SMUD's Pilot Natural Refrigerant Incentive Program

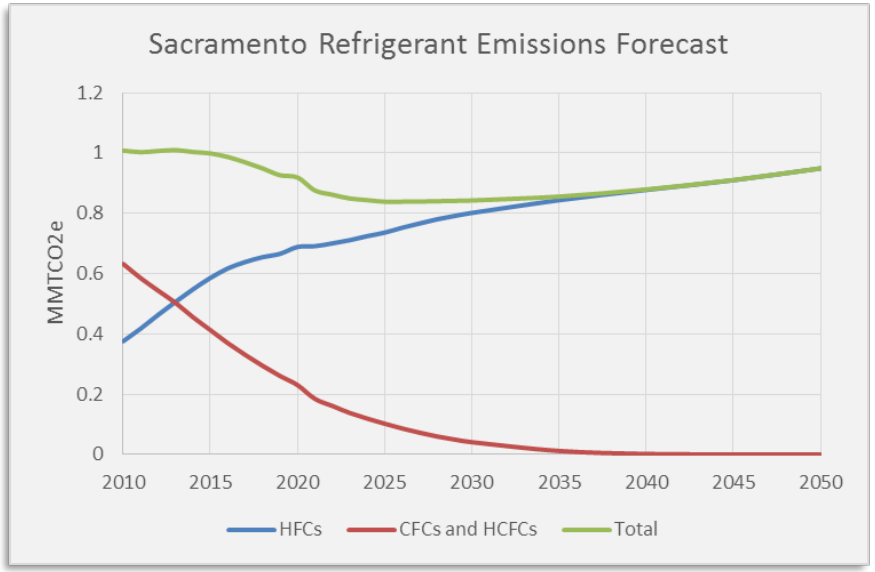
Incentivizing Direct GHG Emission Reductions in Commercial Refrigeration

Sacramento Municipal Utility District

Introducing the Pilot Natural Refrigerant Incentive Program

- Builds on SMUD's existing Custom Incentive and Savings by Design programs
- Maintains incentive for energy(kWh) and demand (kW) reductions
- Additional incentive for direct GHG emission reductions from new or retrofitted natural refrigerant systems
- SMUD pays for energy performance metering and data collection to understand performance of natural refrigerant systems

- High-GWP refrigerants are projected to result in annual GHG emissions of 1 million MtCO2e in Sacramento alone by 2050

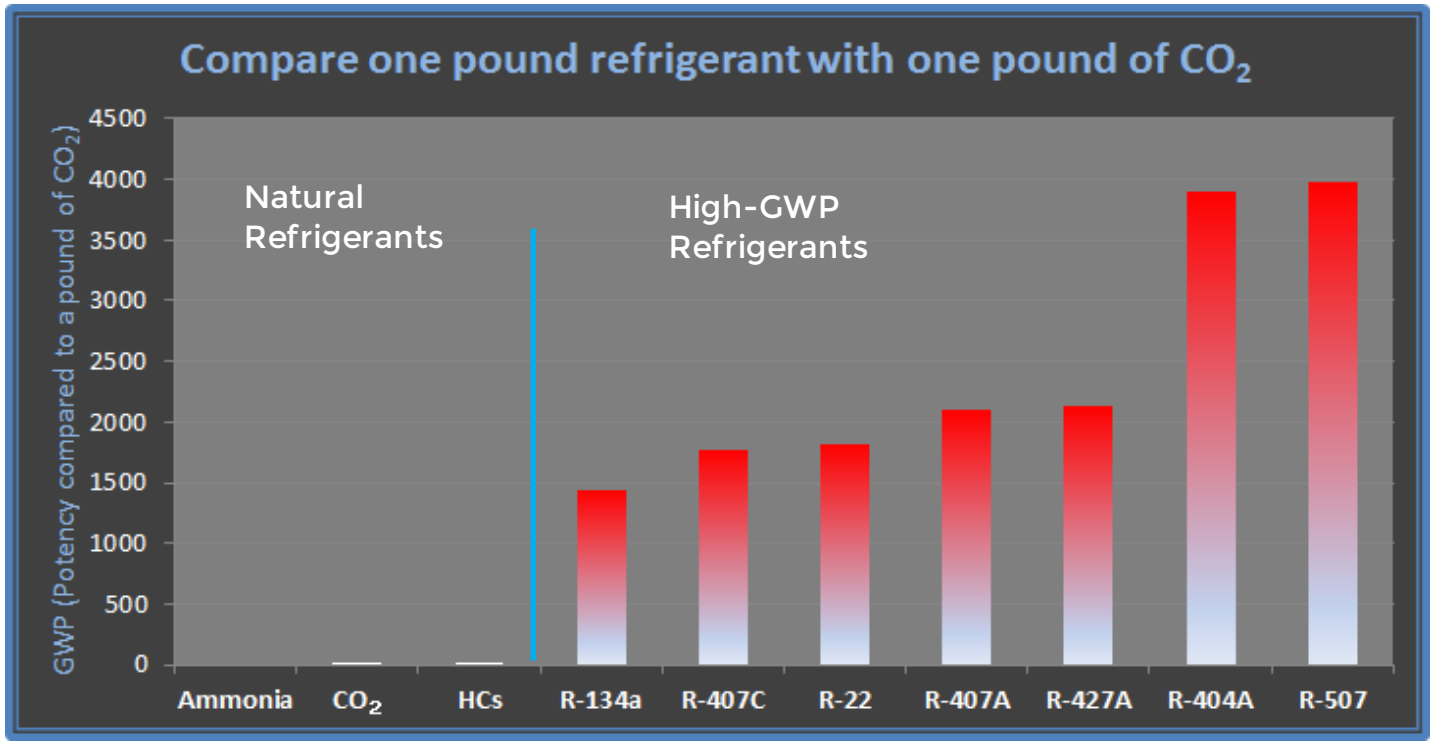


SMUD
Sacramento Municipal Utility District

wsp

Natural Refrigerant GHG Benefits

- Direct emissions can be reduced by over 99%
- High-GWP gases have GWPs from 1,500 to 4,000, while natural refrigerants have GWPs that are typically less than 4



SMUD® Sacramento Municipal Utility District

wsp

SMUD Program Objectives

- Establish a cost-effective pathway for natural refrigerants
- Create a model incentive for others to reference
- Spur market transformation to support SMUD's SD-7
- Position SMUD to leverage potential State funding on customer's behalf
- Build a network of manufacturers, engineers, technicians, and customers

"SMUD will provide leadership in the reduction of the region's total emissions of greenhouse gases through proactive programs in all SMUD activities and development and support of national, State, and regional climate change policies and initiatives." SMUD Strategic Directive 7

Customers Benefits

- **End the expensive cycle** of refrigeration system upgrades and retrofits due to refrigerant phase outs and replacements with a permanent long term solution
- **Assist with the initial cost** of new equipment installation
- **Support emerging technologies** that enable customers to improve energy efficiency and reduce direct GHG reductions
- **Lower customer energy bills and refrigerant costs**
- **Eliminate liability** associated with leak inspections, fines, and enforcements
- **Provide Access** to network of equipment manufacturers, engineers, technicians, and successful project implementations

"There is no question in my mind we are all going to wind up using environmentally friendlier natural refrigerants. It's more of a question of whether it's going to take us five years or 15 years. To move ahead as fast as we'd like, we need a concentrated effort – now – to put the necessary building blocks in place." – Tristam Coffin, Sustainable facilities coordinator at Whole Food Market

"There aren't enough technicians in the US who are trained in the use of ammonia, hydrocarbons, and carbon dioxide in food retail refrigeration. Opportunities to gain hand-on experience are still fairly rare."

– Bryan Beitler, Vice President and Chief Engineer at Source Refrigeration

SMUD® Sacramento Municipal Utility District

WSP

Pilot Incentive Structure and Limits

- Direct GHG emission reduction incentives
  - *Based on decreasing direct refrigerant emissions over the system lifetime*
- Energy (kWh) and demand (kW) incentives
  - *Up to $150,000: refer to the Custom Incentive and Savings By Design Program requirements for the respective incentive structures.*

$25/MTCO$_2$e
emissions reduction from refrigerants

25% bonus
projects located in disadvantaged communities and implemented by small-to-medium sized business owners

$150K or 30%
of project cost limit, whichiver is less (emissions reduction from refrigerants)

$250K or 50%
of project cost limit combined with energy incentive, whichever is less

SMUD® Sacramento Municipal Utility District

WSP

Incentive Eligibility and Structure

Program Parameters	Existing Program Requirements	Refrigerant Incentive Requirements
Retrofit	Meet the existing requirements of the Custom Incentive Program	System uses natural refrigerant (CO2, ammonia, hydrocarbon)
New system	Meet the existing requirements of the Savings By Design Program	System uses natural refrigerant (CO2, ammonia, hydrocarbon)
Required system monitoring	None	Three years, SMUD pays installation/integration
Permanent Change	Permanent physical system change required so operation doesn't revert to the baseline technology	Physical system component or change must be made that prevents reverting to high-GWP refrigerant

More information available in the SMUD Pilot Natural Incentive Program Summary

SMUD Sacramento Municipal Utility District

wsp

Developing an Appropriate Direct Incentive Rate Level

- Direct incentive rate was evaluated in two ways, both supported a valuation of approximately $25/MTCO2e
  - *Based on SMUD current Custom Inventive energy incentives*
    - $0.10/kWh converted to $/MTCO2e using marginal emission factor for 15 year life
  - *Based on California GHG Allowance Price Floor*
    - Average of price floor for 15 years based on annual escalation of 5% plus inflation

Example of Refrigerant Incentives (excl. energy)

Project Specifications	Example 1 – large centralized system, 1,000 MBtu/hr cooling capacity (new system)	Example 2 – medium centralized system 300 MBtu/hr cooling (retrofit)	Example 3 – Stand Alone Unit (New, small business, disadvantaged Comm.)
Baseline Refrigerant	R-407A	R-407A	R-404A / HFC-134a
Baseline GWP	2,107	2,107	2676
Baseline Charge (lbs.)	2,560	768	1
Baseline Leak Rate (%/year)[3]	20%	20%	8%
Baseline Emissions (MtCO2e/year)	490	147	0.05
Natural Refrigerant	R-744 (Carbon Dioxide)	R-744 (Carbon Dioxide)	R-290 (Propane)
Natural Refrigerant GWP	1	1	3
Natural Refrigerant Emissions ($MtCO_2e$/year)	0.2	0.1	0
Direct GHG Reduction ($MtCO_2e$/year)	490	146	0.1
Direct GHG Incentive ($/MtCO2e)	$25	$25	$25
Bonus Incentive (Small Business, Disadvantaged Community)	0	25%	25%
Equipment Lifetime	15 years	15 years	20 years
Refrigerant Incentive payment ($)	**$150,000 ($183,750 is above program cap)**	**$68,440 ($54,750 without bonus)**	**$67 ($53 without bonus)**
Lifetime GHG Reduction ($MtCO_2e$*15-yr lifetime)	**7,337**	**2,196**	**2**

SMUD Sacramento Municipal Utility District

WSP

Progress to Date

- Pilot program announced March 30, 2017 at North American Sustainable Refrigeration Council workshop at SMUD headquarters
- Announcement by California Air Resources Board May 11, 2017
- No projects funded yet, but…
- Both SMUD and ARB are fielding calls from around the State from interested stores
  - *There is clear demand for similar programs in from other utilities*

For More Information Contact:

R. Ryan Hammond, P.E.
Senior Energy Advisor, Commercial Services
w. 916-732-5647 | c. 916-262-5356 |
Ryan.Hammond@smud.org

Kathleen Ave
Climate Program Manager, Energy Research & Development
w. 916-732-5302 | c. 916-600-5002
Kathleen.Ave@smud.org

Tim Kidman
Project Director, Sustainability and Energy
w. 619-525-8399
Tim.Kidman@wspgroup.com

SMUD®
Sacramento Municipal Utility District

WSP

SMUD®
Sacramento Municipal Utility District

wsp