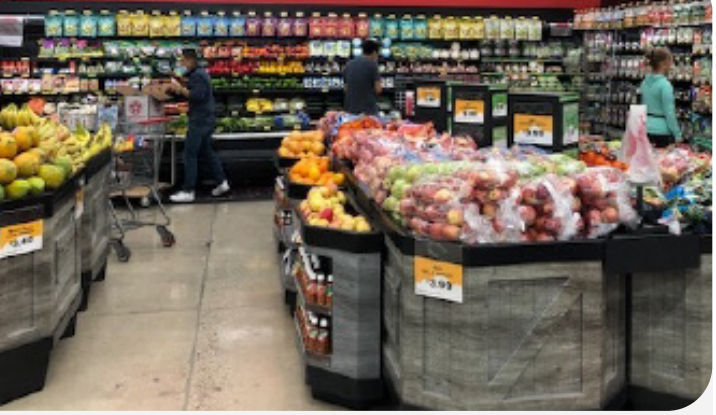

Retailer

Grocery Outlet

East Sacramento, California

This study compared costs, energy performance, and total emissions of a new CO2 Transcritical system and existing HFC system.

"We wanted to be prepared for California's new HFC regulations. This project was our first CO2 Transcritical site. We feel this will be the most common technology in the future and wanted our technician base to get familiar and be prepared to service this system type."

– Frank Davis, Senior Director of Refrigeration and Sustainability, Grocery Outlet

CO2 (R-744) Refrigeration rack for the East Sacramento neighborhood Grocery Outlet store

NORTH AMERICAN Sustainable Refrigeration Council

CO_2 Case Study

Project Profile

The new refrigeration system design is a CO2 (R-744) transcritical booster system with an adiabatic gas cooler.

System Type: Transcritical CO2

Refrigerant: CO2 (R-744)

Global Warming Potential (GWP): 1

ASHRAE Climate Zone: 3B

Utility: Sacramento Municipal Utility District (SMUD)

Average Electric Rate: $0.14 per kWh

Study Overview

The Sacramento Municipal Utility District (SMUD) commissioned a study as part of their Natural Refrigerant Incentive Program (NRIP) to compare the new CO2 (R-744) system located in East Sacramento to a traditional Hydrofluorocarbon (HFC) system in the nearby Pocket neighborhood. The study included an analysis of the upfront installation costs, ongoing energy use, and CO2 equivalent emissions of both systems.

System Summary	Baseline (Pocket)	Installed (E. Sacramento)
Refrigerant	R-404A	R-744
Refrigerant GWP	3922	1
Refrigerant Charge	600 lbs.	420 lbs.
System Type	DX rack	Transcritical
Condenser	Air-Cooled	Adiabatic
Refrigeration Load (MBH)	240.9	404.5
Store Square Footage	23,200	24,000
Vintage	2013	2020

Key Outcomes: Grocery Outlet

The study found that while the upfront equipment and installation costs of the East Sacramento's CO_2 (R-744) system were higher than the baseline HFC Pocket system, **the East Sacramento CO_2 system was superior in energy performance, energy costs, and CO_2-equivalent emissions impact.**

Project Cost

CO_2 System **24%** higher than **HFC System**

The upfront cost of equipment and installation were approximately **24% higher for the East Sacramento CO_2 system than a traditional HFC system**. This was primarily due to the additional cost of components with energy saving features, such as the adiabatic gas cooler.

Energy Savings

27% less than Baseline

Energy Cost

23% less than Baseline

The study collected energy data from the refrigeration rack at 15-minute intervals for a 2-year period and normalized by refrigeration system capacity. **The analysis showed a 27% reduction in energy use (kWh) and 23% reduction in annual energy cost** for East Sacramento's CO_2 system compared to the Pocket's HFC system.

Indirect GHG

36% reduction in CO_2e emissions*

**compared to Pocket's HFC system*

Direct GHG

92% reduction in CO_2e emissions*

**compared to EPA average*

The study compared the total greenhouse gas (GHG) emissions from both the indirect emissions attributed to the energy use, and direct emissions attributed to the refrigerant leaks. **East Sacramento's CO_2 system reduced indirect GHG emissions by 36% compared to Pocket's HFC system and reduced direct GHG emissions by 92% compared to EPA's national average.**

Incentives

This project received funding from several sources that covered 100% of the incremental cost of the CO_2 system equipment and installation. SMUD's NRIP provided incentives for both GHG emissions savings and energy savings, and an additional grant was awarded through the American Public Power Association's (APPA) Demonstration of Energy and Efficiency Developments (DEED) program.

Funding Sources	
SMUD NRIP (GHG Savings)	$78,728
SMUD Savings by Design (Energy Savings)	$13,294
APPA DEED Grant (SMUD & NASRC)	$125,000
Grand Total	**$217,022**

"We learned that it's very important to have a strong partnership with the installing contractor and OEM."

– Frank Davis, Senior Director of Refrigeration and Sustainability, Grocery Outlet

Partners

SMUD®

AMERICAN PUBLIC POWER ASSOCIATION

NORTH AMERICAN Sustainable Refrigeration Council

NASRC is a 501(c)(3) environmental nonprofit working to advance climate-friendly natural refrigerants and reduce greenhouse gas emissions caused by traditional hydrofluorocarbon (HFC) refrigerants. We collaborate with stakeholders from across the industry, including over 38,000 food retail locations, to eliminate the barriers to natural refrigerants in supermarkets.