

# ET Summit 2021

Presented by



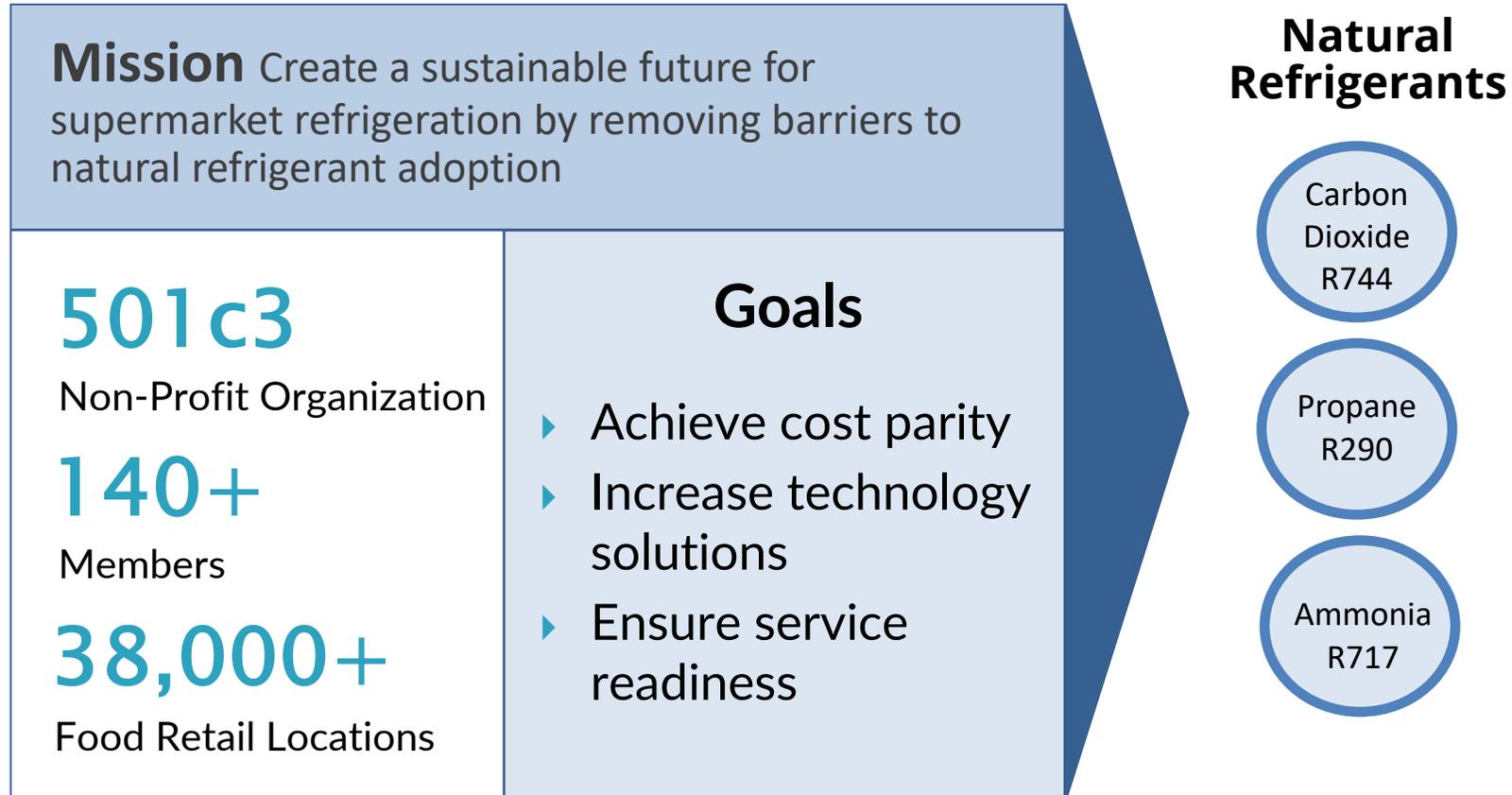
# Food Retail Refrigeration

## Trends & Opportunities

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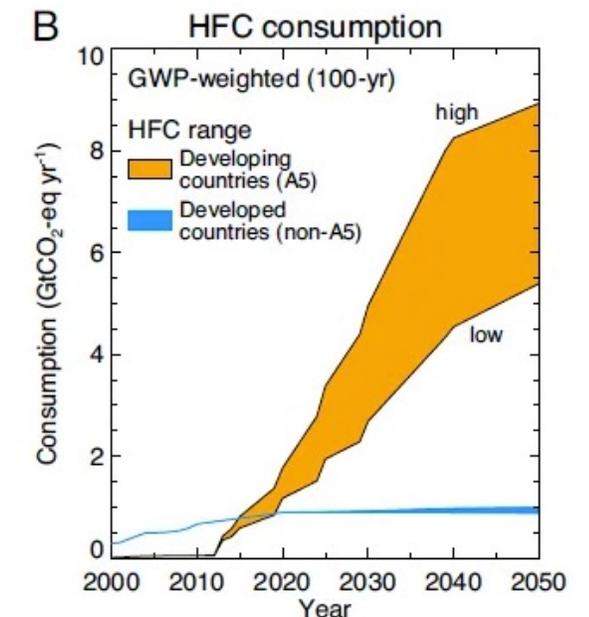


# North American Sustainable Refrigeration Council (NASRC)



## The Problem: Hydrofluorocarbons (HFCs)

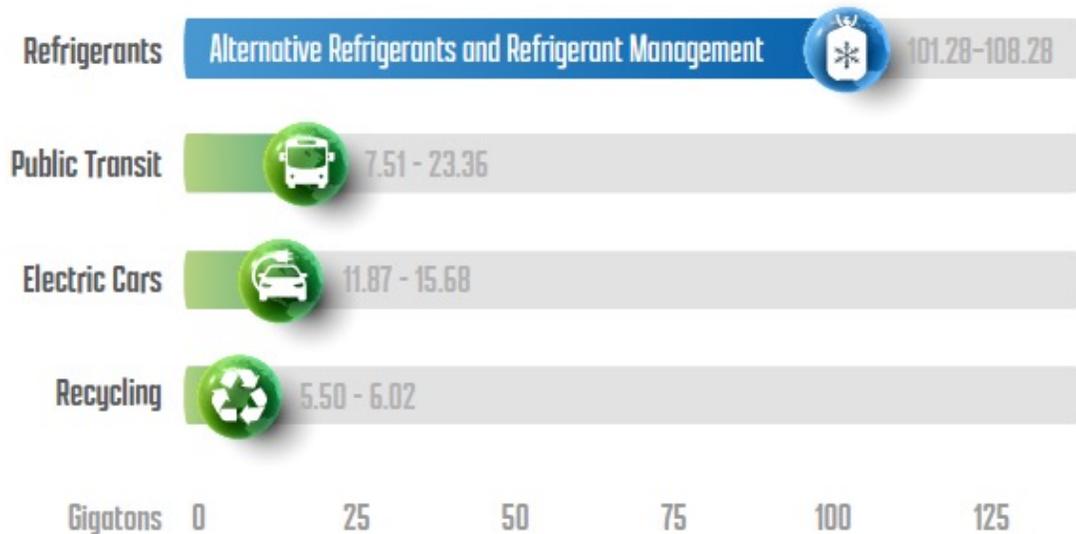
- Hydrofluorocarbons (HFCs) are synthetic, man-made chemicals commonly used in air-conditioning & refrigeration
- HFCs are **SUPER** Climate Pollutants
  - **High** global warming potential
  - **Thousands** times more heat-trapping power than CO<sub>2</sub>
  - **Short** Lived Climate Pollutants
  - **Fastest growing** source of GHGs globally



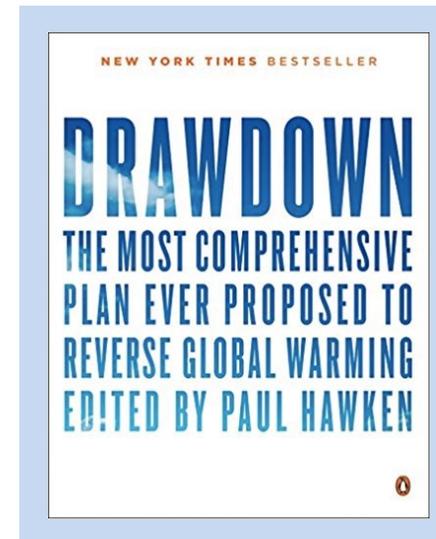
# The Leading Climate Solution

## Sustainable Refrigeration is the Most Impactful Solution to Climate Change

### CO2 Emission Reduction Potential by 2050



Source: Project Drawdown <https://drawdown.org/solutions/table-of-solutions>

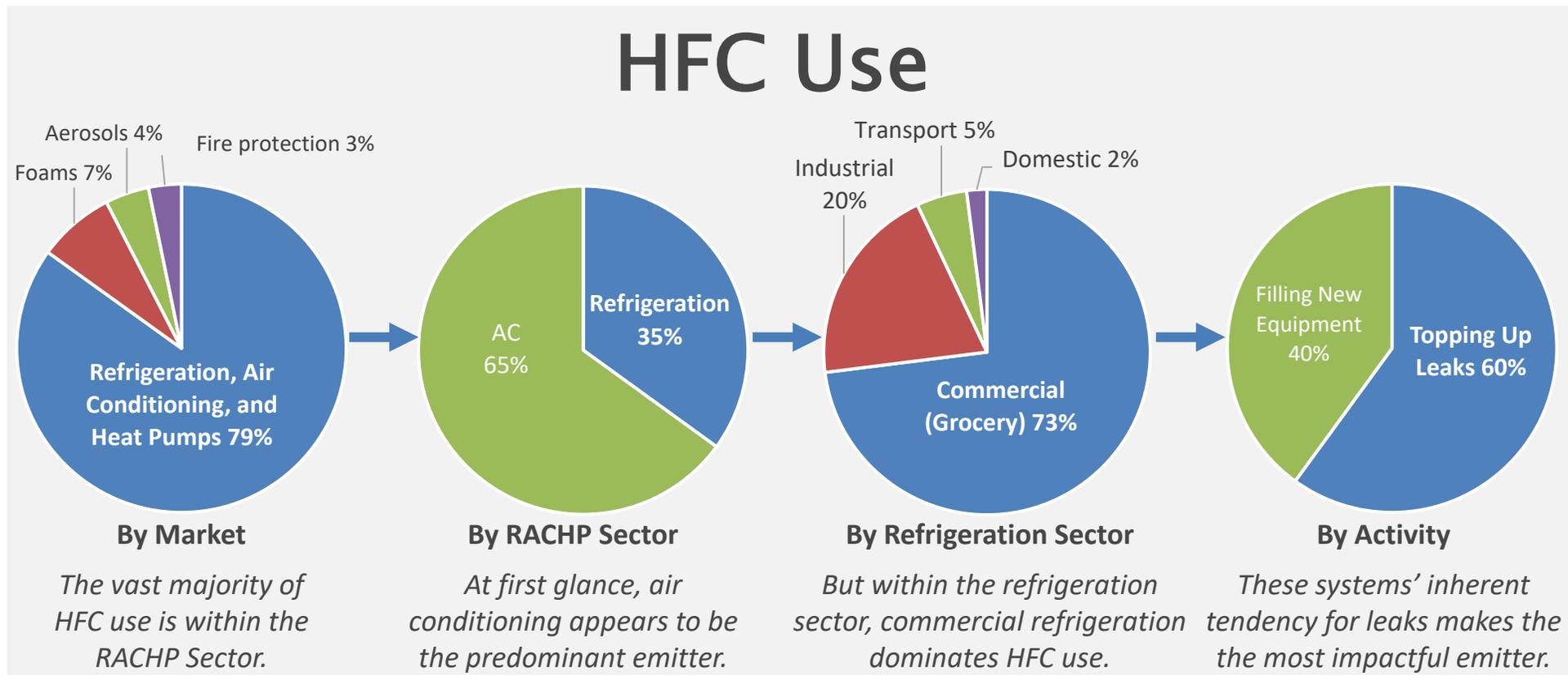


**#1** climate solution

Avoid **0.5** degree C of warming by 2100

# HFCs in Grocery Stores

Commercial refrigeration, including grocery stores, represents the **greatest global GWP-weighted HFC consumption** within the refrigeration sector. Systems leaks cause the majority of HFC use to go towards topping up system leaks, making them the most impactful source of emissions.

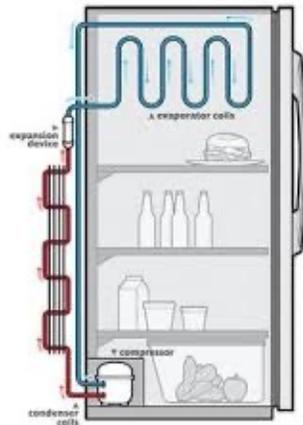


\*RACHP: Refrigeration, Air Conditioning, and Heat Pumps  
Source: UNEP Ozone Secretariat, Fact Sheets on HFCs and Low GWP Alternatives, October 2015

# Grocery Refrigerant Leaks

*Grocery systems are large, complex, and inherently leaky. By comparison, self-contained refrigerators contain a very small amount of refrigerant and have negligible leak rates.*

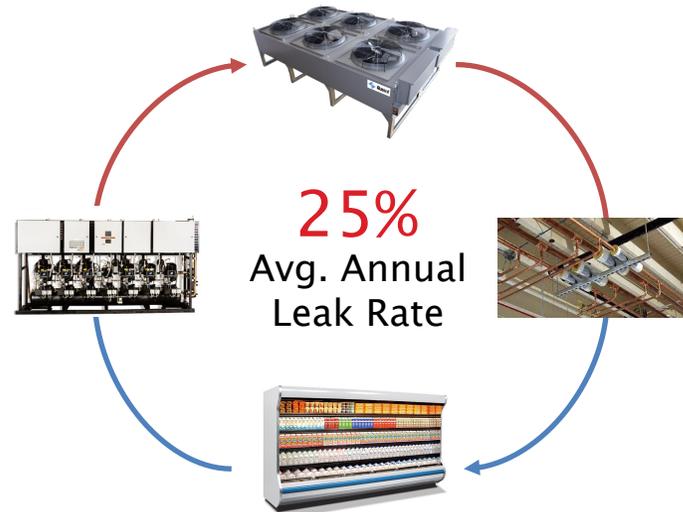
Self-Contained  
Home Refrigerator, Plug-in Unit



<1%  
Leak Rate

<10 Lbs. Refrigerant

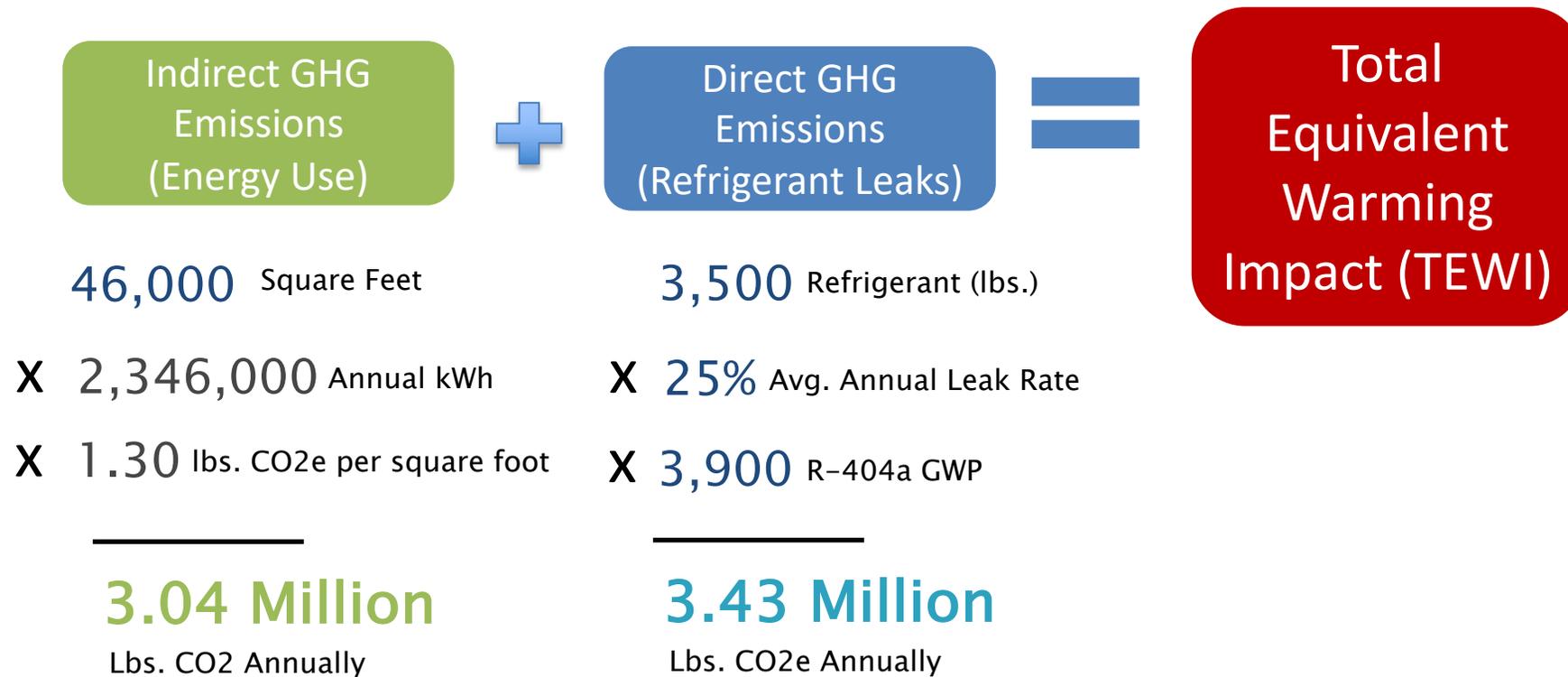
Remote System  
Grocery Store



25%  
Avg. Annual  
Leak Rate

3,500 Lbs. Refrigerant

# Average Grocery Store Emissions



Source: US EPA, Profile of an Average U.S. Supermarket's Greenhouse Gas Impacts from Refrigeration Leaks Compared to Electricity Consumption

# Refrigerants Avoided Cost Calculator

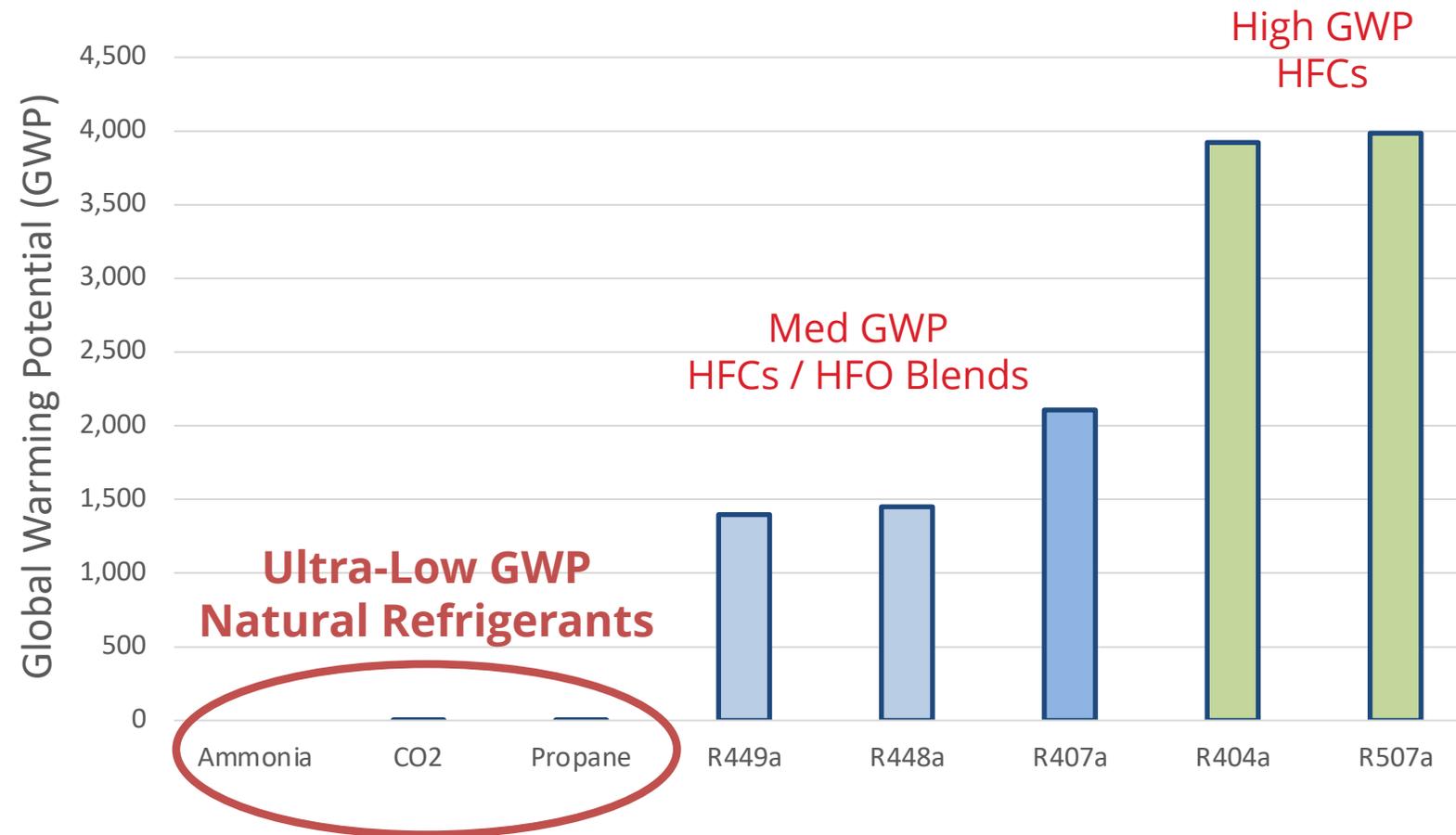
## Refrigerant Calculator Dashboard, Example 3

Inputs		Result
Device type	Large retail food refrigeration 2,000 lbs. +	NPV Avoided Costs (\$2020)
Use ARB average device lifetime or user-specified?	ARB average	\$ 1,357,042
Active device lifetime (yr)	15	
Device installation year	2020	
Use ARB average refrigerant charge or user-specified	ARB average	
Active device refrigerant charge (lb)	3352	
Device refrigerant used	R-404A	
WACC selection	PG&E	
Active WACC (%)	7.81%	
GWP time horizon (100-yr is default)	100-yr	

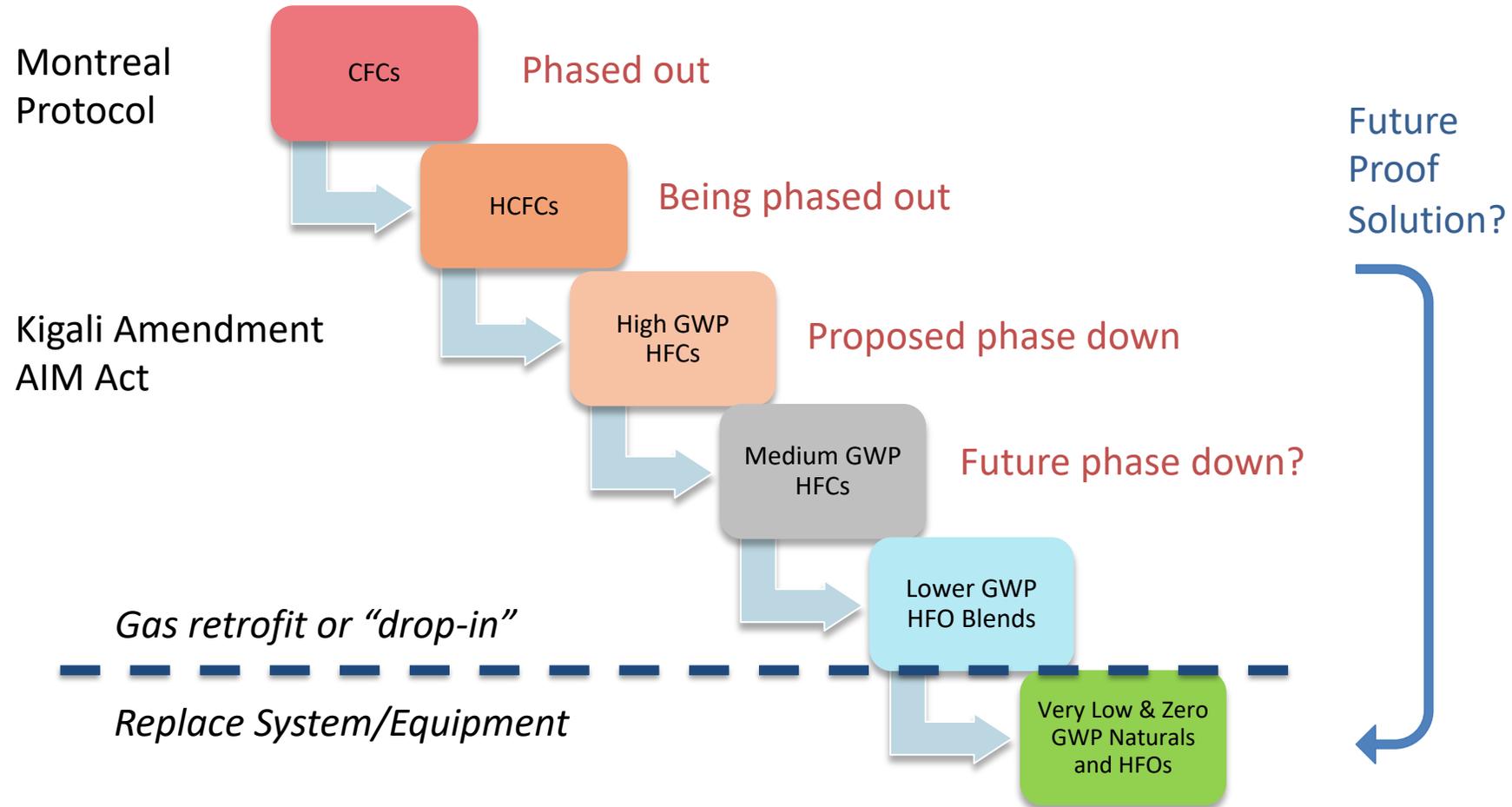
**\$1.4M in benefits for a single store. Wow!**

- Switching from high-GWP refrigerant like R-404A to a low-GWP refrigerant in a single large supermarket refrigeration system can provide millions of dollars in societal benefits, according to the refrigerant avoided cost calculator.

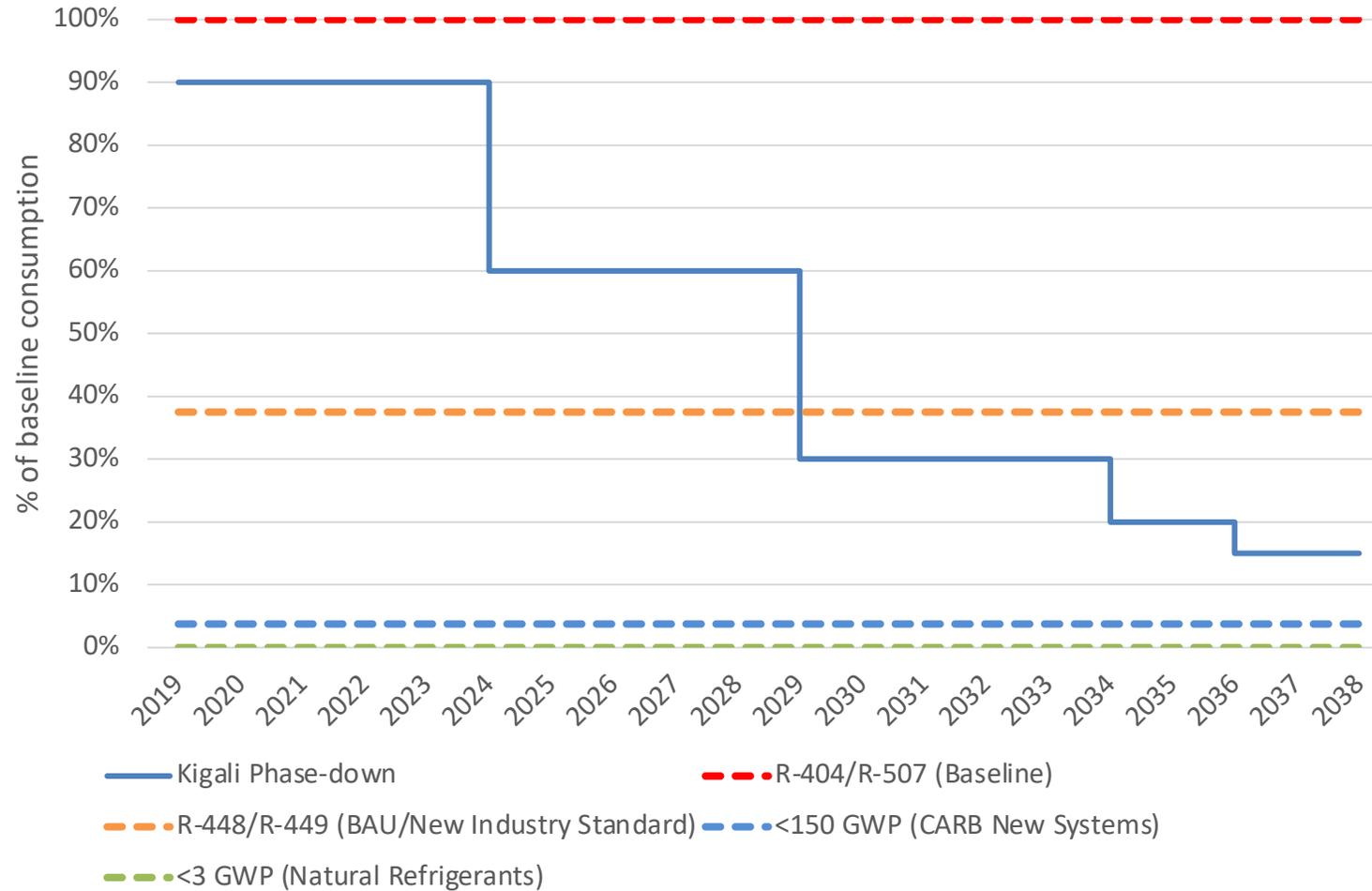
# Refrigerant Global Warming Potential (GWP)



# US Refrigerant Transitions



## US AIM Act (Kigali) Phasedown Schedule



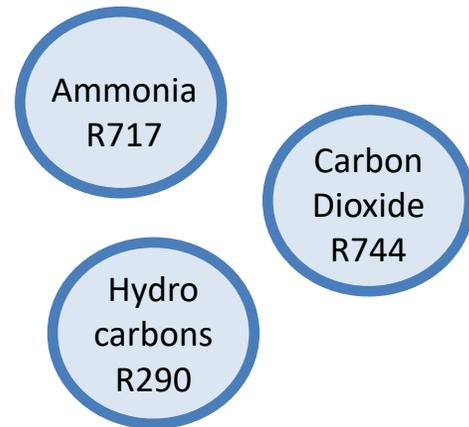
# US Climate Alliance HFC Regulations

✓ = Established    ✓ = In Progress

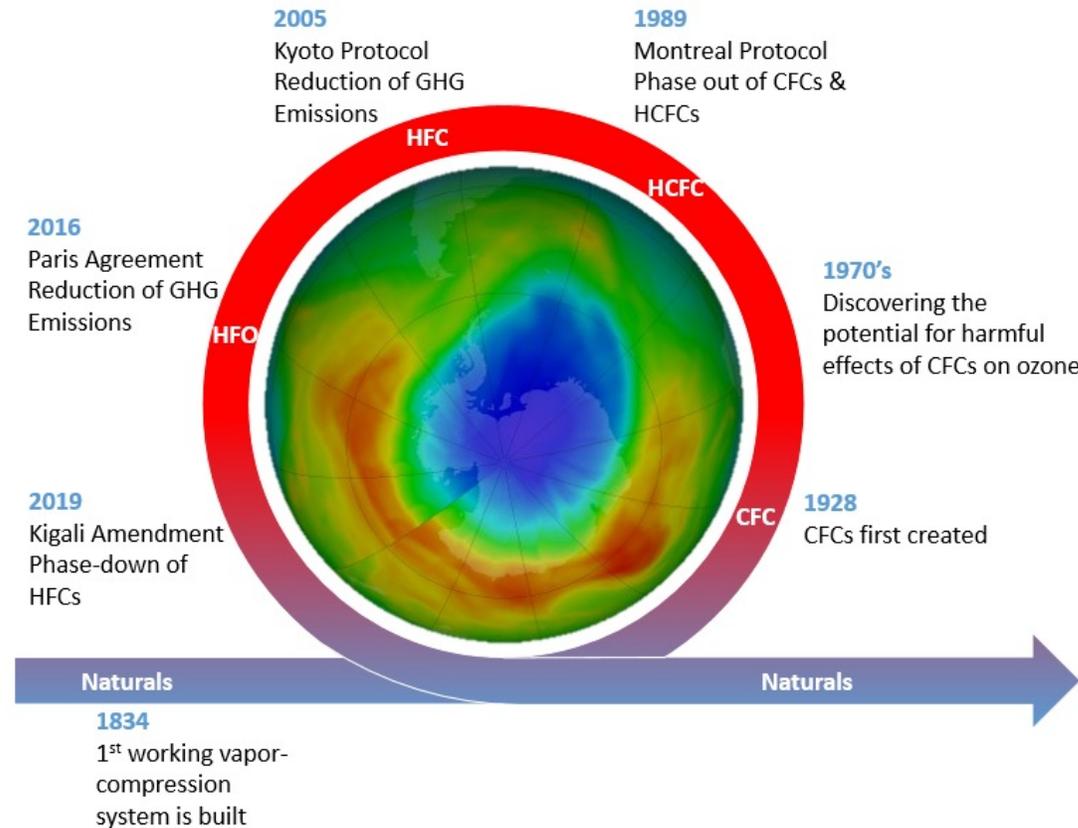
HFC Commitments	SNAP Rules 20 & 21	Section 608 Ref. Mgmt.	Additional GWP Limits	Effective Date	Incentive Program
California	✓	✓	✓	Jan 1, 2022	✓
Colorado	✓			Jan 1, 2021	
Connecticut	✓			TBA	
Delaware	✓			Jan 1, 2021	✓
Hawaii	✓			Jan 1, 2021	✓
Maine	✓			Jan 1, 2021	
Maryland	✓			Jan 1, 2021	
Massachusetts	✓			TBA	
New Jersey	✓			July 1, 2020	✓
New York	✓			Jan 1, 2021	
Oregon	✓			Jan 1, 2021	
Pennsylvania	✓			TBA	
Rhode Island	✓			Jan 1, 2021	
Vermont	✓			Jan 1, 2021	
Virginia	✓			July 1, 2021	
Washington	✓	✓	✓	Jan 1, 2020	✓

*\*Last Updated February 11, 2021*

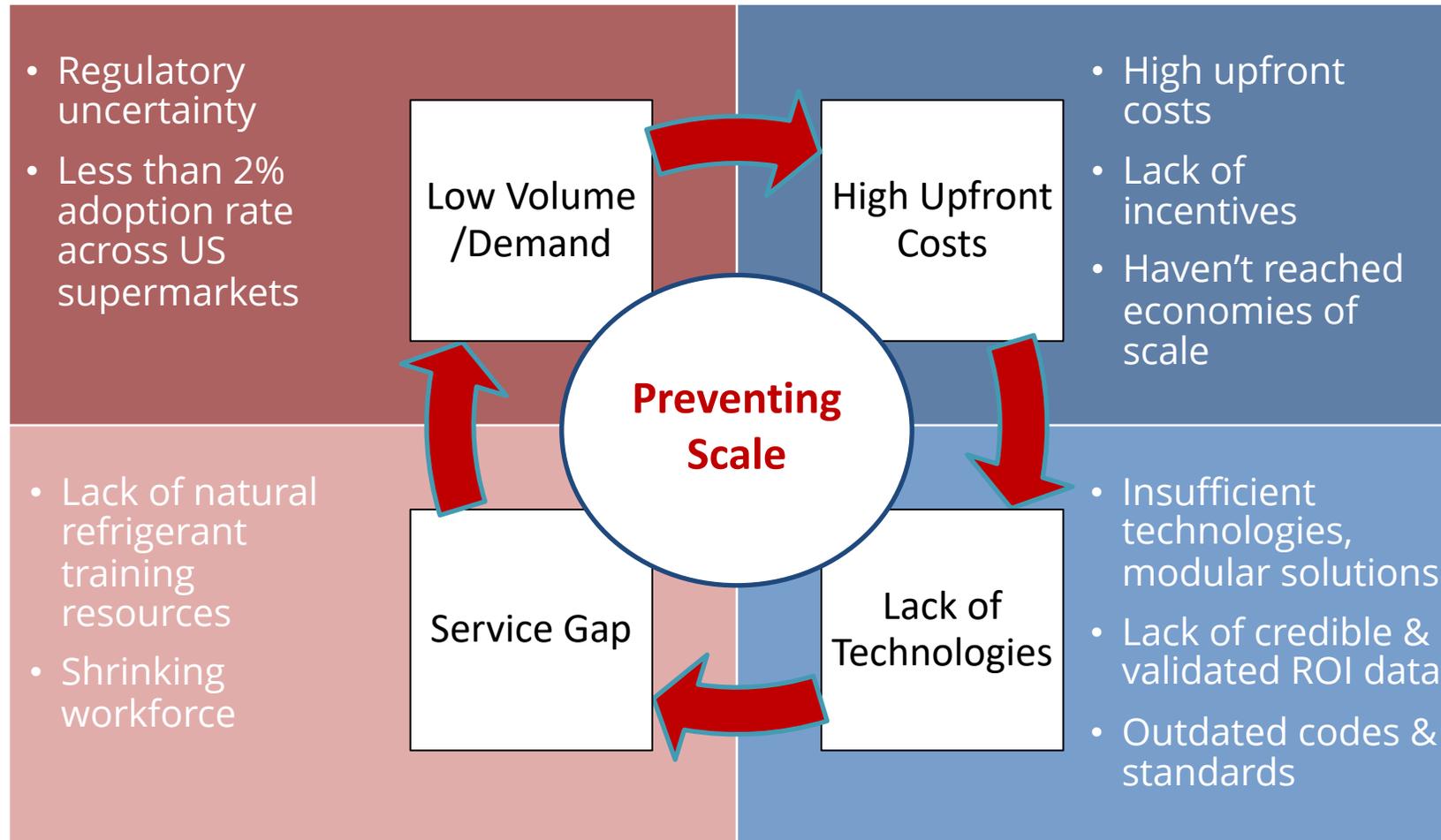
# Natural Refrigerants: The Future-Proof Solution



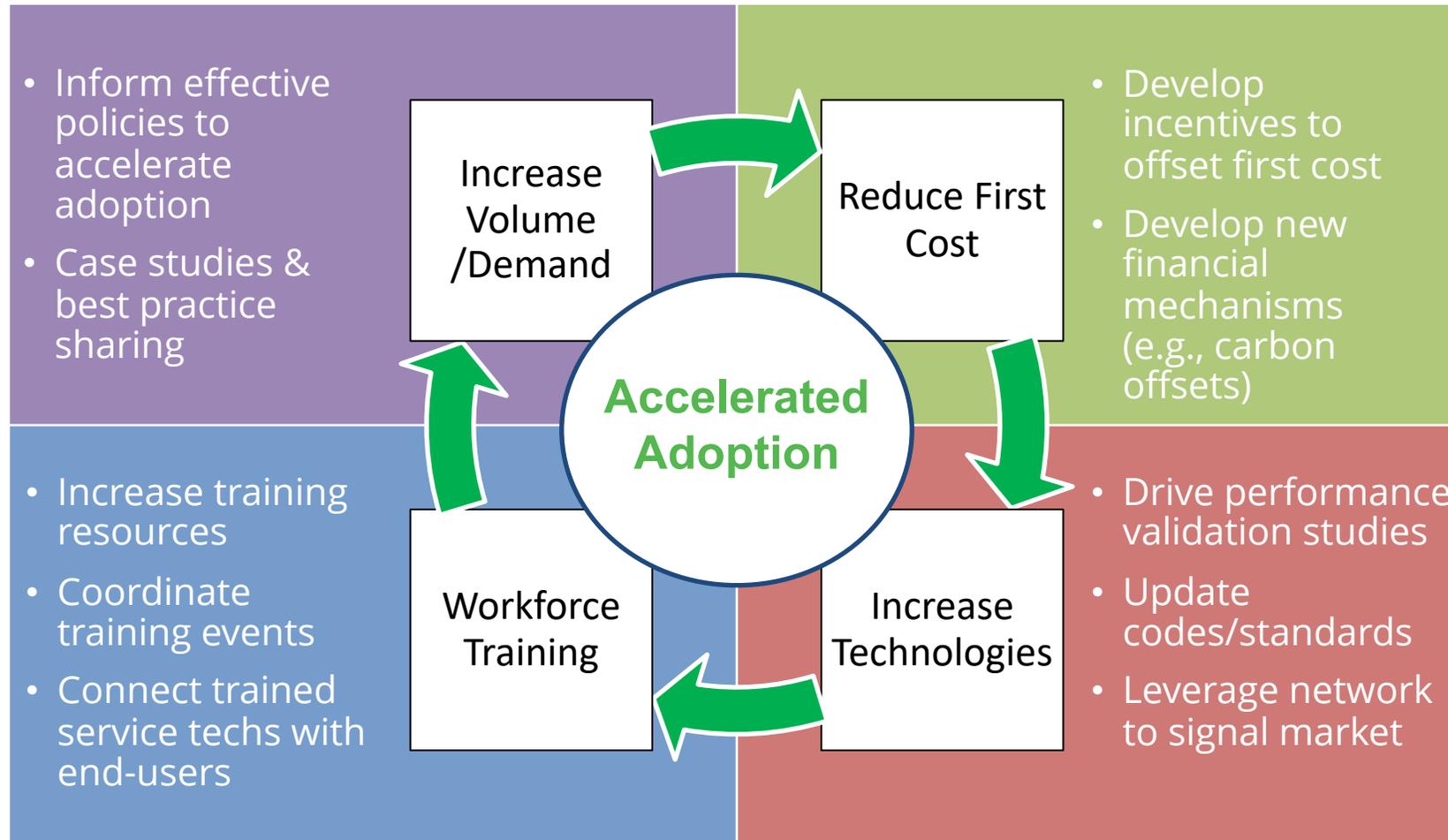
- Naturally occurring
- Cannot be patented
- Negligible climate impact



# Natural Refrigerants Challenges



# NASRC Solutions



# NASRC Solution: Coordinate Scalable Funding

## 1. Utility

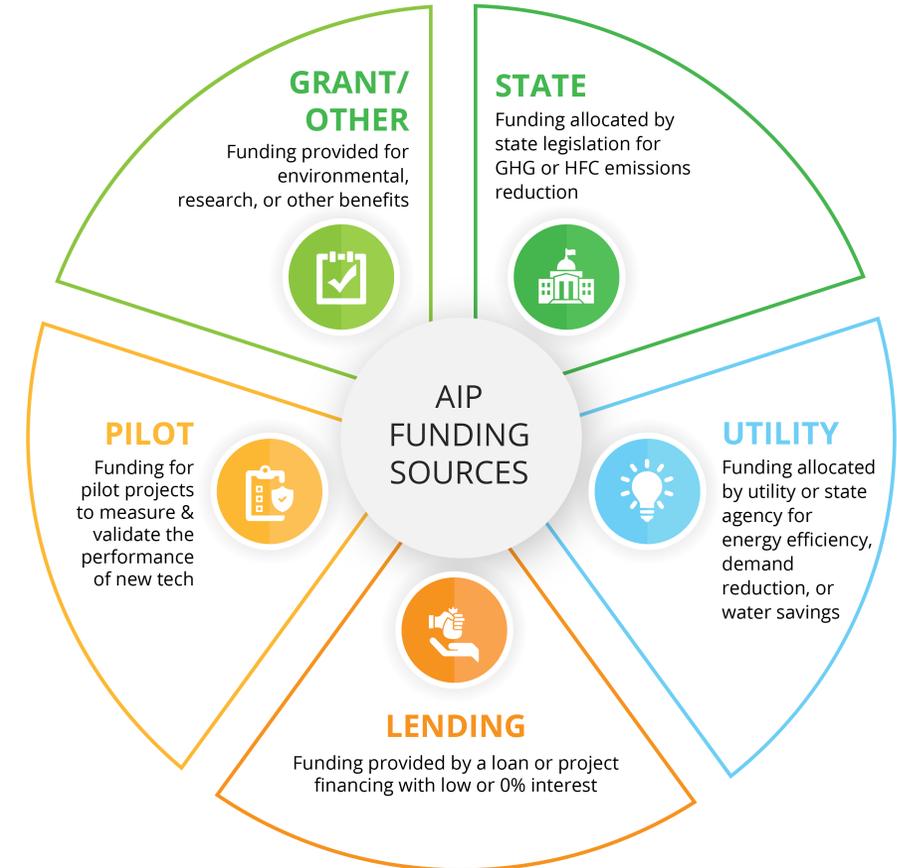
- Incentives for energy efficiency and GWP reduction

## 2. State

- Expand CARB F-gas Reduction Incentive Program ([\\$880k allocated](#))
- \$15 Million Proposed for 2022-23 Budget

## 3. National

- Carbon Offset Credits Pilot
- Federal Tax Credits



<https://nasrc.org/aggregated-incentives-program>

# NASRC Solution: Advance Technology Roadmap

Ref.	Technology	Component /Feature	T24 Code	Energy Model	Pilot/ Study	Custom/ Rx Measure
CO2 (R744)	Transcritical	Adiabatic Cooler				
		Parallel Compression				
		Multi-ejectors				
		HVAC Integration				
	CO2 Secondary	Partial remodel				
	CDUs	Replacing rack	NA	NA		
Propane (R290)	Self-contained Case replacement	<150g Air cooled	NA	NA		
	Micro-Distributed System (MDS) Replacing rack	<150g – Air cooled				
		<150g – Water loop				
	Self-contained Case replacement	<500g* Air cooled	NA	NA		
	Micro-Distributed System (MDS) Replacing rack	<500g* - Air cooled				
		<500g* - Water loop				
	CDUs	<500g* Replacing rack	NA	NA		
Ammonia (R717)	CO2 Secondary	New build				
	Chiller w/ CO2 loop	Replacing rack				

\*R290 charge limit to be increased

■ = Complete

■ = Limited/In Progress

■ = Missing

— = Waiting on Code Update

## NASRC Solution: Update Codes & Standards

R290 (Propane) charge limit increase

- **150g** = current charge limit\*
- **300g** = **NEW** limit\* for closed appliances (cases with doors)
- **500g** = **NEW** limit\* open appliances (open cases)

Code/Standard	Status	Next Step	Timeline
UL 60335-2-89	Approved	Finalize standard published on October 27, 2021	Complete
EPA SNAP	Waiting on UL	SNAP rule to include both A2L/A3s	2022
ASHRAE 15	In Progress	Awaiting Publication Public Review (Addendum L)	2022
Building Codes	TBD	Update international codes and implement state-by-state approach	2024? 2027?

\*limit per circuit

## Key Takeaways

1. Federal and state GHG/GWP emissions targets are driving fundamental shift in grocery refrigeration systems
2. Zero or near-zero GWP (natural refrigerant) technology solutions are available today
3. Existing grocery stores = Biggest opportunity and challenge

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