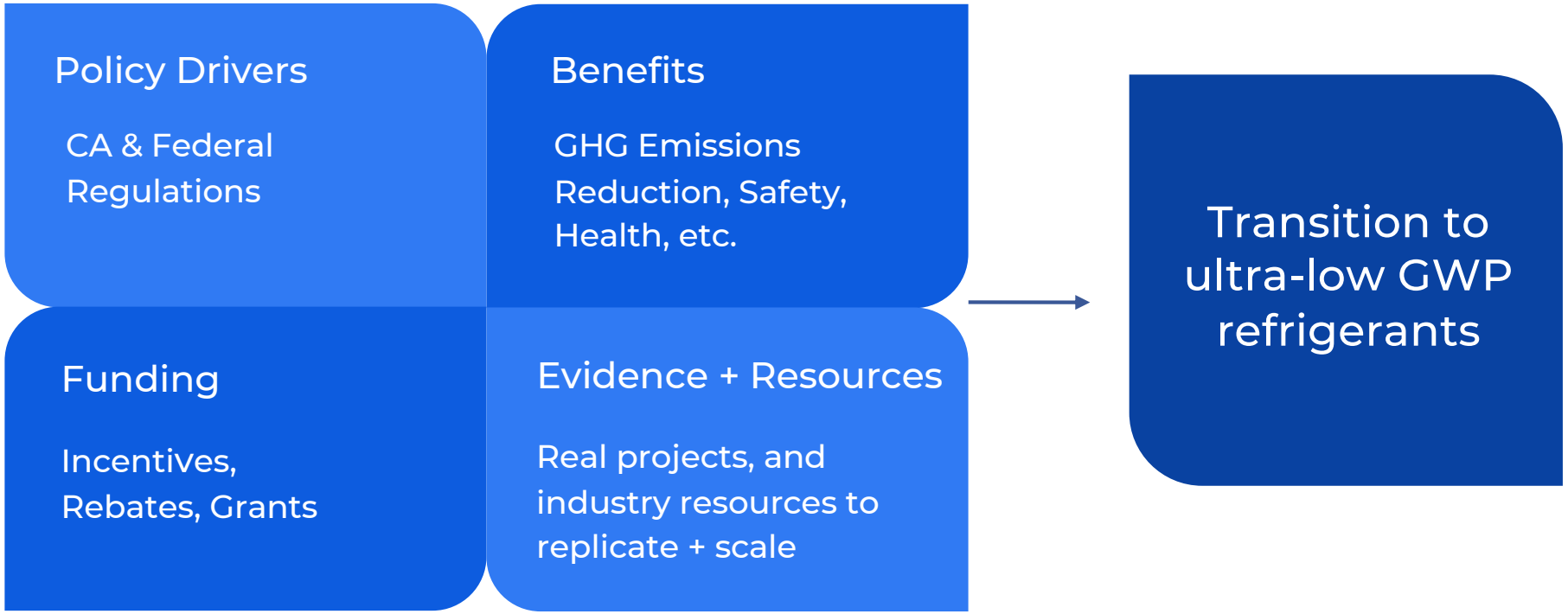
Natural Refrigerants in Action: R744 Heat Pumps for HVAC & Refrigeration

ET Summit

September 17, 1:00 – 2:00pm

ProspectSV

The path to ultra low-GWP refrigerants



The path to ultra low-GWP refrigerants

ProspectSV

CO2 Heat Pump Demonstration Projects

Funding

Incentives,
Rebates, Grants

Evidence + Resources

Real projects, and industry resources to replicate + scale

Transition to ultra-low GWP refrigerants

ANSWR

CO_2 Heat Pump

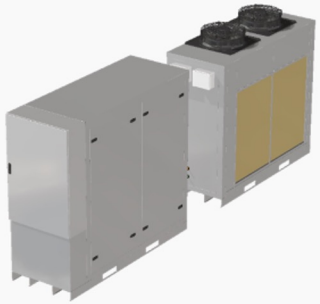
Air-to-Water and **Water-to-Water**

HVAC Heating + Cooling, Simultaneous Heating + Cooling, DHW Production, Hot Water Boiler

Nominal Sizes: 20, 60, 90, 120 Tons

20TR Model

(fits through door and elevator)

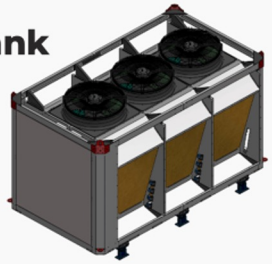


20 Ton model used for FLEXLAB, 60 Ton for Straus

Heat Pump(s)

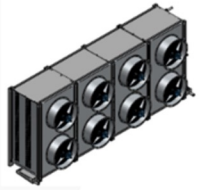
Gas Cooler(s)

V-Bank



Horizontal

Vertical



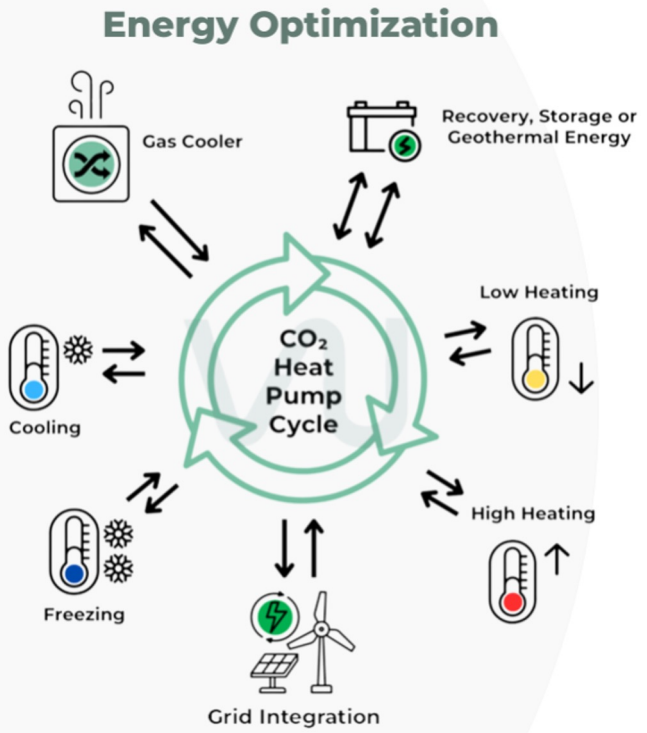
Modules are designed for parallel installation

Flow

Why Flow Environmental Systems?

Strong potential for impact...

- Low-GWP, natural refrigerant (CO2)
- Performance factors
  - High delivery temp (up to 180F)
  - Cold climate performance (down to -40F)
  - Efficient - high COP, no defrost
- Strong retrofit option
  - Simplified system design + install



ProspectSV

ANSWR

CO_2 Heat Pump

Webpage:

Two CO_2 Heat Pump Demonstrations

HVAC in Large Commercial Buildings

FLEXLAB – Berkeley, CA

- *Simultaneous Heating/Cooling/HW*
- *Advanced HVAC Controls*
- *Model Predictive Grid Response*

Commercial Cold Storage

Straus Family Creamery – Rohnert Park, CA

- *Multiple Facility Cold Rooms*
- *Advanced Defrost Controls*
- *Model Predictive Grid Response*

Heat Pump Demo: Large Commercial HVAC

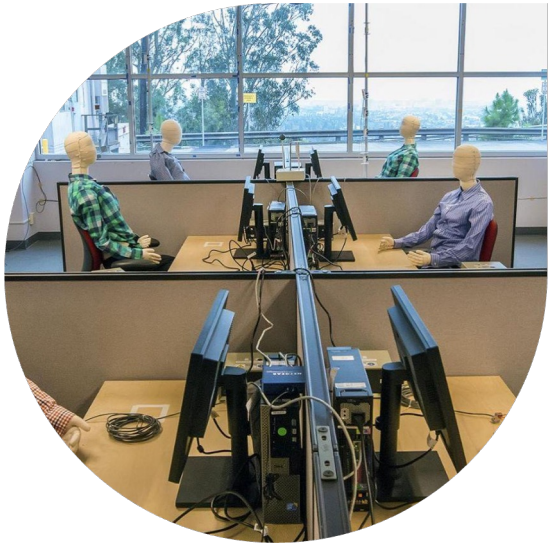
Goal: Demonstrate an advanced heat pump system that uses ultra-low GWP refrigerant, reduce high first costs, and improve efficient, dynamic operations.

Demonstration Site: Department of Energy's FLEXLAB® testing facility in Berkeley, CA

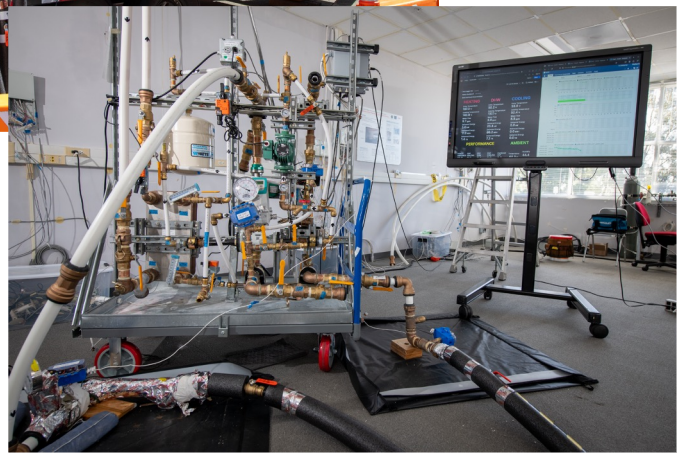
Technology: 20-ton ANSWR system, demonstrating simultaneous heating, cooling & DHW

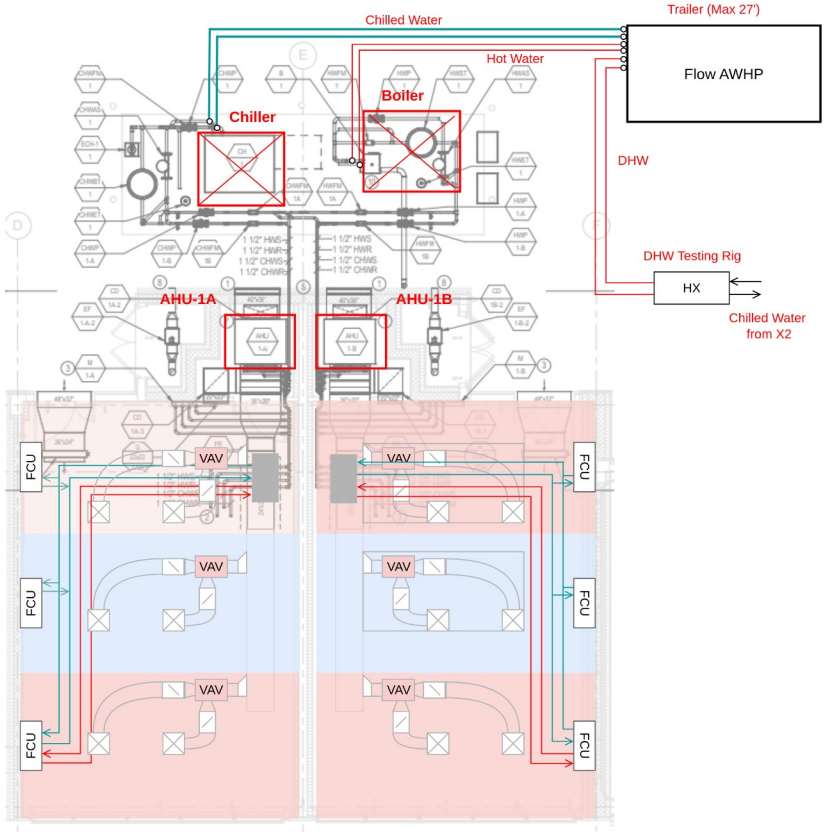
M&V: Independently verified performance by LBNL

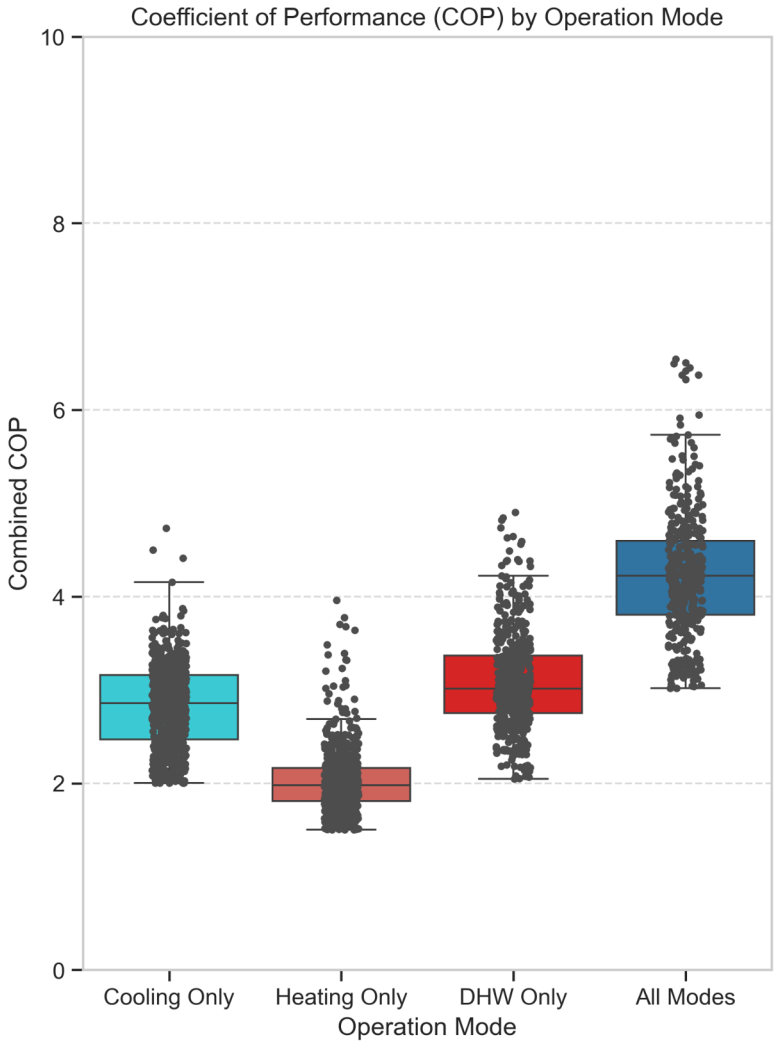
Industry Engagement: Testing results, modeling work & products, ANSWR performance factors, DMG Training Program



FLEXLAB Demonstration Configuration







Preliminary Results

Flow's heat pump performed within the target ranges for COP and % modulation

Performance Metric	Target Range	Results
COP (Cooling only)	3.0 - 6.2	2.0 - 4.2 (mean: 2.82)
COP (Heating only)	2.1 - 2.3	1.6 - 2.7 (mean: 2.01)
COP (DHW only)	3.0 - 6.4	2.0 - 4.2 (mean: 3.09)
COP (Simultaneously Heating, Cooling, DHW)	3.0 - 9.7	3.0 - 5.8 (mean: 4.30)
% Modulation of Load	0% – 100%	0% - 60%

Takeaways

- **Plug & play integration**
  - Flow HP easily replaces chiller + boiler
- **Simultaneous heating/cooling/DHW operations**
  - Significantly greater system efficiency compared to individual modes
  - Well-balanced thermal loads yield optimal performance
- **Acoustic Performance**
  - Heat pump unit: 60-65 dB at 1 meter distance vs Existing chiller: 75-80 dB at 1 meter distance
- **System Capacity Limitations**
  - Efficient FLEXLAB testbed design and mild spring weather conditions constrained testing capacity to below rated values
- **Operational Challenges**
  - Unit experienced downtime due to high pressure protection switch → converted to automatic reset

Heat Pump Demo: Commercial Cold Storage

Goal: Demonstrate an advanced heat pump system for commercial cold storage, reduce GHG emissions, save cost, improve energy efficiency and demand flexibility

Demonstration Site: Straus Family Creamery – multiple cold storage sites, -30F to +35F

Technology: 60-ton ANSWR system + thermal energy storage & advanced defrost controls

M&V: Independently verified performance by LBNL

Industry Engagement: Testing results, modeling work & products, ANSWR performance factors, DMG Training Program

Courtesy Straus Family Creamery

Connecting with the Industry

System specifications, performance, modeling results, etc.

Summary of the demonstration with impacts (economic + environmental)

DMG Training Center: installation, operation and maintenance of CO2 heat pumps

Stay Connected

Be the first to know about upcoming webinars, events, and industry resources, including DMG's upcoming Training Program.

Sign up for our newsletter with the QR Code!

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