condenser fans, with control based on $T_{\text{db}}$ (air-cooled) or $T_{\text{wb}}$ (evap)
  o Floating compressor suction pressure
  o Display case lighting control
  o Heat recovery for space heating
CA Title 24, Part 11: California Green Building Standards Code

- Section 5.508: Outdoor Air Quality

- Requirements
  - No CFCs or halons
  - Leak reduction measures for systems using refrigerant with GWP > 150; measures address
    - Refrigerant piping and valve design
    - Corrosion resistance of evaporator coils
    - Refrigerant level indicators
    - Pressure testing and system evacuation
ARB Refrigerant Management Program (RMP)

• Applies to facilities with refrigeration systems having > 50 lbs of high-GWP refrigerant

• Requirements
  o Conduct and report on periodic leak inspections
  o Repair leaks promptly
  o Maintain on-site service records

• Affected facilities meet requirements using R3 tool

• ⇒ RMP data may be of particular value in informing the calculation of direct refrigerant emissions in IIR LCCP evaluation methodology
CA High-GWP Refrigerant Stock (2013)
(as percentage of total = 11 million pounds)

Based upon self-reported data from stationary, non-residential facilities having systems with charge size ≥ 50 lbs
Annual Leakage Rate Varies With Refrigerant Type

Leakage rate also varies with system type, charge size, ...
ARB Low-GWP Refrigeration Project: Methodology (Preliminary)

• TEWI < LCCP < LCA

• DOE-2.2R or EnergyPlus to evaluate energy consumption

• Overall model to evaluate various:
  o Facility sizes
  o Refrigeration system types
  o Refrigerant types
  o Condenser types
  o Levels of effectiveness for leak prevention
  o Electricity CO₂ emissions factors
  o and …
16 California Climate Zones
Synergy between SFSU / ARB and IIR WP on LCCP Evaluation

• California-specific data can be provided to guide development of IIR LCCP evaluation methodology
• Cases selected for modeling by SFSU / ARB can serve as IIR LCCP case studies
• IIR LCCP evaluation methodology can guide and validate SFSU / ARB efforts
Thank you

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