Navigating State HFCs Regulations – Current Landscape and Pragmatic Refrigerant Strategies

September 26, 2023

Call-in Details 1-978-806-0340 ID: 446 232 474 #

Today's Host

Annie Kee
Environmental Protection Specialist
U.S. Environmental Protection Agency (EPA)
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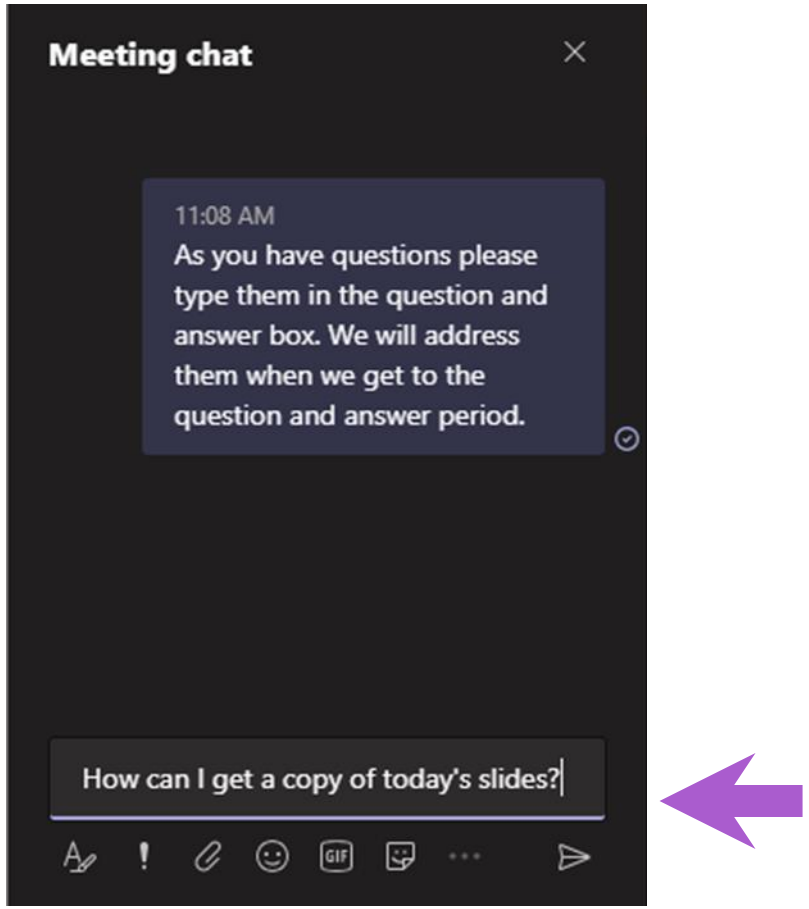
Annie is an Environmental Protection Specialist in the Stratospheric Protection Division (SPD) in EPA's Office of Atmospheric Protection, where she works on rulemakings under the American Innovation and Manufacturing (AIM) Act and partnership programs. Prior to SPD, she also worked on EPA's SmartWay program, which helps companies advance supply chain sustainability by improving freight transportation efficiency.

Questions

Question and Answer (Q&A) Session

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



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Webinar Feedback and Materials

Feedback Form

- We value your input!
- The link to a feedback form will appear in the chat window

Recording and Slides

- Webinar is being recorded
- Materials will be posted on the GreenChill website under Events and Webinars: www.epa.gov/greenchill
- To receive notification when materials are posted email: EPA-GreenChill@abtassoc.com

Program Overview

www.epa.gov/greenchill

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

Become a GreenChill Partner!

Join your Industry Peers!

GreenChill is actively recruiting new Food Retail Partners

epa.gov/greenchill/about-greenchill-corporate-emissions-reduction-program

Upcoming GreenChill Webinars

- November 29, 3 pm Eastern: Refrigerant Management Solutions with DC Engineering

- We are planning GreenChill's 2024 webinar series. Have ideas for a webinar or would you like to present? Email GreenChill@epa.gov

- To join our webinar invitation list, email EPA-GreenChill@abtassoc.com

You're Invited!

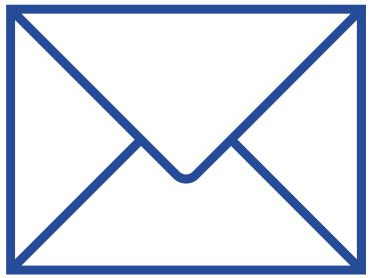
GreenChill 2023 Recognition Event

October 4, 2023 at 7 am

Baltimore, MD

In conjunction with the Food Industry Association Energy & Store Development Conference

Learn More



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Today's Speakers…

Taryn Finnessey

Taryn Finnessey
Managing Director, US Climate Alliance
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Taryn is the Managing Director of the U.S. Climate Alliance, where she works to advance the climate priorities of the Alliance's governors, oversees the Secretariat's efforts to create comprehensive policy solutions and build state capacity, and helps set coalition-wide strategy. She previously led the Alliance's efforts to reduce emissions of short-lived climate pollutants and increase equity in the transition to a clean energy economy. Prior to joining the Alliance, Taryn was the Senior Climate Change Specialist for the State of Colorado, where she coordinated climate change efforts across state agencies to integrate scientific and policy innovations that reduce emissions and address climate change impacts, and helped establish Colorado as a national and international leader on drought resilience.

Kareem Hammoud

Kareem Hammoud
Policy Advisor, US Climate Alliance
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Kareem is a Policy Advisor with the U.S. Climate Alliance, where he leads the Alliance's industrial decarbonization and short-lived climate pollutants work and manages the Alliance Policy Database. Before joining the Alliance, he completed a Master of Environmental Management at the Yale School of Environment, where he specialized in environmental policy analysis, clean energy systems, and industrial ecology. While at Yale, he worked on multiple projects that identified and quantified top decarbonization policies for implementation by U.S. actors, including the 2019 America's Pledge report. Hammoud previously performed environmental, social, and governance (ESG) research for a San Francisco mutual fund and obtained a B.S. in Environmental Science from U.C. Berkeley.

Tristam Coffin

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Co-founder & President
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Tristam Coffin is a Co-Founder and President at êffecterra a sustainability and engineering solutions group based in the U.S. and United Kingdom (U.K.). Prior to êffecterra, he spent the majority of his career implementing sustainability and environmental initiatives as Director of Sustainability & Facilities for Whole Foods Market. He is a Leadership in Energy and Environmental Design (LEED) Accredited Professional and sustainability leader with expertise in multiple areas including high performance buildings, advanced refrigeration/heating, ventilation, and air conditioning (HVAC) systems, renewable energy, and waste diversion. He also co-founded the North American Sustainable Refrigeration Council (NASRC) and the Refrigerant Emissions Elimination Forum (REEF).

Will Casey

Will Casey
Lead Analyst
êffecterra, inc.
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Will Casey is a founding team member of êffecterra and leads several technical sustainability projects for a diverse group of clients and partners globally. He has worked in various engineering roles for over eight years including many with a close focus on refrigeration, covering system design, project management and strategy development and implementation. Being based in the U.K. Will has helped many partners navigate the European Union (EU) fluorinated gas (FGas) regulations, and is excited to be helping U.S. retailers learn and optimize their strategies from this experience.

UNITED STATES CLIMATE ALLIANCE

State Hydrofluorocarbon (HFC) Regulations

What Industry Should Know

September 26, 2023 – GreenChill Webinar

Agenda

1. Who we are
2. Our work on refrigerants
3. State progress
4. On the horizon

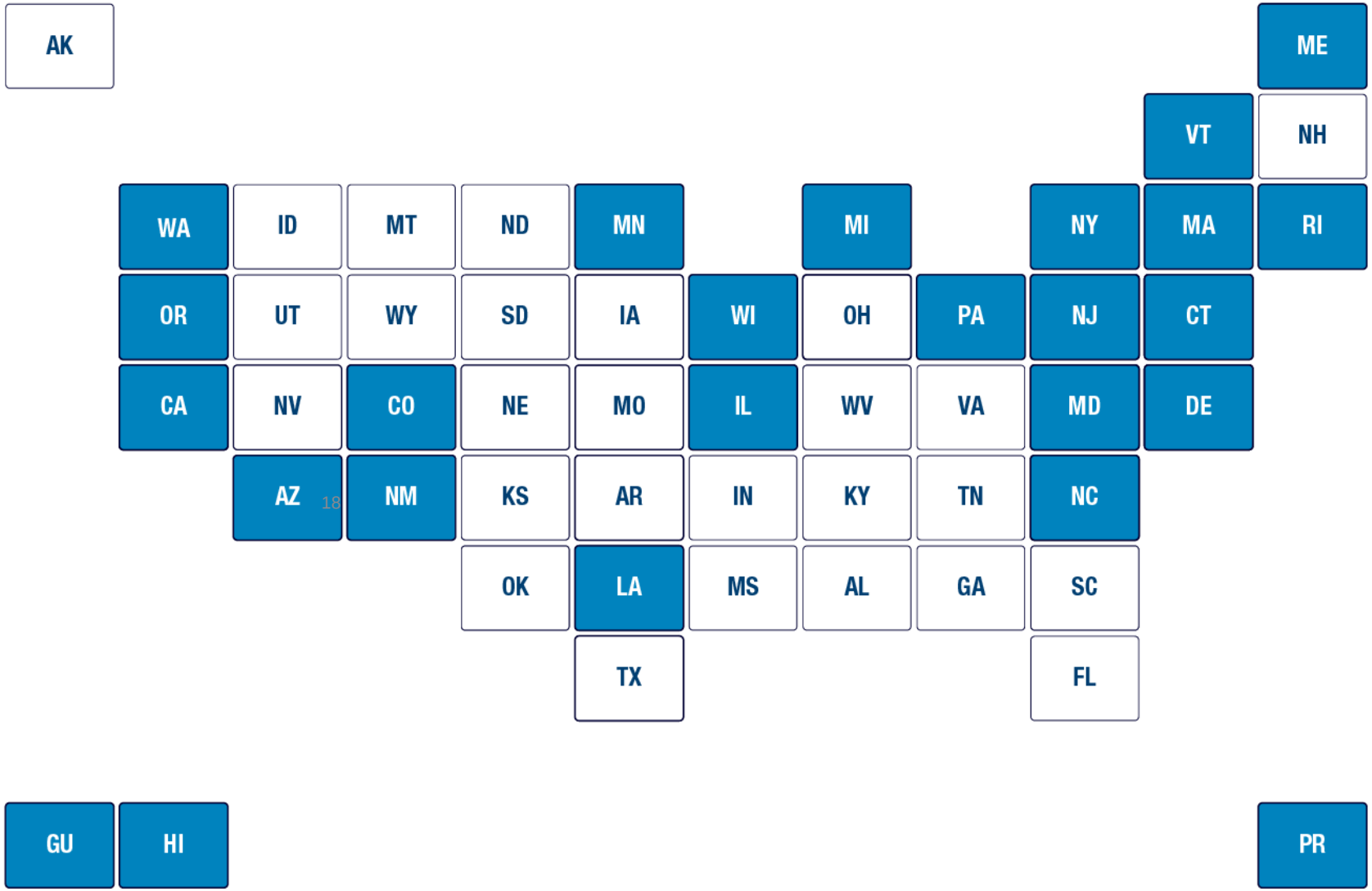
About Us

The U.S. Climate Alliance (USCA) is a bipartisan coalition of 25 governors securing America's net-zero future by advancing state-led, high-impact climate action.

Launched in 2017 by the governors of Washington, New York, and California, the Alliance now includes governors from 25 states and territories, representing approximately 55% of the U.S. population, and 60% of the U.S. economy.

Arizona
California
Colorado
Connecticut
Delaware
Guam
Hawai'i
Illinois
Louisiana
Maine
Maryland
Massachusetts
Michigan
Minnesota
New Jersey
New Mexico
New York
North Carolina
Oregon
Pennsylvania
Puerto Rico
Rhode Island
Vermont
Washington
Wisconsin

Our Coalition



Member Commitments

Alliance members are working to achieve the Paris Agreement's goal of keeping temperature increases below 1.5 degrees Celsius through four key commitments:

1 Reducing Emissions

Reducing collective net greenhouse gas (GHG) emissions at least 26-28% by 2025 and 50-52% by 2030, both below 2005 levels, and collectively achieving overall net-zero GHG emissions as soon as practicable, and no later than 2050.

2 Accelerating Action

Accelerating new and existing policies to reduce climate pollution, build resilience to the impacts of climate change, and promote clean energy deployment at the state and federal levels.

3 Centering Equity

Centering equity, environmental justice, and a just economic transition in their efforts to achieve their climate goals and create high-quality jobs.

4 Tracking Progress

Tracking and reporting progress to the global community in appropriate settings, including when the world convenes to take stock of the Paris Agreement.

Policy Priorities

Together, Alliance members are advancing high-impact policies, actions, and regulations across 10 key policy areas:

- GHG Targets & Governance
- Buildings
- Climate Finance
- Electricity Generation
- Industry & SLCPs
- Just Transition & Equity
- Natural & Working Lands
- Pricing Carbon & Valuing Damages
- Resilience
- Transportation

SLCP: short-lived climate pollutant

Our Impact

Compared to the rest of the country, Alliance members are collectively delivering more:

- Air Pollution Reductions
- Economic Growth
- Clean Energy Jobs
- Emissions Reductions[21]
- Energy Savings
- Climate Resilience
- Zero-Carbon Electricity

See our website for our latest action.

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Why Short-Lived Climate Pollutants (SLCPs)?

- **Market Impact**: Alliance states were collectively responsible for 53% of U.S. HFC emissions in 2022.
- **Ambitious Goals**: Alliance states are working to reduce SLCP emissions by 40-50% below 2018 levels by 2030.
- **Large Co-Benefits**: Transitioning towards HFC alternatives could bring as many as 33,000 new manufacturing jobs to our states and communities and add approximately $12.5 billion per year to the U.S. economy
- **Large Climate Benefits**: Compared to CO_2, some HFCs are over 1,000 times more potent global warmers and are among the fastest growing GHG.

Timeline of USCA HFC Work

- **2014**: California prioritizes SLCP reductions.
- **2017**: California releases their SLCP Reduction Strategy.
- **March 2018**: CARB adopt HFC regulations.

June 1, 2018: USCA commits to reducing short-lived climate pollutants as a critical component to meeting the goals of the Paris Agreement.

June-Sept 2018: States lead in developing the SLCP Roadmap that outlines a menu of options to consider to reduce SLCP emissions by 40-50% below current levels by 2030.

GLOBAL CLIMATE ACTION SUMMIT

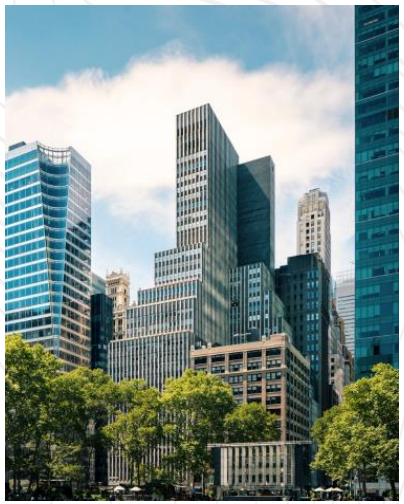
Sept 2018: Connecticut, Maryland, & New York announce their intent to regulate HFCs, joining California.

CARB: California Air Resources Board

Timeline of USCA HFC Work

California introduces groundbreaking program to reduce climate "super pollutants"

Washington State Amps Up Controls on HFC Emissions



2019-2020: USCA & states develops tools and resources to support state specific strategies including inventory tools, and model regulation language leading to 16 states committing to phase down HFCs.

Dec 2020: State action catalyzes a bipartisan, industry supported push to pass a federal framework for HFC phasedown.

2021: State efforts inform AIM Act implementation, while states continue to pioneer next generation efforts to further address HFCs.

2022-2023: Low-GWP building codes work, developing refrigerant management programs to address leaks and end of life, EPA engagement.

AIM: American Innovation and Manufacturing

GWP: global warming potential

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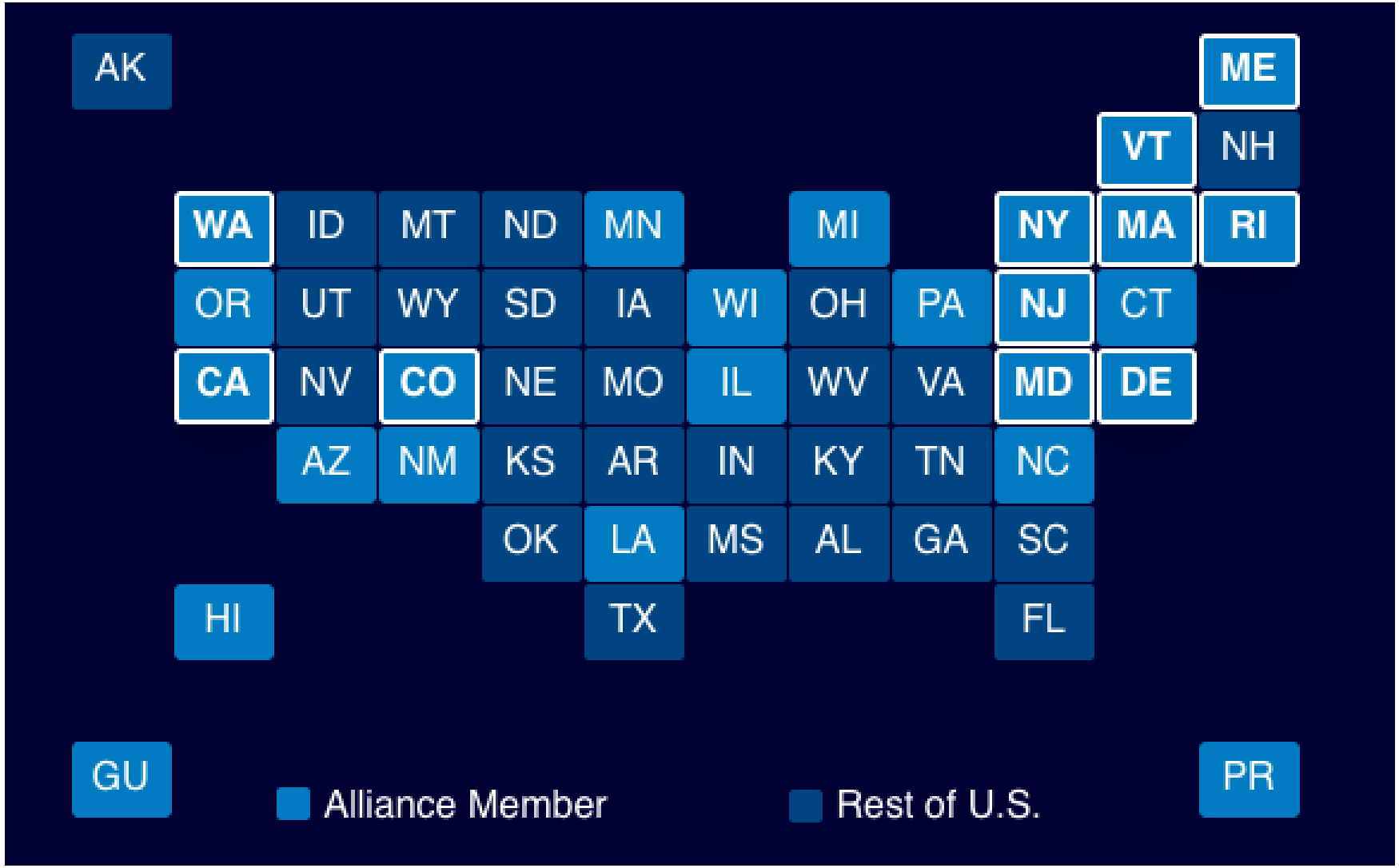
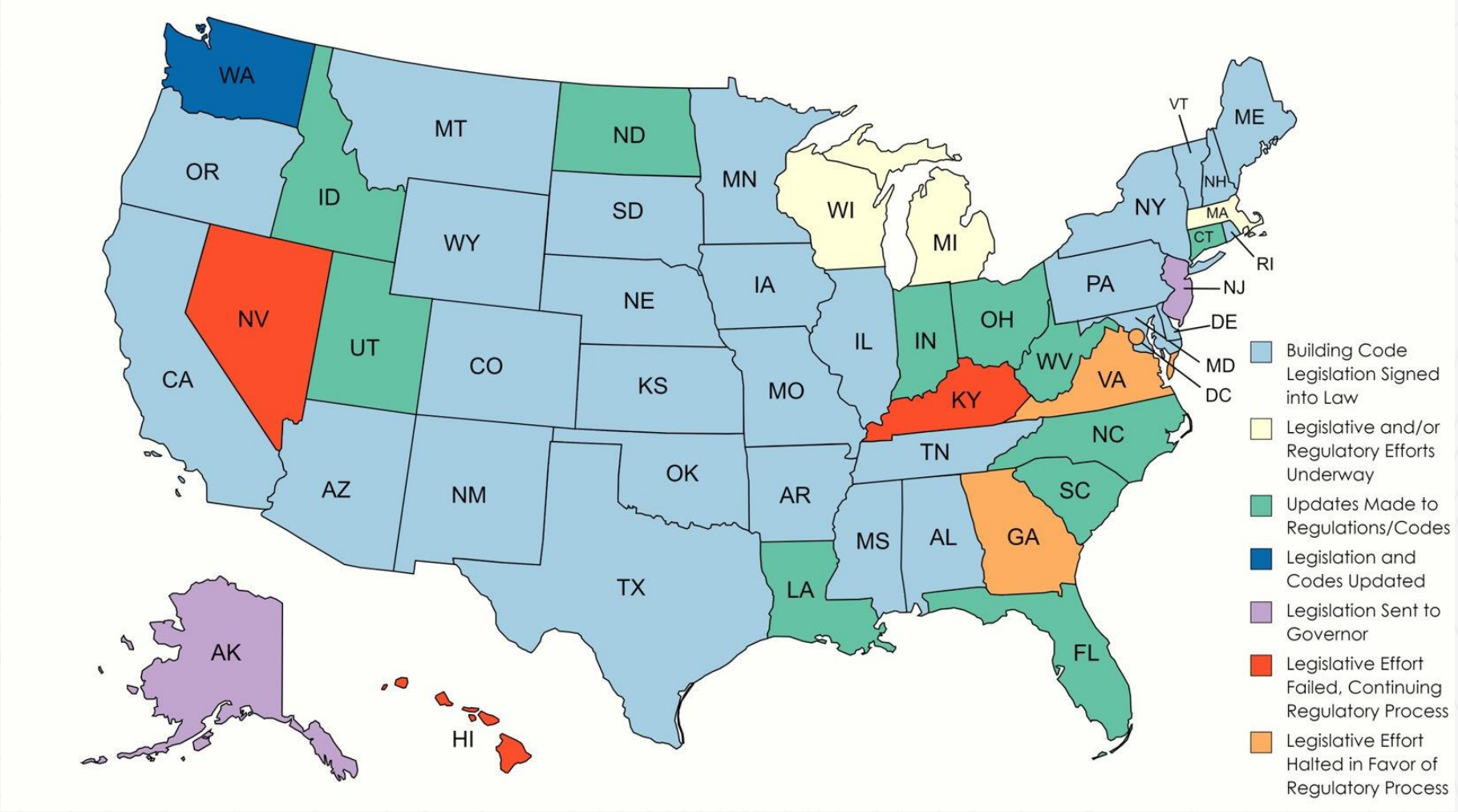
11 Alliance States with Active HFC Policies

California
Colorado
Delaware
Maine
Maryland
Massachusetts
New Jersey
New York
Rhode Island
Vermont
Washington
(Virginia)



Low GWP Building Code Status

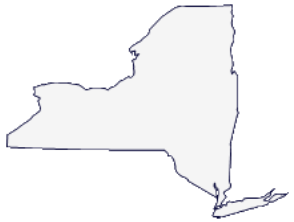
As of August 2023



Refrigerant Management Programs (RMP)

CALIFORNIA

State RMP eff. since Nov. 2010



NEW YORK

Pre-proposal rule update: Department of Environmental Conservation considering registration and annual reporting reqs. for facilities w/ large equipment

WASHINGTON

Proposed rule update: incl. establishing a RMP with registration, leak detection, leak repair, recordkeeping, and reporting requirements for owners or operators of large stationary refrigeration and air conditioning systems

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Improving on State Implementation Challenges

Climate & Equity Requirements

- Emissions
- Workforce
- Overburdened communities

Outreach

- Small business communications
- State program coordination

Effective Program Design

- Understanding costs
- Understanding benefits
- Effective incentives

Institutional Challenges

- Capacity
- Whole of government

What is Next?

- Pursuing next generation policies (e.g., expanding regs to cover additional end uses, establishing GWP thresholds)
- Understanding & addressing supply chain impacts
- Addressing recovery, reclaim and reuse
- Working with small business on transition
- Engage on additional EPA rulemakings
- Navigate regulatory overlap with PFAS and HFCs

PFAS: per- and polyfluoroalkyl substances

UNITED STATES
CLIMATE
ALLIANCE

Questions?

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Legacy Stores, Modern Challenges

Pragmatic Retail Refrigerant Strategies for Planet and Profit

September 2023

Contents

Executive Summary

Refrigerant strategy is a critical consideration for food retailers:

1. Refrigerants are often the **largest scope 1 emission** (and will remain so or increase with the electrification of heating)
2. Focus of significant **existing and incoming regulations**
3. Strategic decisions made today can potentially minimize **billion $$$ risks** (retailer dependant)
4. Strategic decisions will also **influence emissions, capital expenditure (CAPEX), operational expenditure (OPEX) & customer experience**

Often the correct solution is a balanced approach between multiple solutions and/or project types. There is seldom a one size fits all approach.

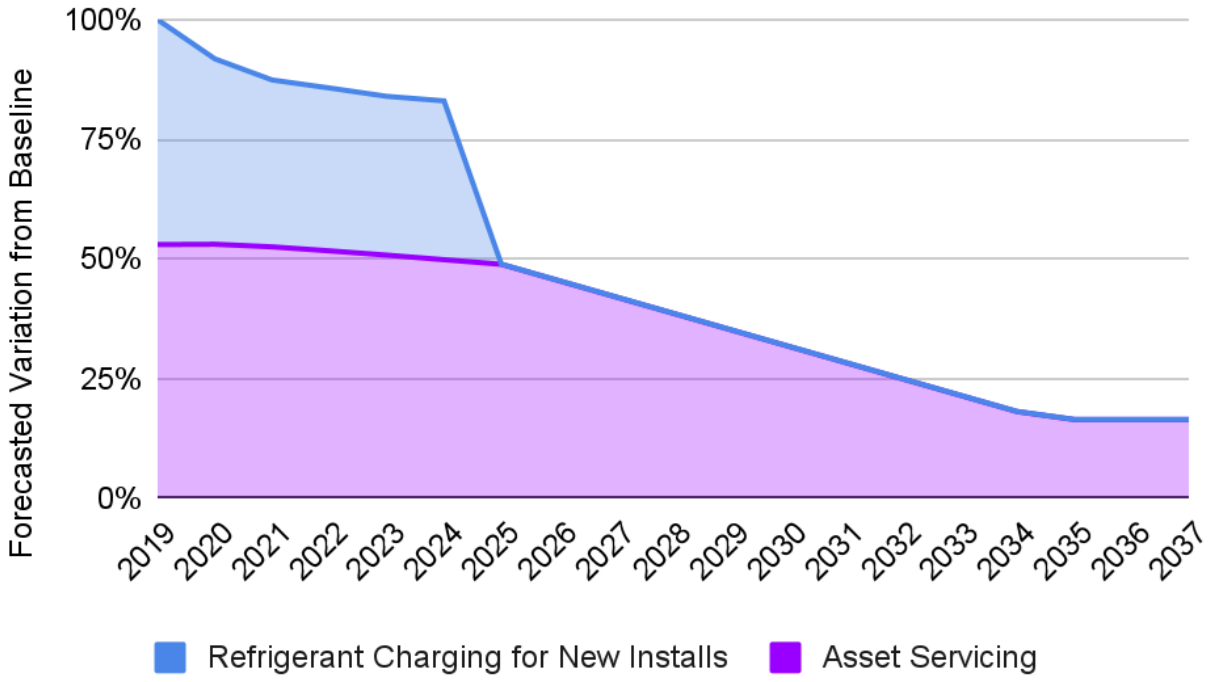
Existing Store Challenges & Opportunities

Too often we focus on new stores, but existing store strategies are the key to successful regulatory compliance, emissions reduction, and cost control.

Data provides the opportunity to optimize existing store strategies, while balancing the challenges inherent with these stores (i.e., operational impacts).

	Factor	Existing Stores	New Stores
Opportunity	Emission Reduction Potential	**Opportunity**	None
Opportunity	Cost Reduction Potential	**Opportunity**	None
Opportunity	Transferable Asset Opportunity	**Opportunity**	None
Opportunity	Historical Data	**Opportunity**	None
Challenge	Compliance Risks	**Challenge**	**Challenge**
Challenge	Legacy Investments	**Challenge**	None
Challenge	Store Disruption	**Challenge**	None

Refrigeration Sector Refrigerant Demand Forecasting



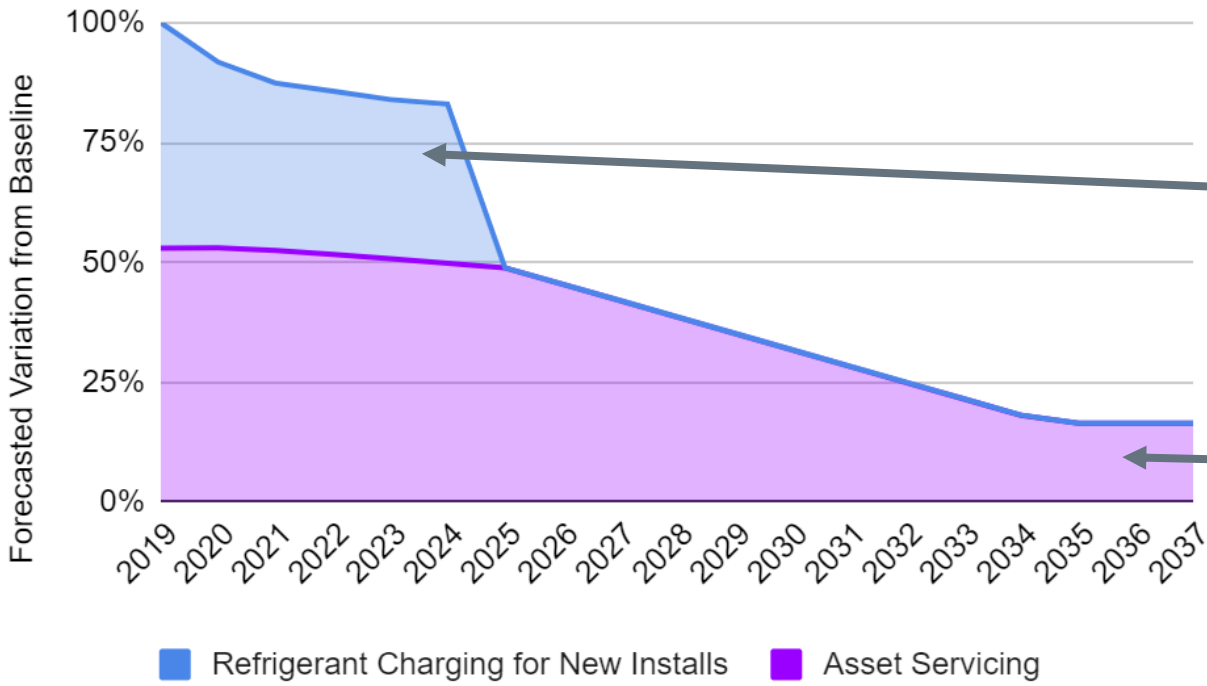
- Data can help us forecast and understand the long term challenges.
- US refrigeration sector mtCO2e (metric tons of carbon dioxide equivalent) demand has been modelled.
- This shows that at current rates*, the refrigeration industry refrigerant demand will be overwhelmingly generated from existing stores today.
- With factors such as the AIM Act HFC phasedown, these assets will be subject to serviceability and price increase risks.
- This shows existing assets are critical, as well as the benefits of increased rates of refrigerant reclaim

Model Notes

EPA reports Inventory of U.S. Greenhouse Gas Emissions and Sinks and Draft Regulatory Impact Analysis Addendum: Impact of the Technology Transitions Proposed Rule (December 2022) are sources for many of the factors included, such as: refrigerant transitions (R-744 assumed for new assets from 2025), refrigeration sector growth, asset leak rates, asset turnover rates.

Baseline & new asset leakage assumed consistent. New asset charge sizes assumed consistent with baseline equipment. No refrigerant stockpiling or reclaim factored in.

What needs to Happen?



Minimize entrained carbon (GHGp*) required to charge asset initially and therefore potential for emissions from leaks

Minimize leakage as assets wait to be replaced

**GHGp = Refrigerant Amount x GWP*

Simply put, these 2 activities are the keys to:

- Being compliant with EPA and state HFC regulations
- Reducing emissions
- Reducing OPEX costs (e.g., price increases for high-GWP refrigerants)

A data driven refrigerant strategy can balance the financial and environmental considerations and help find the most appropriate means of carrying out these 2 key activities.

Existing Site Project Type Overviews

At a high level, an existing store refrigerant strategy generally involves carrying out 3 project types.

	Gas Changes	System Replacements	Maintenance
Description	Replace the refrigerant in existing systems with a new refrigerant	Replacing refrigerant equipment with new equipment	Maintain equipment without significant changes
Emissions Reduction (Scope 1)	Medium	Good	Varied
CAPEX	Medium	Bad	Good
OPEX	Varied	Good	Varied
Project Store Disruption	Medium	Bad	Good
Key Risk	Subsequent projects likely necessary in near future	Potential write-off of existing equipment before end of life	Leakage reduction is inherently uncertain
Opportunity	Cost effective means of high GWP removal and establishment of gas bank reserves	Significant reduction in GWP. New assets improve efficiency and in-store experience	*Can* be the most cost effective way to minimize leakage

Optimizing your strategy means picking the right option or options for a given store or asset, maximizing the upside of a given approach and minimizing the risk associated with it.

Strategic Forecasting Process Overview

We have developed tools to find the optimal strategy, and to track and manage strategy execution.

How it works

1. Start with the data
2. Add industry knowledge and form asset replacement prioritization order
3. Compare different asset strategies in dynamic forecasting tool
4. Choose strategy and plan projects
5. Provide real time oversight to track implementation & progress of chosen strategy
6. Adjust and improve data and strategy as required

Existing Asset Prioritization Metrics

Existing stores have data that can inform your decisions of what option or options to apply for a given store or asset, and strike the right balance between key strategic goals.

Data can also provide you with the most pragmatic and impactful project order for the given objectives.

Some of the useful metrics to consider are as follows:

- Maintenance Spend
- Energy Consumption
- Asset Age
- Entrained Carbon or GHG potential (tCO2e)
- Leakage Event Counts or Frequency
- Annual Leak Rate %
- Annual Emissions (tCO2e)
- Option Emissions Reduction Potential
- Option Emission Reduction per Unit Cost (e.g. tCO2e per $)
- Compliance Risk
- Any additional metrics based on store or asset specific data (e.g. store profitability, recent investments, etc.)

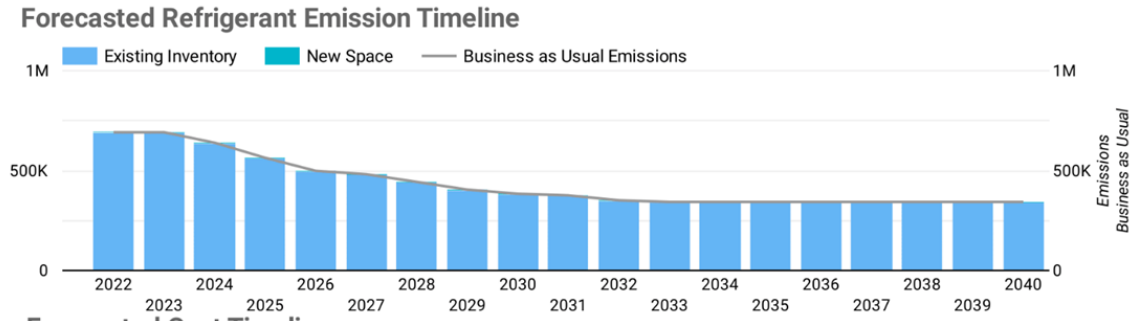
Even without a quality data starting point, estimates can often be made from what data is available, and significant improvements on a ‘hit and hope’ strategy can still be achieved.

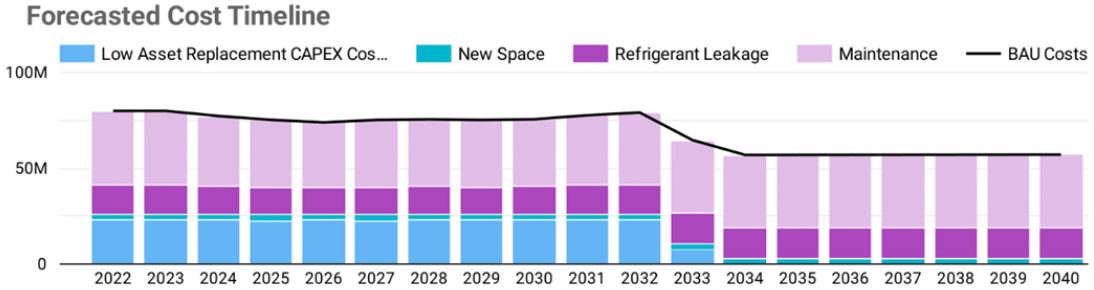
Project Roadmapping

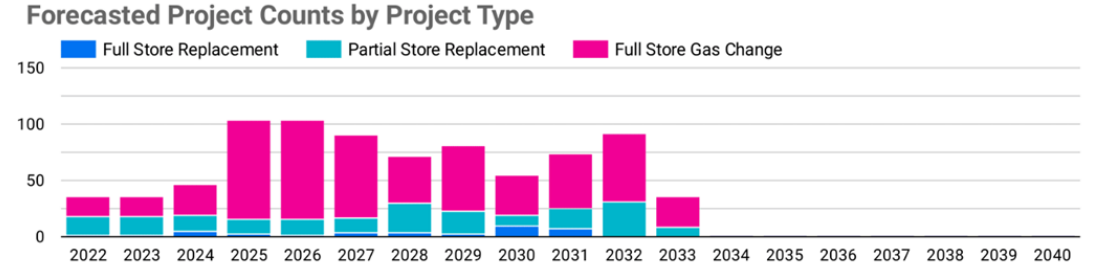
- Once sites and assets are designated to the various project types that are being considered, project strategy roadmaps can be created.
- The impact of a given roadmap can be forecast to show the short and long term environmental, compliance and financial impacts of a given strategy.
- Multiple roadmaps can be created and compared, to aid decision making and strike the right balance between the various considerations.
- This data will often show that the environmental option is the most financially beneficial.
- The following slides look at finding an optimal strategy to reduce emissions considering 4 different project types:

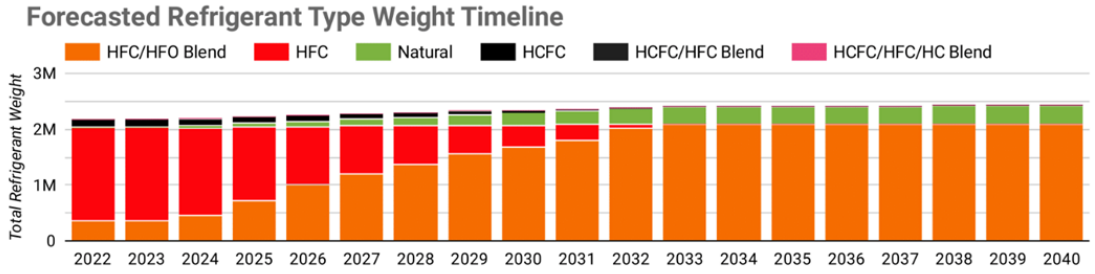
Gas Changes	Replacements	Improved Maintenance	Business As Usual (BAU) Maintenance
Assets with large charges of high GWP refrigerant but low leak rates, and recent new equipment or investments	Assets nearing or at end of life (EOL), prioritized in order of sites with most EOL assets in them	Sites with medium GWP refrigerant (such as recently gas changed assets), and moderate leak rates	All other sites

Example Scenario
Aggressive Gas Change Strategy









	Emisions Reduction from 2019
In 2030	45% Decrease
In 2040	50% Decrease

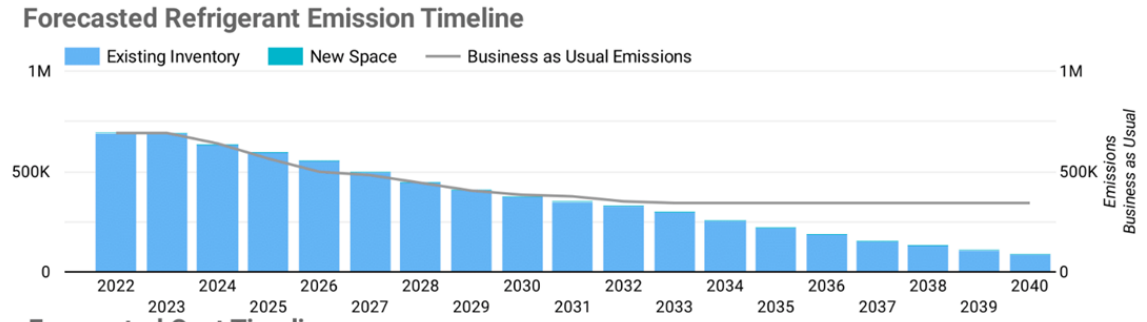
	2022 STATS	FORECASTED 2030 STATS
SUSTAINABILITY	Annual Emissions 691.9K	Annual Emissions 383.9K
	Refrigerant Weight 2.2M	Refrigerant Weight 2.3M
	Entrained Carbon 3.1M	Entrained Carbon 1.7M
	Leak Rate % 22.0%	Leak Rate % 24.3%
FINANCIAL	Maintenance Cost $38M	Maintenance Cost $35M
	Refrigerant Cost $16M	Refrigerant Cost $14M
	Replacement Cost $30M	Replacement Cost $30M
	New Space Cost $3M	New Space Cost $3M
	Total Annual Cost $84M	Total Annual Cost $80M

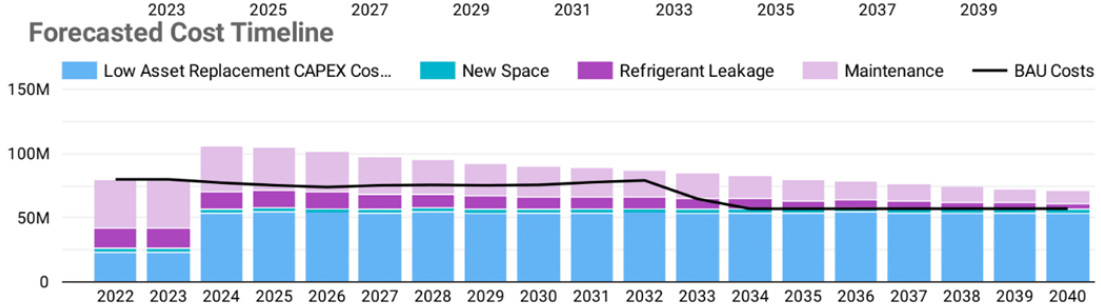
	2030	2040
Emissions Reduction	High	Low
Regulation Risk	Likely to cause cost and serviceability issues	
Project Store Disruption	Lots of marginally disruptive projects	
Cost	Low upfront CAPEX but OPEX largely unchanged and risks increasing in future	

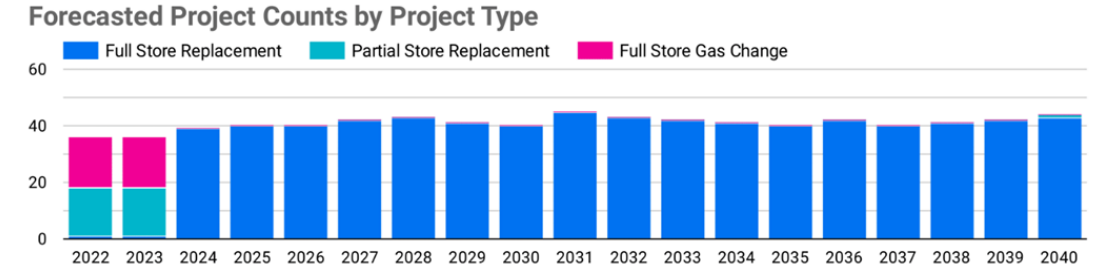
High Level Scenario Description

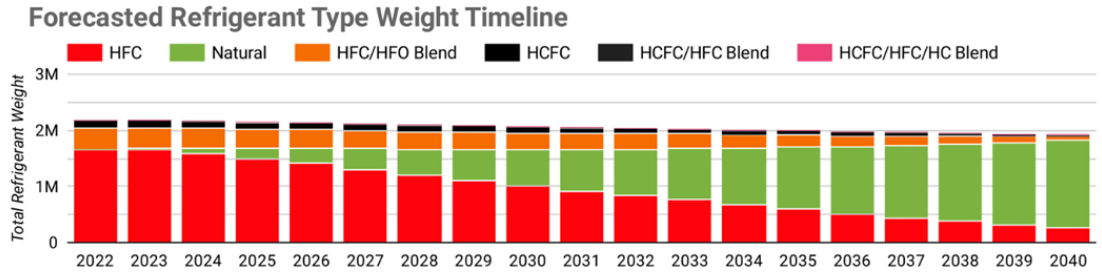
- Strategy heavily dependant on R-448A gas changes
- Leak rates of gas changed assets assumed to be 22%, the existing average leak rate.
- R-744 remodels done to assets at EOL or failure
- Emission reduction possible in near term, but there is a limit to this reduction possible without further investment as portfolio becomes R-448A saturated.
- This would require additional projects and expenditure on the aging R-448A fleet
- Scenario very susceptible to R-448A price increases and serviceability risk if proposed regulations come into play
- Scenario does enable large amounts of HFCs to be removed from the estate, building the gas bank and presenting future carbon credit opportunities.

Example Scenario
Aggressive Low-GWP Refrigerant Remodel Scenario









	Emisions Reduction from 2019
In 2030	46% Decrease
In 2040	87% Decrease

	2022 STATS	FORECASTED 2030 STATS
SUSTAINABILITY	Annual Emissions 691.9K	Annual Emissions 375.7K
	Refrigerant Weight 2.2M	Refrigerant Weight 2.0M
	Entrained Carbon 3.1M	Entrained Carbon 1.9M
	Leak Rate % 22.0%	Leak Rate % 16.4%
FINANCIAL	Maintenance Cost $38M	Maintenance Cost $24M
	Refrigerant Cost $16M	Refrigerant Cost $10M
	Replacement Cost $30M	Replacement Cost $70M
	New Space Cost $3M	New Space Cost $3M
	Total Annual Cost $84M	Total Annual Cost $103M

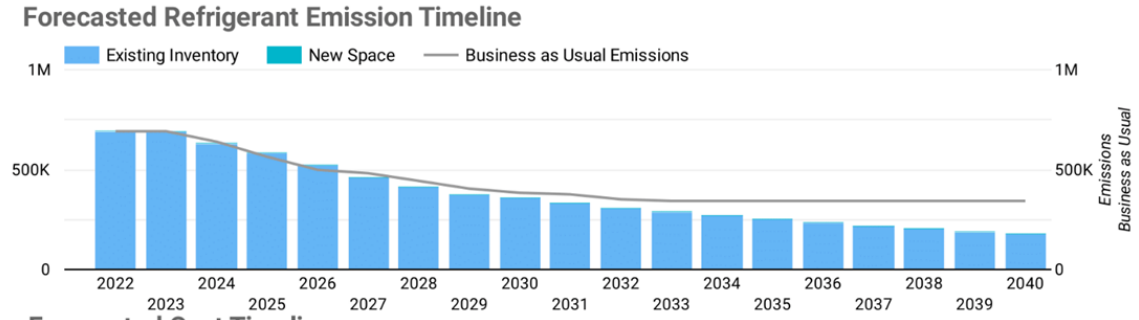
	2030	2040
Emissions Reduction	High	High
Regulation Risk	HFC serviceability risk as they are removed	
Project Store Disruption	Smaller amount, but very disruptive projects	
Cost	Large increase in replacement CAPEX	

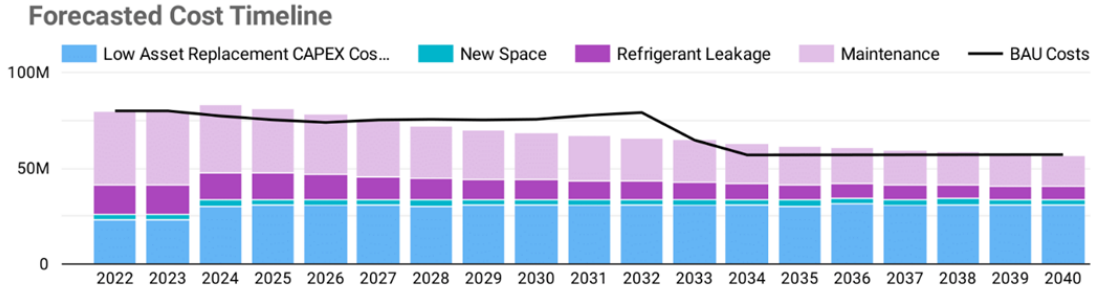
High Level Scenario Description

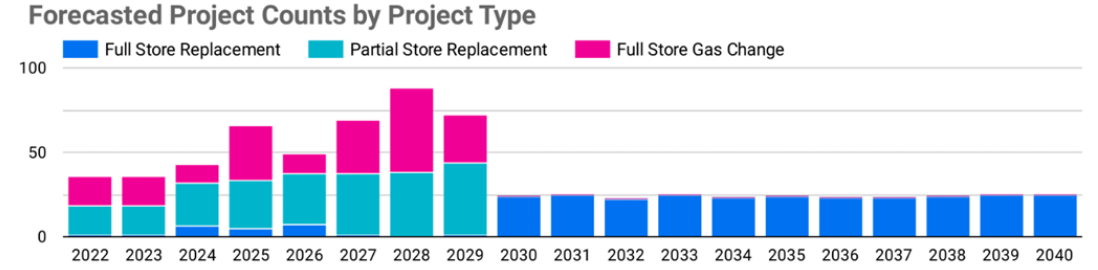
- All projects convert assets to new ultra low GWP refrigerant (i.e. R-744) equipment.
- More expensive & disruptive projects converting to ultra low GWP will enable significant long term emission reductions.
- High GWP refrigerants, subject to regulatory pressure will still remain for a long time (the high cost nature of these projects means realistically speaking less projects can be done, therefore there is less removal of existing high GWP refrigerants).
- Overtime, this can gain cost parity, but the cumulative spend up to that point is much higher.

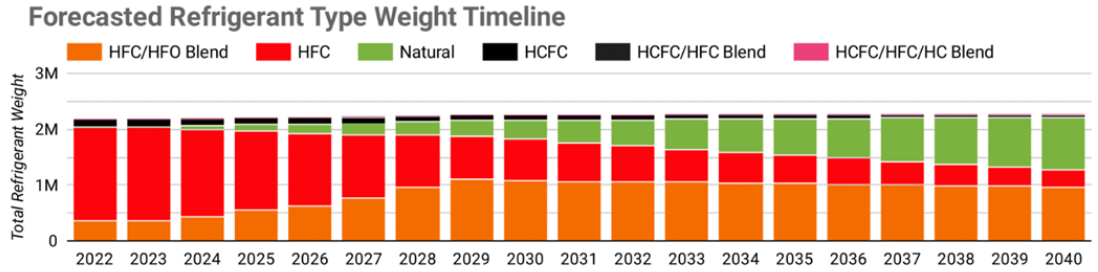
Example Scenario

Balanced Gas Change, Low-GWP Refrigerant Remodels & Post Project Maintenance









	Emisions Reduction from 2019
In 2030	48% Decrease
In 2040	74% Decrease

	2022 STATS	FORECASTED 2030 STATS
SUSTAINABILITY	Annual Emissions 691.9K	Annual Emissions 360.1K
	Refrigerant Weight 2.2M	Refrigerant Weight 2.2M
	Entrained Carbon 3.1M	Entrained Carbon 1.9M
	Leak Rate % 22.0%	Leak Rate % 16.2%
FINANCIAL	Maintenance Cost $38M	Maintenance Cost $25M
	Refrigerant Cost $16M	Refrigerant Cost $10M
	Replacement Cost $30M	Replacement Cost $40M
	New Space Cost $3M	New Space Cost $3M
	Total Annual Cost $84M	Total Annual Cost $75M

	2030	2040
Emissions Reduction	High	High
Regulation Risk	Balanced approach minimizes risk	
Project Store Disruption	Balanced approach of project types	
Cost	There's variation to the BAU, but cost per tCO2e reduction is lower overall	

High Level Scenario Description

- Balanced scenario consists of
  - Gas changes to well performing assets with long lifetimes left until 2030.
  - Increased rate of low-GWP refrigerant remodels to poor performing assets
  - Added maintenance and post project monitoring included to ensure leak rates do not increase after projects, as is often the case for gas changes.
- Cost reduction possible in long term, while continuing to reduce emissions
- Most high risk assets removed and replaced with ultra low GWP option
- HFC gas reclaimed via gas changes can help serve remaining stocks as they're phased out

Strategy Feedback Loops & Adjustment

Once a strategy is chosen, communicated & implemented, data can also provide the basis for continuous improvement of the strategy, focusing on themes such as:

- Continuously addressing the top 1% of emission assets (often accounts for a high % of total emissions)
- Post project monitoring, ensuring the projects intervention have the desired effect
- Feeding back information into the project roadmaps and adjusting strategy as required
- Forecasting impacts of new developments, such as equipment price changes or new regulations

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