Sustainable
Refrigeration Summit

Connecting the Pieces for
Supermarket Refrigeration Solutions

NORTH AMERICAN
Sustainable
Refrigeration
Council

nasrc.org

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Summit Program

Day 1: Monday, October 24

9AM-10AM PST	11AM-2PM PST	1PM-2PM PST
Keynote: Industry & Regulatory Trends	Technology Focus: Driving CO2 Performance	CO2 Systems: What Retailers Need to Know

Day 2: Tuesday, October 25

9AM-10AM PST	11AM-12PM PST	1PM-2PM PST
Distributed and Self-contained Systems	Technology Focus: Total Cost of Ownership	Measuring Performance of Natural Technologies

Day 3: Wednesday, October 26

9AM-10AM PST	11AM-12PM PST	1PM-2PM PST
Integrating Naturals into Existing Stores	Technology Focus: Modular Tech. for Existing Stores	Funding for Naturals

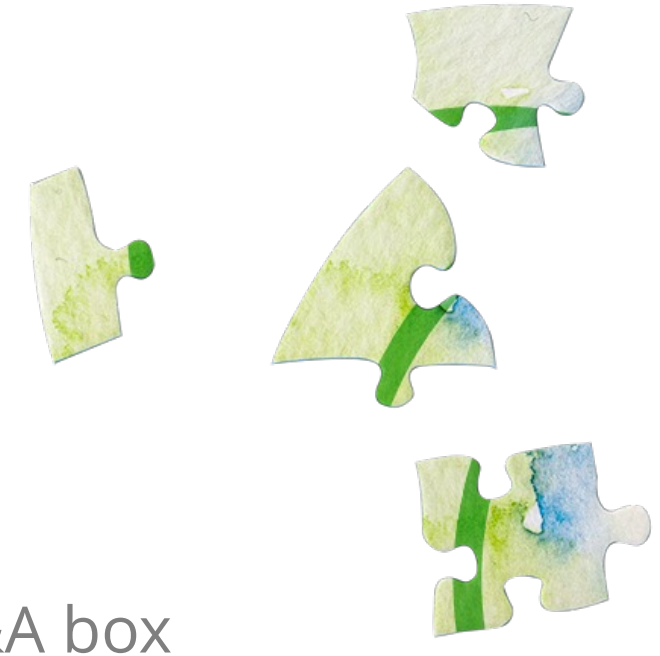
Day 4: Thursday, October 27

9AM-10AM PST	11AM-12PM PST	1PM-2PM PST
Solving the Technician Shortage	Technology Focus: Natural Innovations	Reducing Refrigerant Emissions

Day 5: Friday, October 28

9AM-10:30AM PST	11AM-12:30AM PST
State & Federal HFC Regulations	Workshop: Utility Incentives for Refrigerant GWP

Housekeeping & Logistics



Question and Answer Session

- Participants are muted
- Questions will be moderated at the end
- To ask a question, enter your comment into the Q&A box

Need Help? Click the Support button on sustainablerefrigeration.com

Missed a Session? Session recordings will be available on the platform

NORTH AMERICAN Sustainable Refrigeration Council

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Contact us at info@nasrc.org

Reducing Refrigerant Emissions

Thursday, October 27th, 2022

NORTH AMERICAN Sustainable Refrigeration Council

Reducing Refrigerant Emissions

Hear from experts on strategies to reduce refrigerant emissions by proactively addressing leaks and reducing overall refrigerant charge.

Ed Estberg
Refrigeration Consultant
Raley's Supermarkets

Kersey Manliclic
Program Manager
U.S. EPA GreenChill

U.S. EPA GreenChill Program

Kersey Manliclic, Program Manager

EPA's GreenChill Partnership Program: Reducing Refrigerant Emissions

NASRC Sustainable Refrigeration Summit

October 27, 2022

Presentation Overview

- GreenChill Overview
- Current Leak Rates (%), Trends, and Partner Achievements Over the Last 15 Years
- Advantages of Being a GreenChill Partner
- Strategies & Technologies to Reduce Leaks
- Bright Future

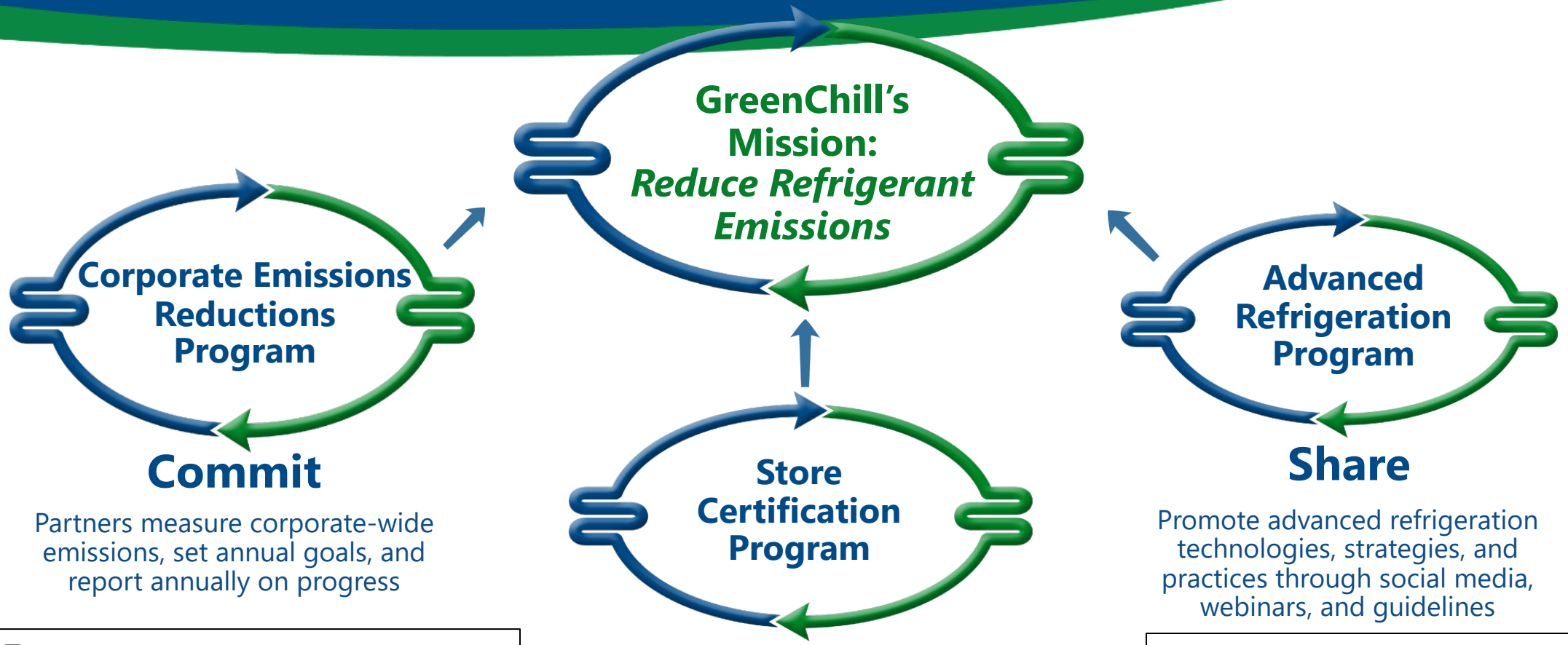
Program Overview

GreenChill is a voluntary partnership program that works collaboratively with the food retail industry to reduce refrigerant emissions and decrease stores' impact on the ozone layer and climate system

GreenChill works to help food retailers:

- Lower refrigerant charge sizes and eliminate leaks
- Transition to environmentally friendlier refrigerants
- Adopt green refrigeration technologies and best environmental practices

GreenChill's Mission



Commit

Partners measure corporate-wide emissions, set annual goals, and report annually on progress

Focus:
- Existing stores
- Find leaks more quickly
- Prevent leaks from happening in the first place

Demonstrate

Individual stores earn GreenChill certification for meeting highest standards: low charge size, use of less harmful refrigerants, and low leak rates

Share

Promote advanced refrigeration technologies, strategies, and practices through social media, webinars, and guidelines

Focus:
- Designing leaks out of supermarket systems
- Finding long term solutions to leaks

GreenChill Partners Lead the Way

Store Certification Program

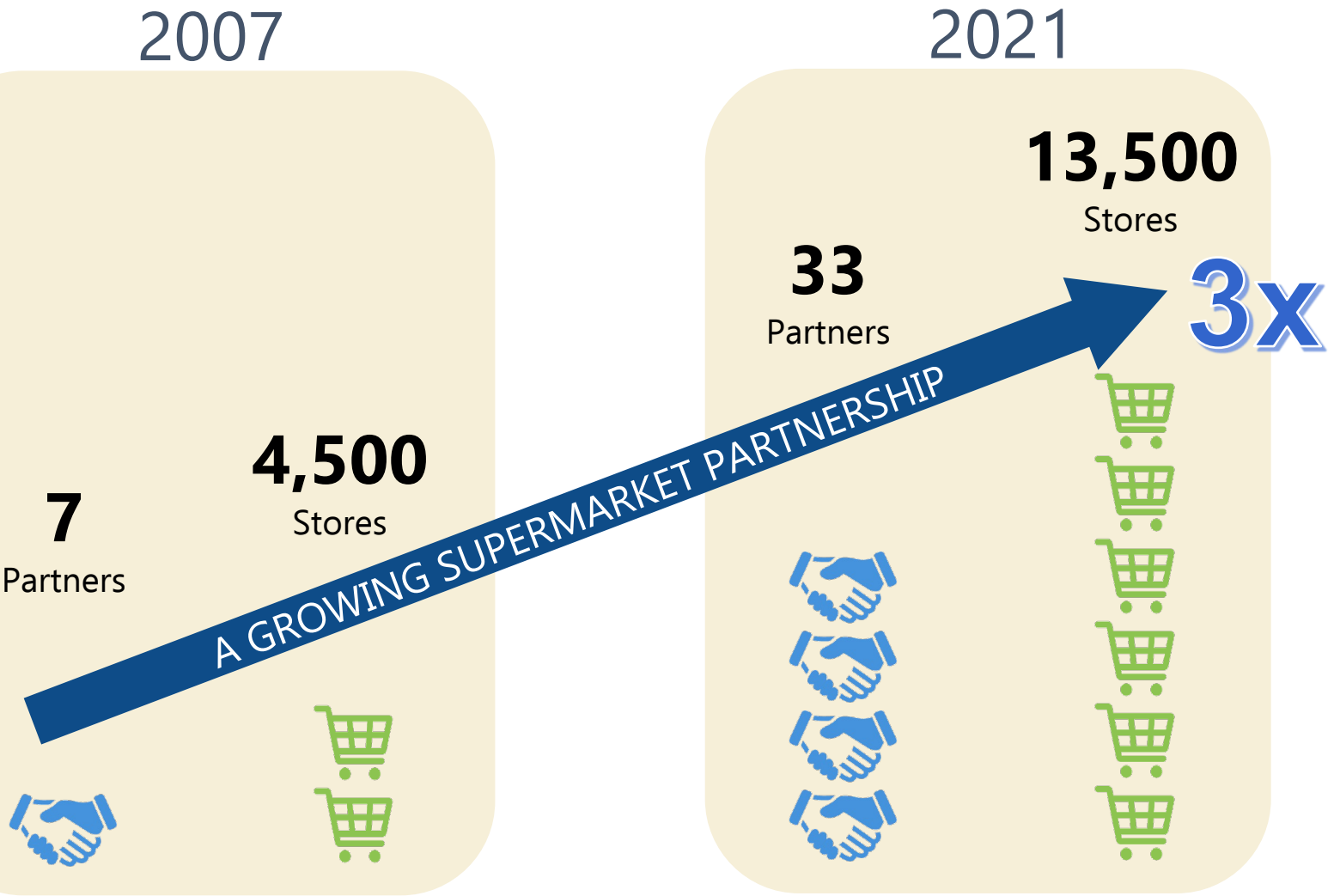
- Certified stores demonstrate leadership in food retail refrigerant management
- These stores:
  - Use only non-ozone depleting refrigerants
  - Have lower refrigerant charge sizes and leak rates compared to the average food retail store*
- **Any food retail store in the United States can apply; not necessary to be a GreenChill Partner**

Platinum, Gold, and Silver certification levels

*Determines certification level.

Leak Rates (%), Trends, and Partner Achievements Over the Last 15 Years

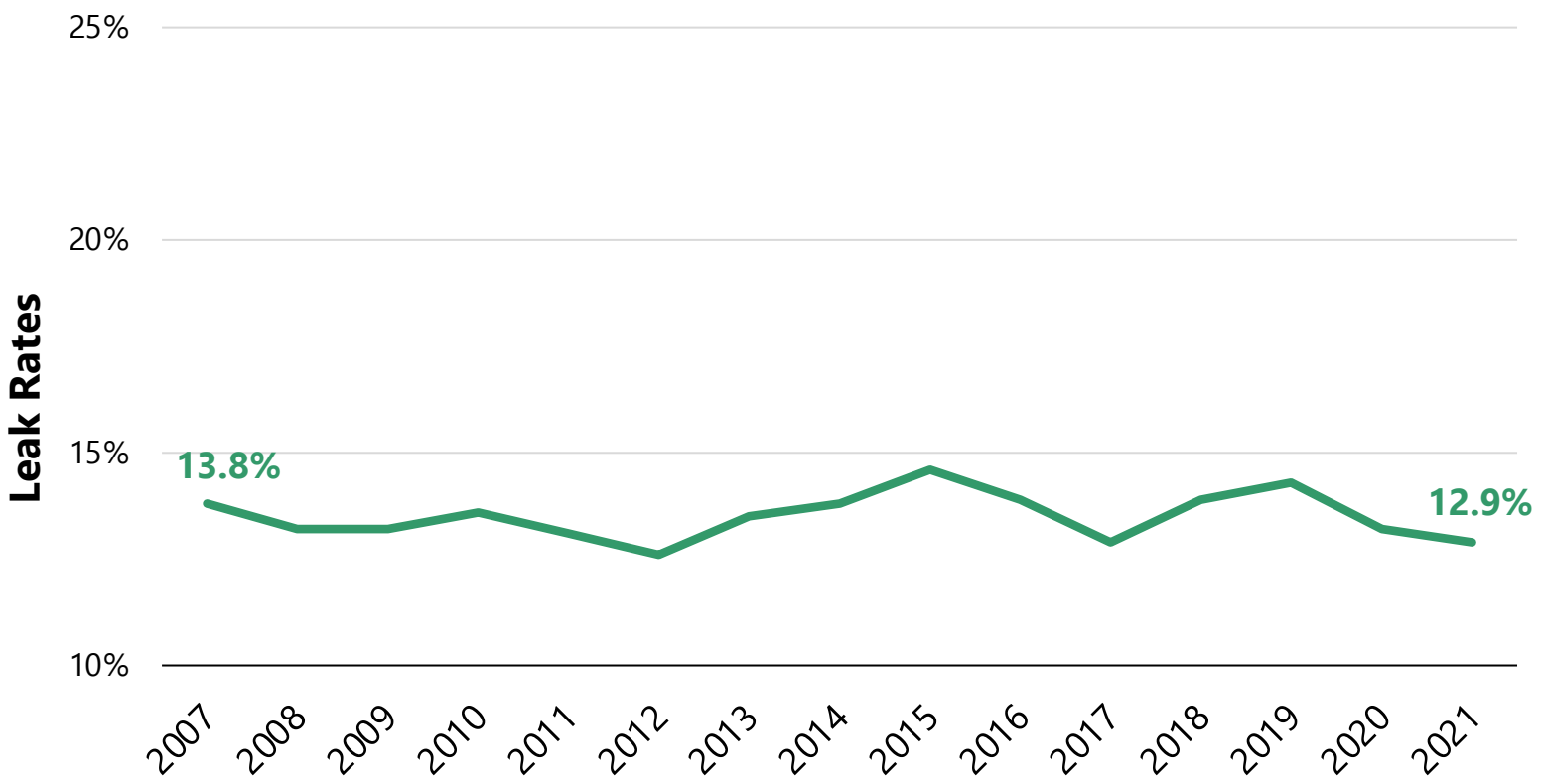
Food Retail Partners



GreenChill Partners account for 1/3 of the supermarket industry*

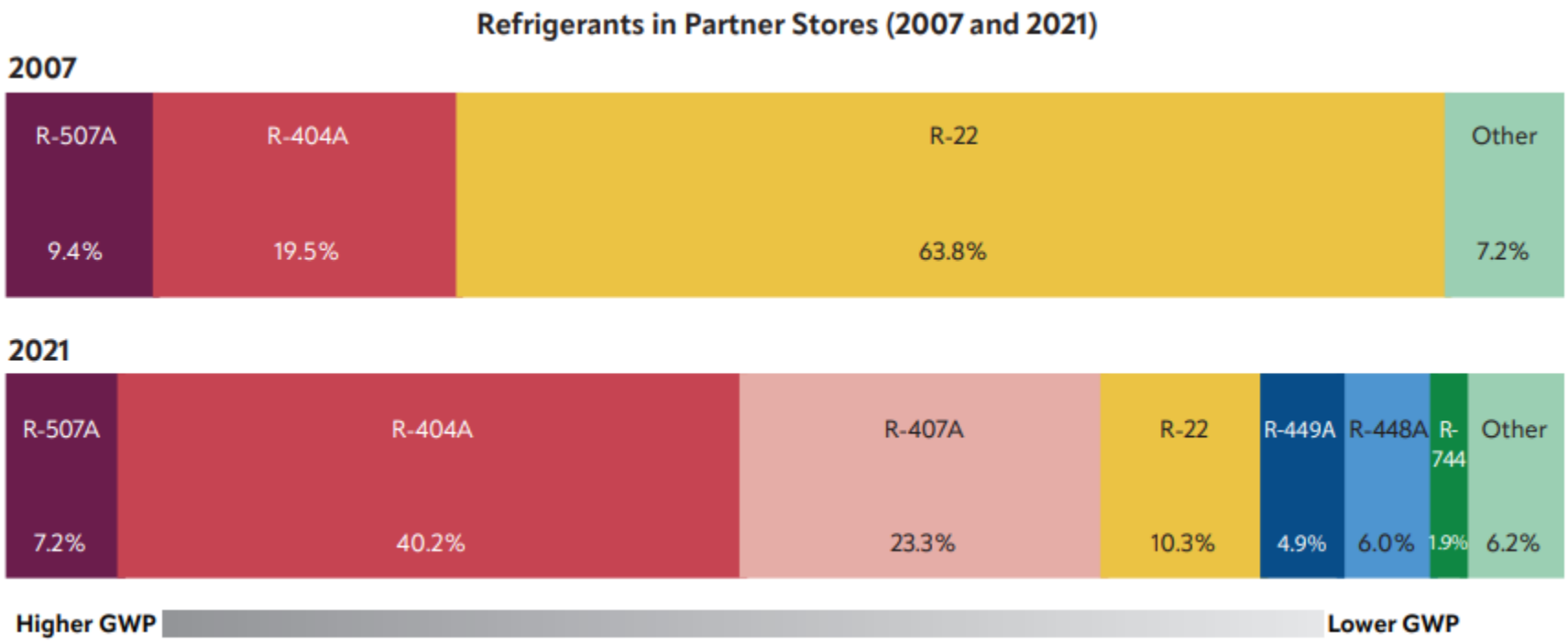
*Food Marketing Institute Supermarket Facts (2018).

Leak Rate - Historical



- Existing partners continue to achieve relatively lower leak rates while adding new stores
- GreenChill has added new partners with additional stores/equipment that are improving leak rates

Partnership Installed Refrigerants



- A much broader array of refrigerants are installed today as compared to 2007
- In 2010, new production and imports of R-22 was prohibited for use in new equipment
- R-22, represents less than 10% of installed refrigerant in 2021

GreenChill Partners have done a great job on ozone layer protection. Today, we have the opportunity to do more to address the climate crisis.

*Only refrigerants used for commercial refrigeration are depicted

**Average Weighted-GWP for "other" has decreased since GreenChill's inception: 3,148 (in 2007), 2,143 (in 2021)

***The Top 7 refrigerants are shown. "Other" incldues includes the remaining mix of refrigerants in a given year

Store Certification Program

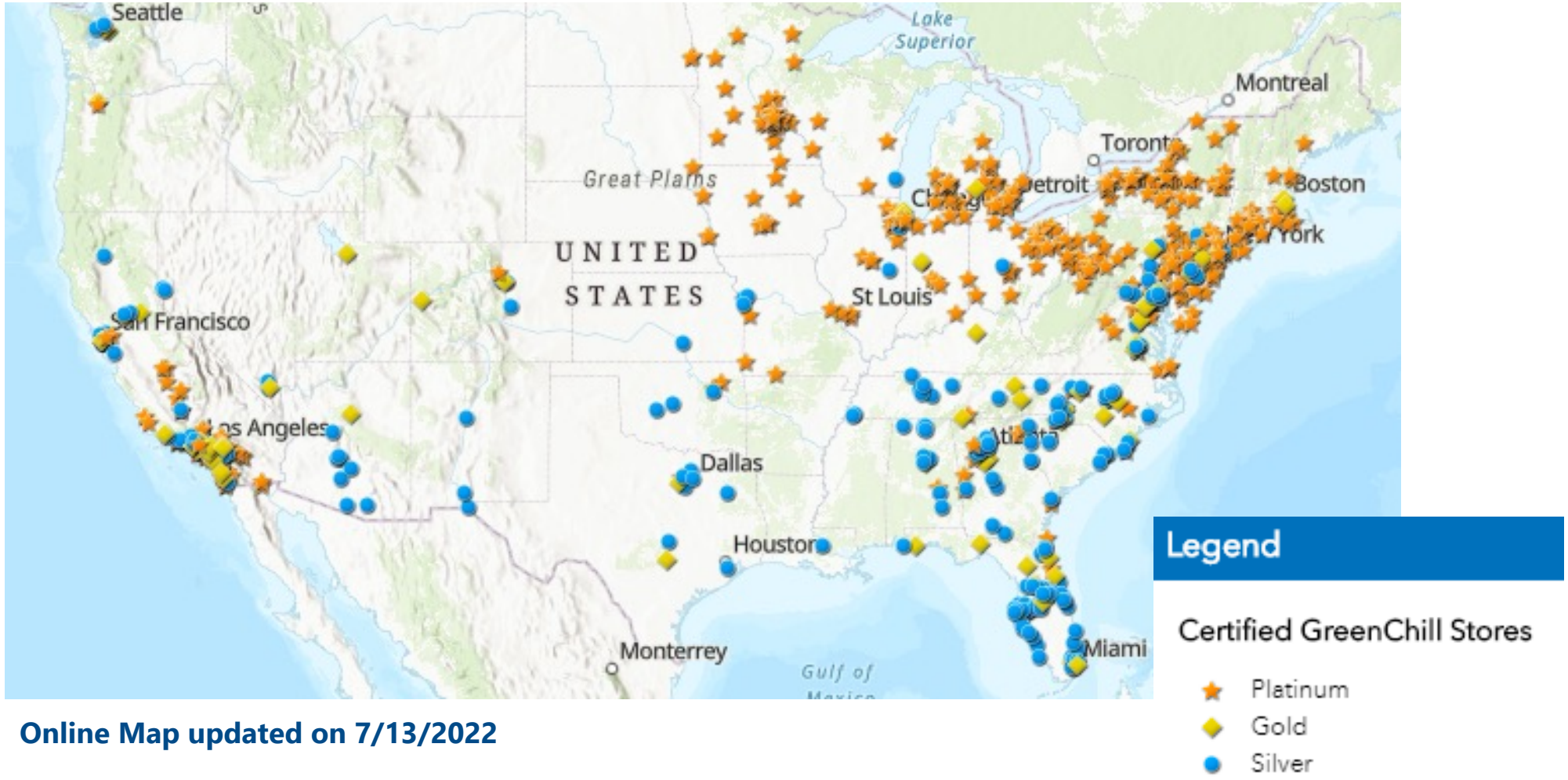
138 stores
have been certified
for 5 or more years*

22%
increase from
2020-2021

809
certifications

*As of July 31, 2022.

Store Certification Map



Online Map updated on 7/13/2022

https://www.epa.gov/greenchill/greenchill-certified-stores

15th Anniversary Report!

For 15 years, GreenChill Partners have led the way for supermarkets, modernizing the technology in refrigeration systems and reducing emissions that can harm our ozone layer. These industry leaders are demonstrating an unwavering commitment to best practices that protect our planet and the people. EPA's GreenChill Program proves that when we work together, we can deliver environmental protections and economic benefits, from job creation to cost savings, for all.

-Michael S. Regan, Administrator
U.S. Environmental Protection Agency

www.epa.gov/greenchill

Advantages of Being a GreenChill Partner

Data and Information Sharing

- GreenChill has a strong, data-driven core
  - Annual Reporting and Customized Individual Data Reports across the partnership
  - Tracking trends

Artificial Data - For illustrative purposes only

Environmental Benefits, Financial Savings

In just one year, if every supermarket reduced its emissions rate to the GreenChill Partnership average, the supermarket industry could…

Reduce emissions by 30 MMTCO2e

Equivalent to avoiding emissions from over **3.4 billion** gallons of gasoline burned

Save more than $541 million in refrigerant replacement costs

*These are based on a comparison of Partners' actual performance versus the industry average assumes industry average leak rate is 25%.

GreenChill Tools & Resources

- Updated Advanced Refrigeration information
- Best Practice Guidelines (e.g., Leak-Tightness)
- Compilation of Industry Resources

For illustrative purposes only

Forums for Discussion

- Partner meetings provide the opportunity to discuss industry challenges and share perspectives
- Opportunities to plan and discuss webinar topics
- *and more…*

For illustrative purposes only

Annual Recognition

U.S. ENVIRONMENTAL PROTECTION AGENCY
GREENCHILL
ADVANCED REFRIGERATION PARTNERSHIP
15 YEARS

Best Emissions Rate

ASHLAND FOOD CO-OP EST. 1972
meijer

Most Improved Emissions Rate

PCC COMMUNITY MARKETS
weis

Superior Goal Achievement

ASHLAND FOOD CO-OP
BJ's
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Exceptional Goal Achievement

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Store Certification Excellence

ALDI
Hillphoenix A DOVER COMPANY

Store Leadership

TARGET

Store Re-Certification Excellence (5 years)

ALDI
meijer
TARGET
SPROUTS FARMERS MARKET
weis

Store Re-Certification Excellence (10 years)

SPROUTS FARMERS MARKET

How to Be a Part of GreenChill...

Corporate Emissions Reductions Program

Store Certification Program

Select the Appropriate Application Form, Complete, and Submit!

Sign-up for our mailing list

Strategies & Technologies to Reduce Leaks

GreenChill Strategies to Reduce Leaks?

Example Strategies from Recent GreenChill Recognition Recipients:

1. Frequent commercial rack leak checks (e.g., quarterly); regular, manual leak prevention checks
2. Immediate notification of refrigerant leak alarms through refrigeration/energy management systems
3. Immediate repair of any identified leak
4. Multi-verification of all completed leak repairs

Sources: 1) 2021 GreenChill Annual Recognition Ceremony (Meijer, Sprouts), 2) 2020 GreenChill Annual Recognition Ceremony (Weis). Link: https://www.epa.gov/greenchill/greenchill-recognition

GreenChill Strategies to Reduce Leaks? (cont.)

5. Use of remote leak detection systems
6. Use of high-quality equipment, training, and technician incentive plans
7. Supervisors frequently review leak rate reports with technicians
8. Entire store is checked if leak is > certain % threshold. Dedicate additional time to check high leak rate stores

Sources: 1) 2021 GreenChill Annual Recognition Ceremony (Meijer, Sprouts), 2) 2020 GreenChill Annual Recognition Ceremony (Weis). Link: https://www.epa.gov/greenchill/greenchill-recognition

Bright Future

Meeting the Coming Challenges

- Partners can lead the way with adopting innovative technologies to reduce their reliance on high GWP HFCs and managing HFCs where they do use them to reduce emissions. GreenChill can support these efforts by sharing Partner success stories.

- GreenChill will be setting up a working groups over the next year to refresh and re-envision many program elements and respond to partners' suggestions (e.g., leak repair, certification levels, treatment of emissions of low-GWP alternatives).

Working Groups

- Areas the EPA is asking for industry input and support as we focus on preparing for the HFC phase-down:
  - Developing a leak reduction challenge that would push the industry beyond the typical GC leak rates
  - Store Certification Updates to ensure we are highlighting stores that are going above and beyond
  - How does GreenChill promote more reclamation among Partners?
- Partner feedback on other novel ideas is welcome

Thank you!

www.epa.gov/greenchill

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Reducing Direct Emissions

Ed Estberg, Raley's Refrigeration Consultant

NORTH AMERICAN SUSTAINABLE REFRIGERATION COUNCIL™

Reducing Direct Emissions

- How does charge reduction and gas change affect direct emissions from supermarket refrigeration systems
- Compared last new store designed with R-404a against last new store designed with R-449a
- Compared a current remodel from existing to latest design

Sustainable Refrigeration Council

New Store Comparison – 2010 vs 2022 Projected Direct Emissions

Store	Raley's #317 Tracy	Raley's 222 Roseville	% Reduction
Refrigerant	R-404a	R-449a	
Refrigerant GWP	3922	1397	-64%
Refrigerant Charge (Lbs.)	2284	1011	-56%
Total Evaporator Load BTUH TR	141.7	95.2	-33%
Leak Rate @ Year of Installation	21.04%	14.12%	-33%
Total GHGP (Lbs. CO2e)	8,957,848	1,412,367	-84%
GHGP per Ton Refrigeration (Lbs. CO2e)	63,217	14,836	-77%
Projected Annual Direct Emissions (Lbs. CO2e)	1,884,731	199,426	-89%

Remodel Comparison
Projected Direct Emissions

Store	Bel Air #502	Bel Air #502 RM	% Reduction
Refrigerant	R-404a	R-449a	
Refrigerant GWP	3922	1397	-64%
Refrigerant Charge (Lbs.)	2460	816	-67%
Total Evaporator Load BTUH TR	113.9	92.4	-19%
Leak Rate @ Year of Installation	14.12%	14.12%	-
Total GHGP (Lbs. CO2e)	9,648,120	1,139,952	-88%
GHGP per Ton Refrigeration (Lbs. CO2e)	84,707	12,337	-85%
Projected Annual Direct Emissions (Lbs. CO2e)	1,362,315	160,961	-88%

Charge Reduction Improvements

1. Convert space heating heat reclaim from refrigerant gas to water. 300 to 600 lb. reduction
2. Eliminate remote condenser, air or water, and use plate heat exchanger in machine room just above the receiver. 400 to 800 lb. reduction
3. Utilize vertical receiver instead of horizontal. Use ”trending” liquid probe instead of full receiver probe. 100 to 200 lb. reduction.
4. Utilized loop piping, one liquid line and one suction line to all fixtures. 100 to 300 lb. saving

Charge Reduction Improvements cont.

5. Use liquid sub cooling and set liquid temperature just above dew point. Size liquid lines for 15lbs. Pressure drop. A 20f drop in temperature allows for 50 lb. drop in pressure before flashing. 75 to 100lb reduction
6. Use glycol for all AC loads, with plate heat exchanger in machine room. 75 to 150lb reduction.

NASRC Leak Reduction Initiative

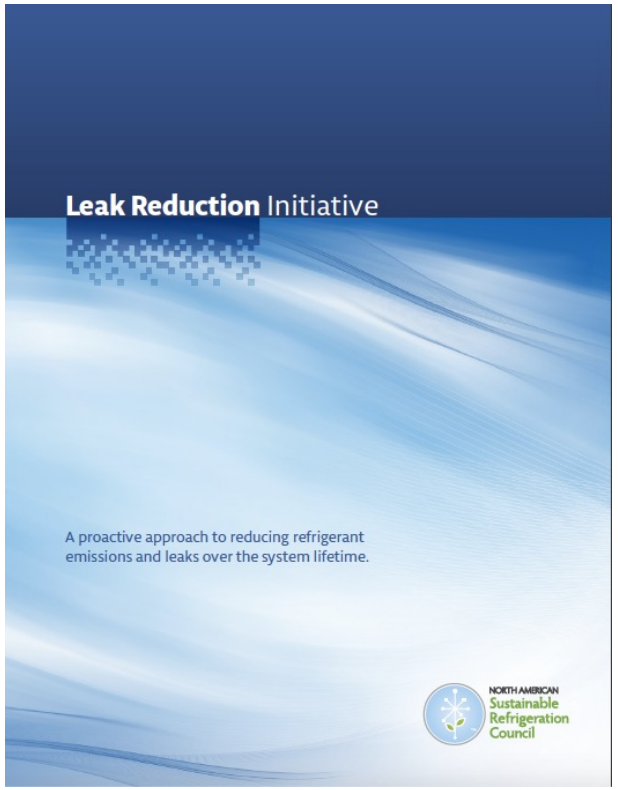
Danielle Wright, Executive Director

Leak Reduction Handout

Retailer-driven initiative to reduce leaks over a system's lifespan

Contents

- Overview of top leak issues
- Leak reduction measures recommended by Best Practices Committee
- Considerations/Challenges for implementing



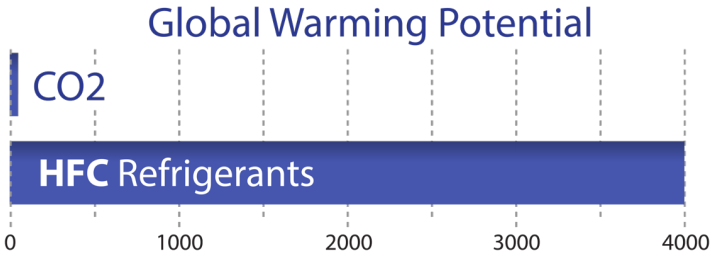
Why Reduce Leaks?

- Environmental Impact
- Regulatory Impact
- Operations Impact

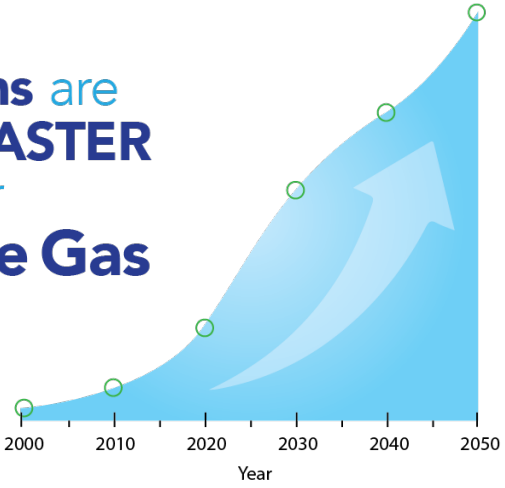
Environmental Impact: Hydrofluorocarbons (HFCs)

HFCs are **SUPER** climate polluting synthetic chemicals commonly used in air-conditioning & refrigeration

HFCs have up to **4,000** TIMES MORE GLOBAL WARMING **IMPACT** than **CO2**



and...
HFC Emissions are **GROWING FASTER** than any other **Greenhouse Gas** on the **Planet**

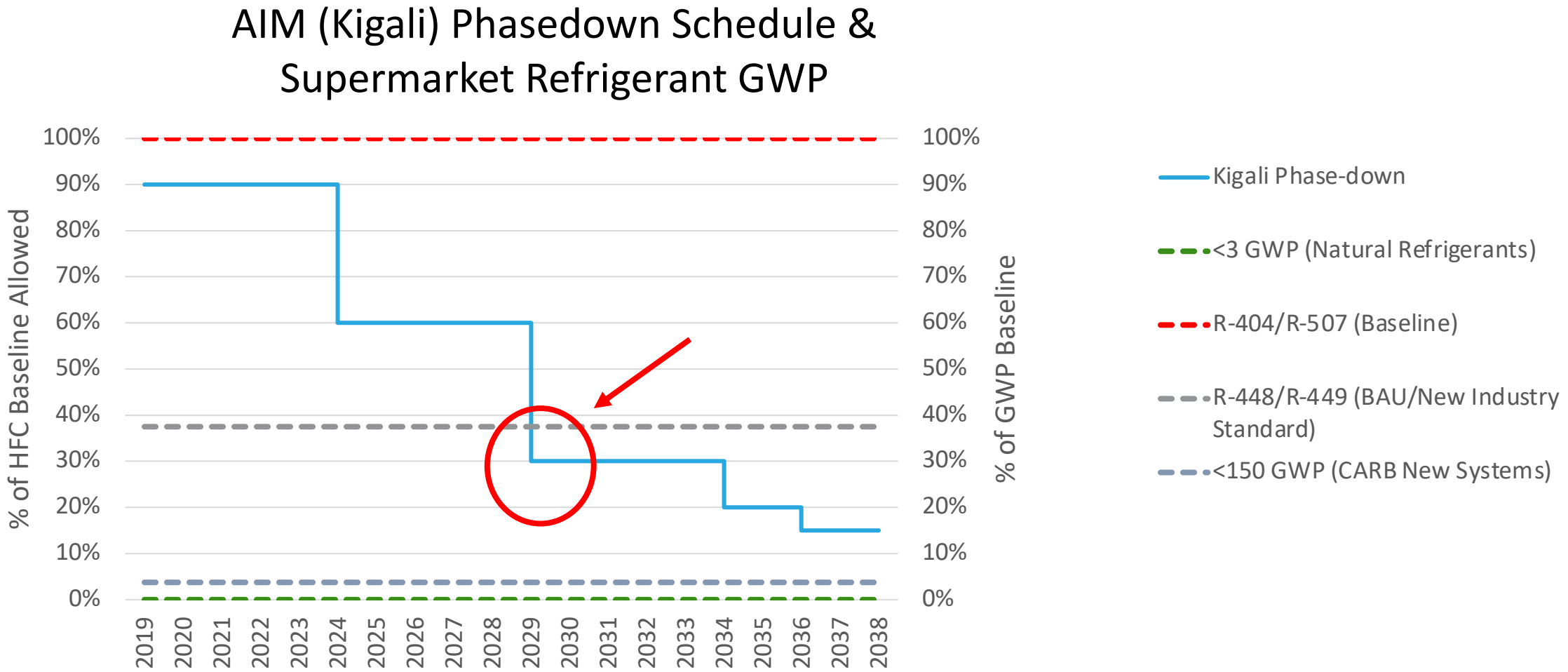


The climate impact

from supermarket and grocery store refrigeration leaks

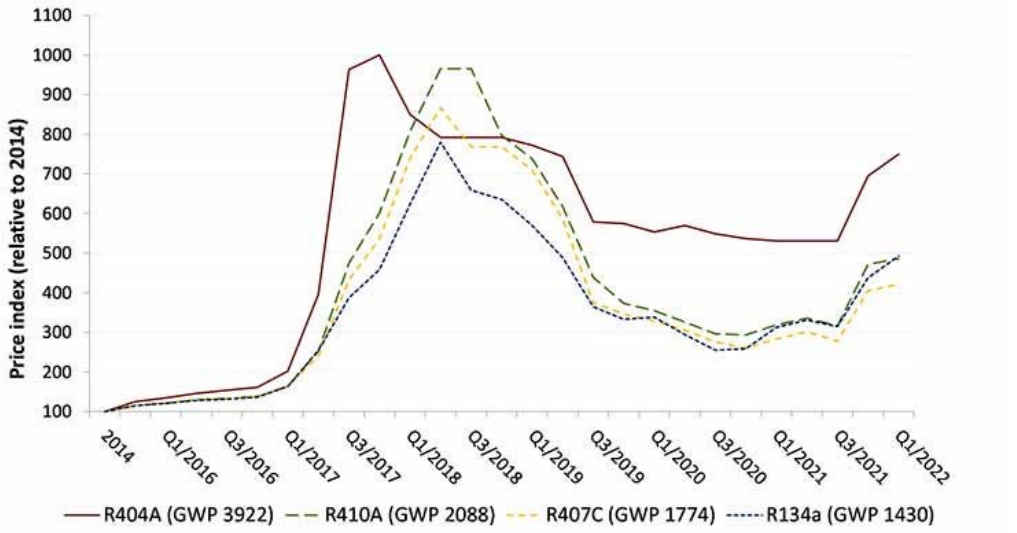
1 Year	10 Year
55 MILLION MTCO2e	**HALF BILLION MTCO2e**

Regulatory Impact: AIM Act Phasedown



Regulatory Impact: Refrigerant Pricing

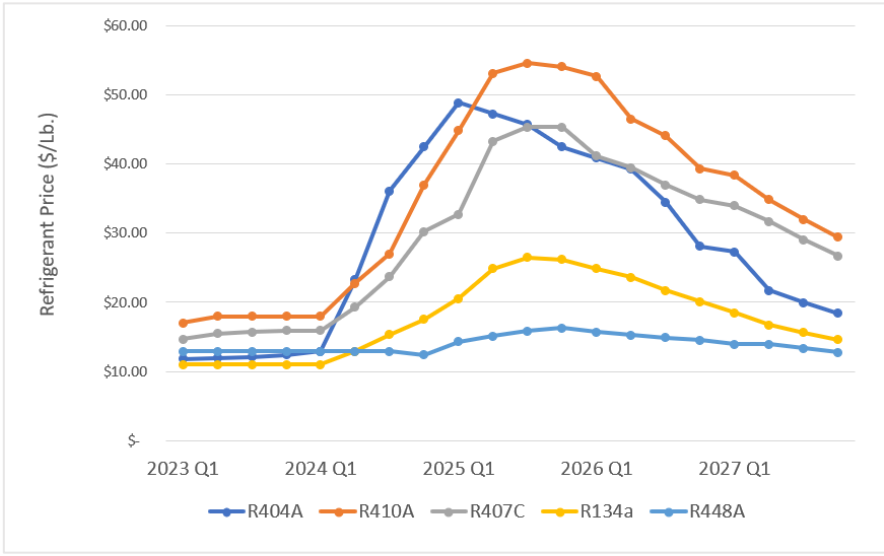
European Refrigerant Pricing
Due to F-gas Regulation



- HFC refrigerants saw initial 800% – 900% price increase
- Prices are on the rise again

Source: Öko-Recherche on behalf of DG Clima

Projected U.S. Refrigerant Prices
Due to AIM Act



- Projected future prices of refrigerant based on European price increases

Source: DC Engineering Presentation, NASRC Sustainable Refrigeration Summit 2021

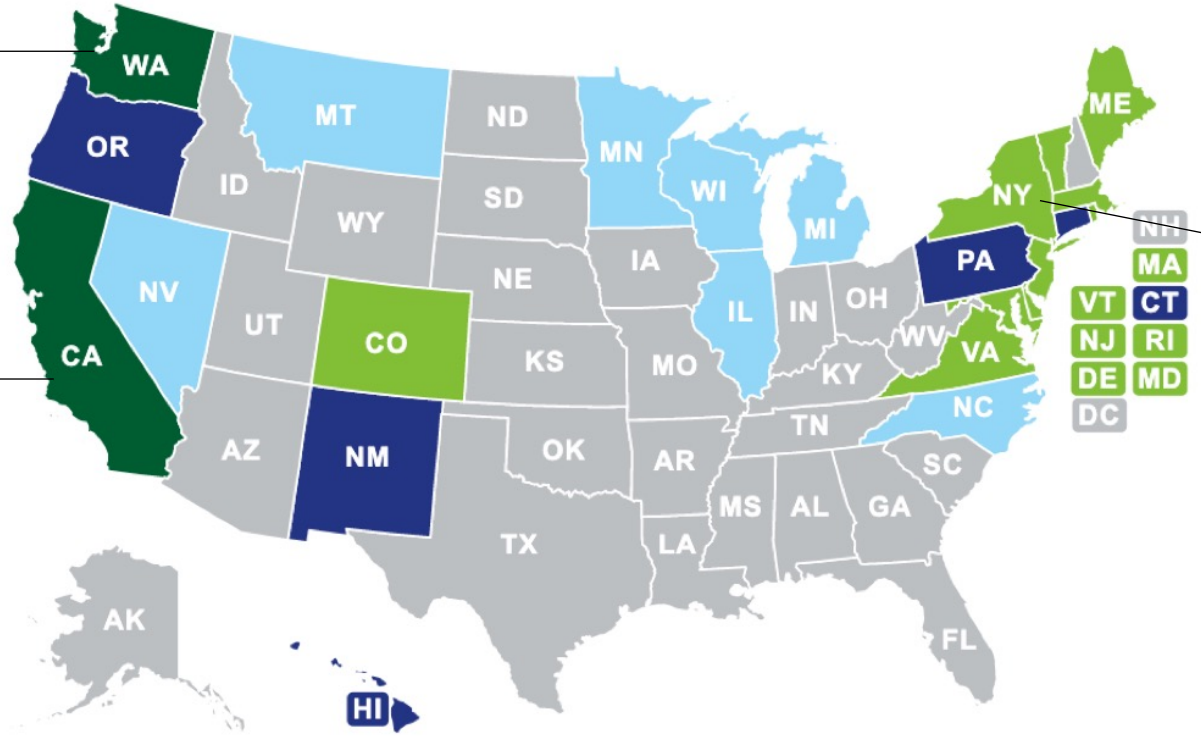
Regulatory Impact: State Regulations

Washington

- *<150 GWP for New EQUIPMENT*

California

- <150 GWP - New Systems
- <1400 GWP - Existing Systems
- NEW! SB 1206 – Virgin Refrigerant Ban



New York

- *<10 GWP for New Systems*
- *GWP threshold for Existing Systems*
- *Refrigerant Ban*

https://nasrc.org/hfc-policy

Operations Impact: Refrigerant Leaks are Bad for Business!

Need to keep food cold!

- Increase service/maintenance costs
- Sub-optimal performance
- Product integrity

Natural Refrigerants Leak too!

- Negligible environmental impact
- Exempt from compliance requirements
- Still bad for business

CO2 Systems

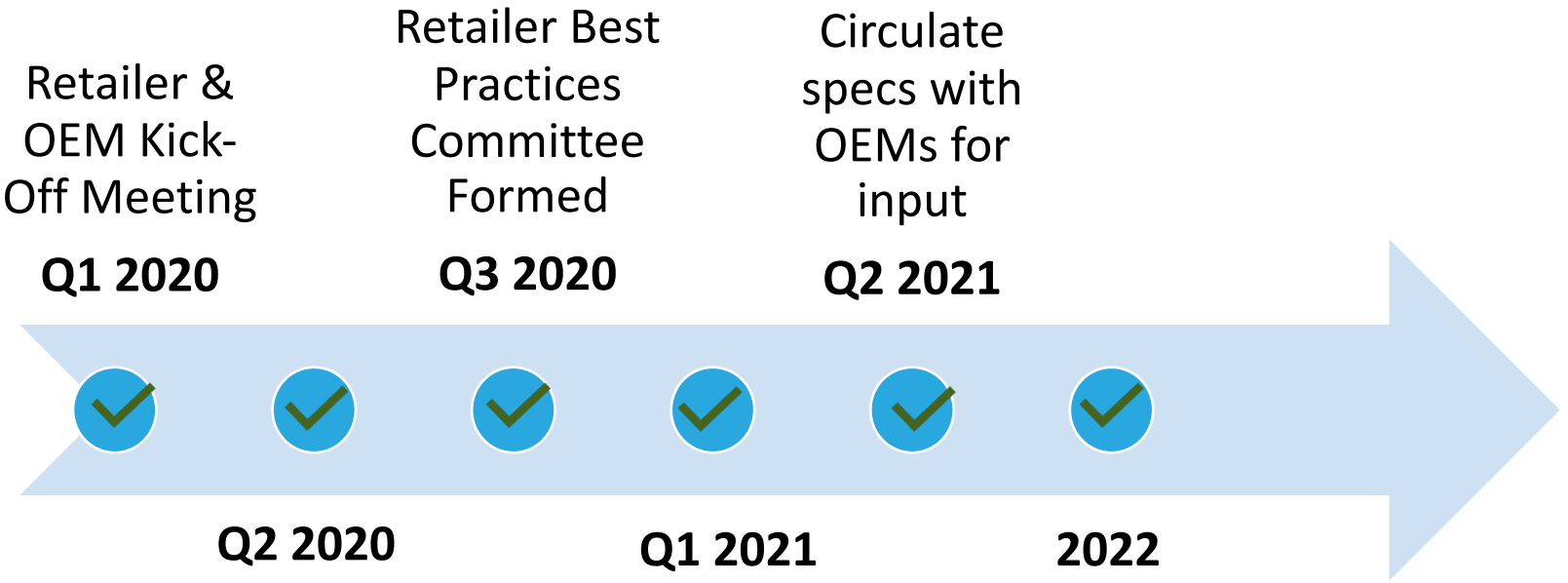
- Higher leak rates
- High pressures
- Venting during service
- No CO2 refrigerant reclaim technology

NASRC Leak Reduction Initiative

Retailer-driven initiative to reduce leaks over a system's lifespan

Retailer Best Practices Committee

Target
ALDI
COSTCO
Whole Foods
Raley's
H-E-B



Top Leak Issues

Leaks Occurring in Cases and Fixtures

1. Evaporator leaks due to tubing failures
2. Access valves used for servicing
3. Lines rubbing together either through contact and vibration or through thermal expansion
4. Electrical wiring failure causing leaks

Leaks Occurring in the Machine Room and Rack

5. Compressor vibration relative to the rack structure, causing tubing failure (stress)
6. Leaks from high side control lines
7. Mechanical fitting connections
8. Access valves used for servicing, such as rotolock valves and stem packing leaks
9. Tubing vibrating against dissimilar metals

Top Leak Issues

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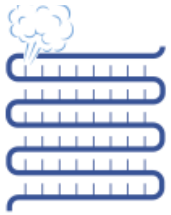


Leaks Occurring at the Condenser

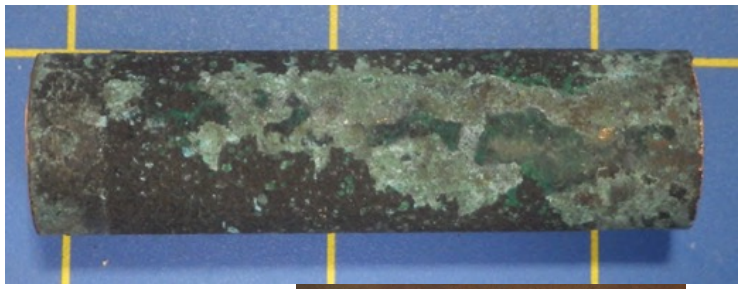
10. Tube sheet leaks at condensers
11. Fan breakage/motors falling into the coil and causing leaks

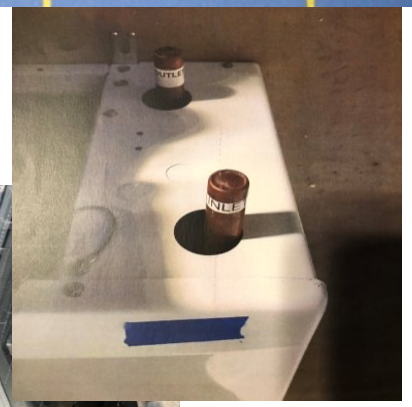
D

Leaks Occurring on Connecting Pipes

12. Corrosion and abrasion

Leak Reduction Measures





MEASURE 1

Require 45 bar working pressure (Type K copper) in display case and walk-in coils, all piping, and on racks

MEASURE 2

Any tubing or part that carries refrigerant cannot come into contact with any other metal

MEASURE 3

Eliminate any flare fittings on copper tubing

Leak Reduction Measures

MEASURE 4

Eliminate rotolock fittings

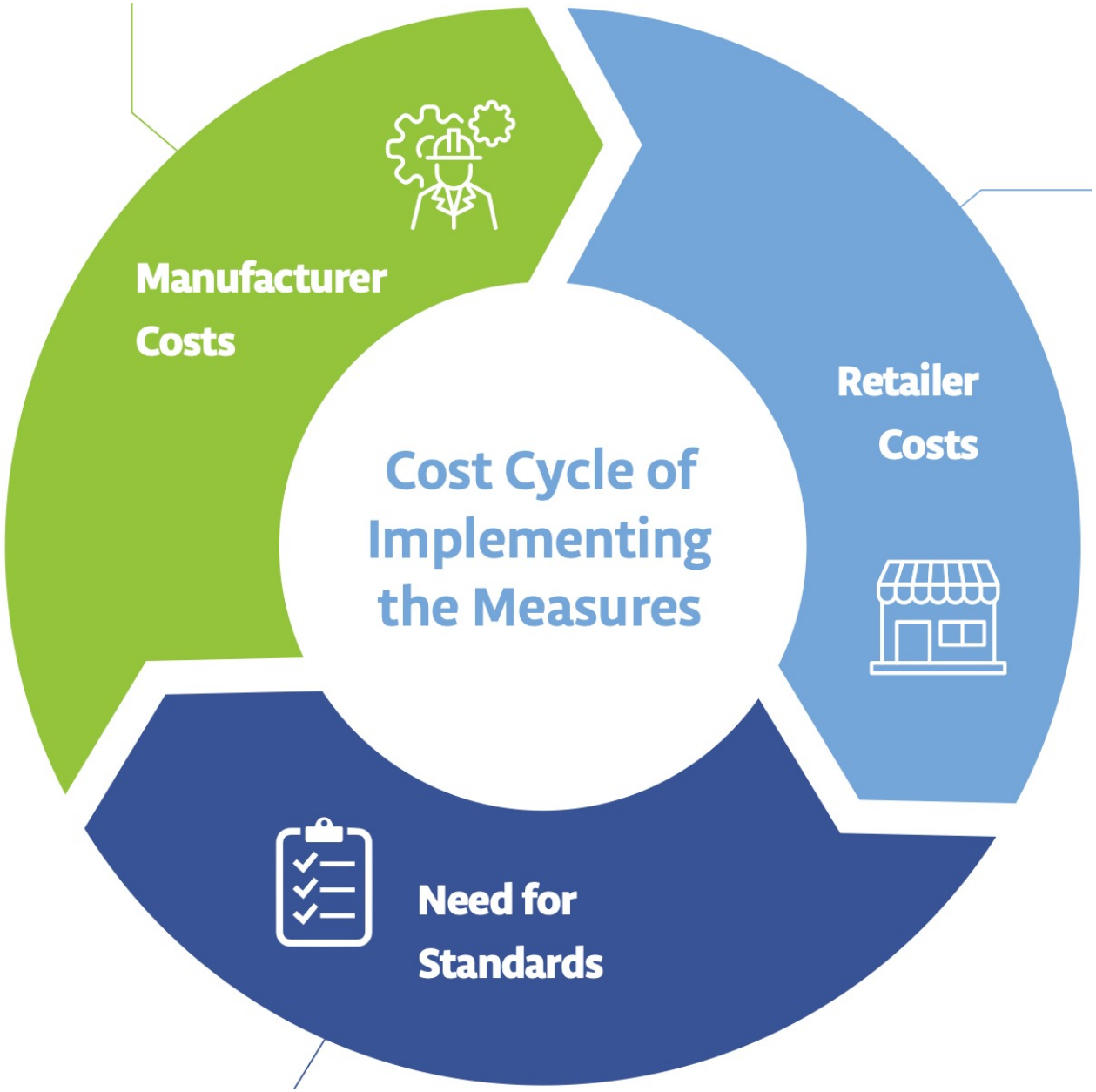
MEASURE 5

Add a temporary pressure gauge or indicator to visually confirm that the system is pressurized after arriving on site

MEASURE 6

Specify better CO2 relief valves

What Can Be Done?



Created to help food retailers and industry partners navigate the transition from high global warming potential refrigerants.

- HFC Policy Tracker
- Refrigerant Alternatives
- Naturals in Supermarkets Factsheet
- Natural Technology Library
- R290 Factsheet

www.nasrc.org/hub