

Natural Refrigerant Case Studies

SMUD's Natural Refrigerant Incentive Program

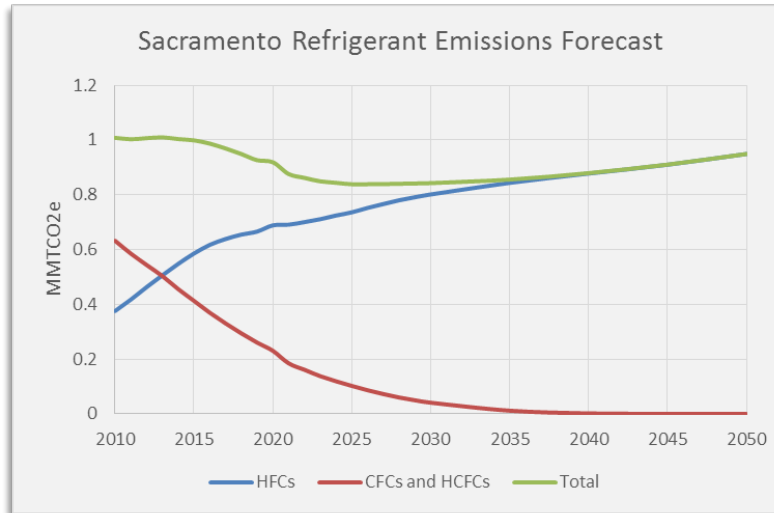
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SMUD Pilot Natural Refrigerant Incentive Program

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



High-GWP refrigerants are projected to result in annual GHG emissions of over 1 million MtCO_{2e} in Sacramento alone by 2050

SMUD Program Objectives

- Spur market transformation to support SMUD’s Environmental Leadership Directive (SD-7)
- Establish a cost-effective pathway for Natural Refrigerants
- Create a model incentive for others to reference
- Build a network of manufacturers, engineers, technicians, and customers
- Position SMUD to leverage potential state funding on our customer’s behalf
- Support transition to a carbon metric for program evaluation

“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

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 (CO ₂ , ammonia, hydrocarbon)
New system	Meet the existing requirements of the Savings By Design Program	System uses natural refrigerant (CO ₂ , 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

Incentive Eligibility and Structure

Custom Program Incentive	Direct GHG Emissions Reductions Incentive
<p>Incentives are based on decreasing your energy use:</p> <ul style="list-style-type: none"> • \$0.10/kWh Energy Reduction Incentive and • \$200/kW Demand Reduction Incentive • Total incentive limited to 30% of project cost or \$150,000, whichever is less 	<p>Incentives are based on decreasing direct emissions from refrigerants over the system lifetime:</p> <ul style="list-style-type: none"> • \$25/MtCO₂e emissions reduction from refrigerants • Total incentive limited to 30% of project cost or \$150,000, whichever is less <p>All projects located in disadvantaged communities (with preference for those in the top 10%) and implemented by small-to-medium sized business owners will receive a 25% incentive bonus</p>
<p>Combined incentive limited to 50% of project cost or \$250,000, whichever is less</p>	

Developing an Appropriate Direct Incentive Rate Level

Direct incentive rate was evaluated in two ways, both supported a valuation of approximately \$25/MtCO₂e

1. Based on SMUD current energy incentives (Custom Incentive and Saving By Design)
 - \$0.10/kWh converted to \$/MtCO₂e using marginal emission factor for 15 year life
2. Based on California GHG Allowance Price Floor
 - Average of price floor for 15 years based on annual escalation of 5% plus inflation

Current Status

- 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
- MANY calls from around the State from interested parties (stores, food processors)
 - There is clear demand for similar programs in from other utilities
- Two active projects utilizing the incentive

Project 1: Grocery Outlet

- Publicly owned company
 - 352 stores, independently owned and operated, in 6 States.
- Project drivers
 - CARB regulation: <150 GWP starting in 2022
 - Gather data and see how the system worked for future new stores.
 - Also installing a micro-distributed R290 system later this year in a new Southern CA site.
 - Aggressive growth plan and commitment to comply with all state & federal requirements in future new stores



CO₂ Transcritical with Adiabatic Condenser

- **Opening date:** January, 2020
- **Project status:**
 - Installation and start up went well.
 - Maintenance challenging lately for Independent Operator, more calls than traditional system. Mainly, oil failure issues and lost frozen product from his coffin cases.

- **Incentives**

Funding Source	Amount
SMUD Natural Refrigerant Incentive Program (GHG savings)	\$78,728
SMUD Savings by Design (Energy savings)	\$13,294
American Public Power Association's Demonstration of Energy & Efficiency Developments Grant (SMUD & NASRC)	\$125,000
Grand Total	\$217, 022

Project 2: Raley's

- Raley's is privately owned Northern California Grocer
 - 130 stores in Northern Cal and Northern Nevada
 - Wanted to be ahead of January 2022 regulations that require <150 GWP refrigerants
 - Choices were NH₃/CO₂, Trans-critical CO₂ or Micro Distributed



Ammonia (NH₃) with liquid pumped CO₂

- Opening Date: April, 2020
- Project Status:
 - Most similar to existing system
 - Estimated lower utility usage, elect, gas, water
 - Maintenance issues
- Other features:
 - Provides cooling for every load, air conditioner to ice machine
 - Uses waste heat for space heating and domestic hot water
 - Uses Dual Medium Condensing System, combination air water that saves on average 5000 gallons of water daily

- Incentives:

Funding Source	Amount
SMUD Natural Refrigerant Incentive Program (GHG savings)	\$150,000
SMUD Savings by Design (Energy savings)	\$100,000
Grand Total	\$250, 000

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