

# New Rulemakings to Reduce HFC Emissions from Stationary Air-Conditioning and Refrigeration



California Air Resources Board Workshop October 24, 2018

# Today's Agenda



- CARB Presentation
  - Background
  - Rulemaking 1: Stationary Air Conditioning
  - Rulemaking 2: Stationary Refrigeration
- Questions/Comments and Open Discussion (after each rulemaking presentation)
- During presentation, webcast viewers can submit questions/comments to: [sierrarm@arb.ca.gov](mailto:sierrarm@arb.ca.gov)

# Background

- ❖ Why regulate hydrofluorocarbons (HFCs)?
- ❖ HFC emissions – what is California already doing to reduce HFCs?
- ❖ How will CA meet the HFC emissions target – 40% reduction by 2030?



# Why Regulate & Reduce HFC Emissions?



Not just HFCs, emissions of all greenhouse gases in California must be reduced:

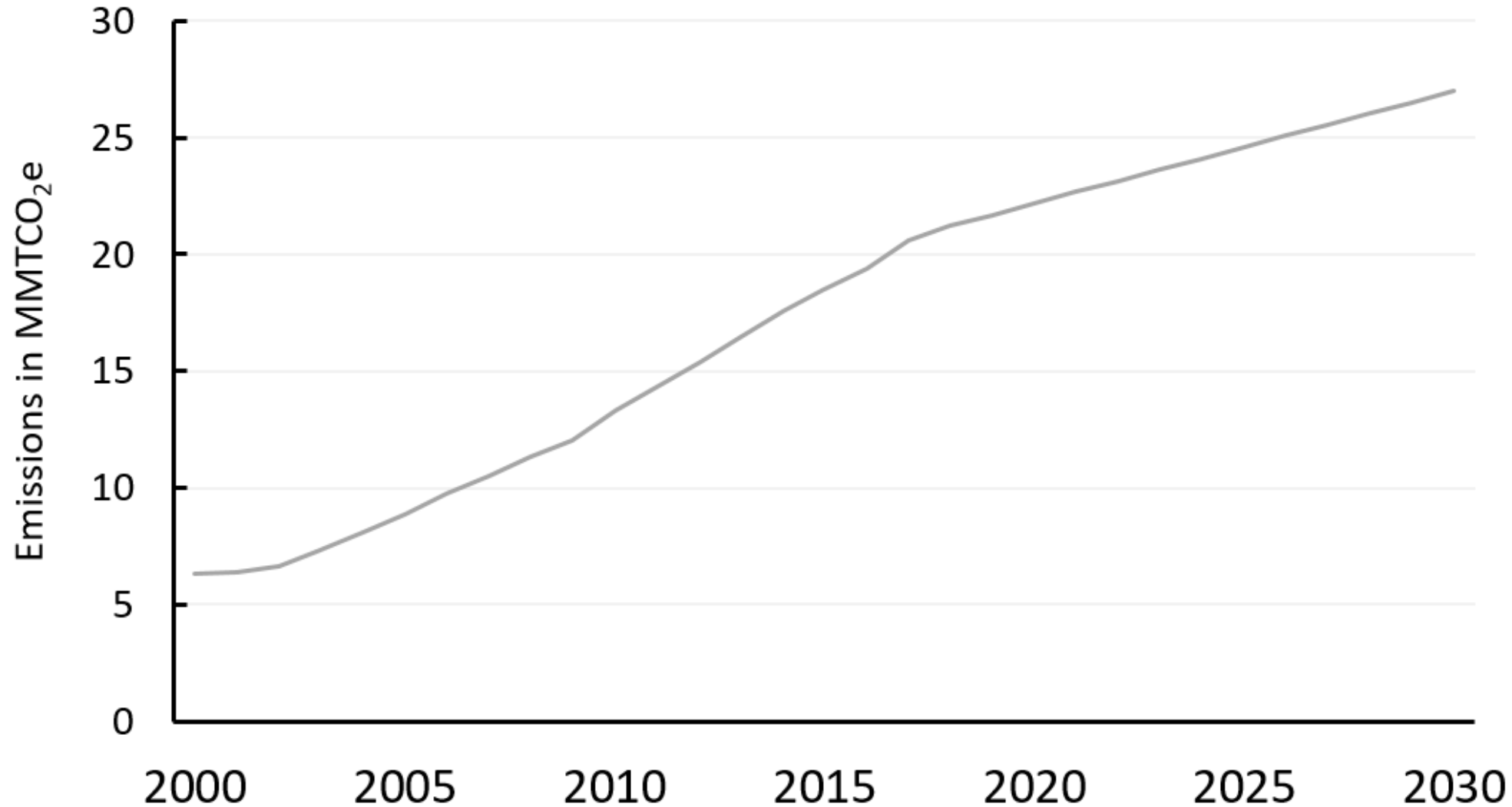
- AB 32 (2006): Reduce GHG emissions to 1990 levels by 2020
- SB 32 (2016): Reduce GHG emissions 40% below 1990 levels by 2030
- Governor's Executive Order B-55-18 (2018): California must be carbon neutral - zero net GHG emissions by 2045.
- HFCs from refrigeration and AC contribute to GHG emissions
- HFCs not included in cap and trade
- SB 1383 specifically requires 40% reduction in HFC emissions

# HFC Emissions

# HFCs are the Fastest Growing Greenhouse Gases



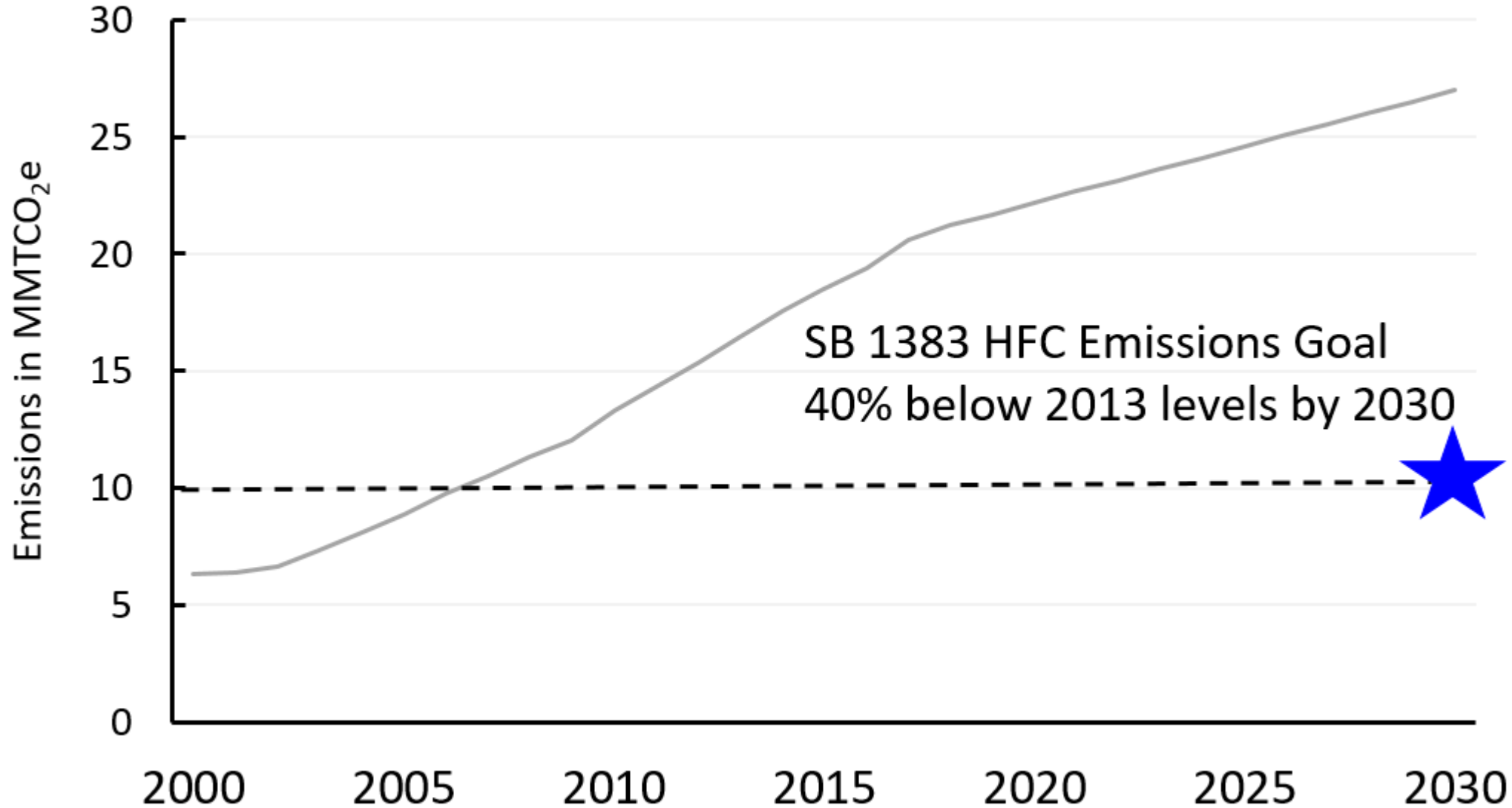
## HFC Emissions in California 2000-2030 (BAU)



# HFCs are the Fastest Growing Greenhouse Gases



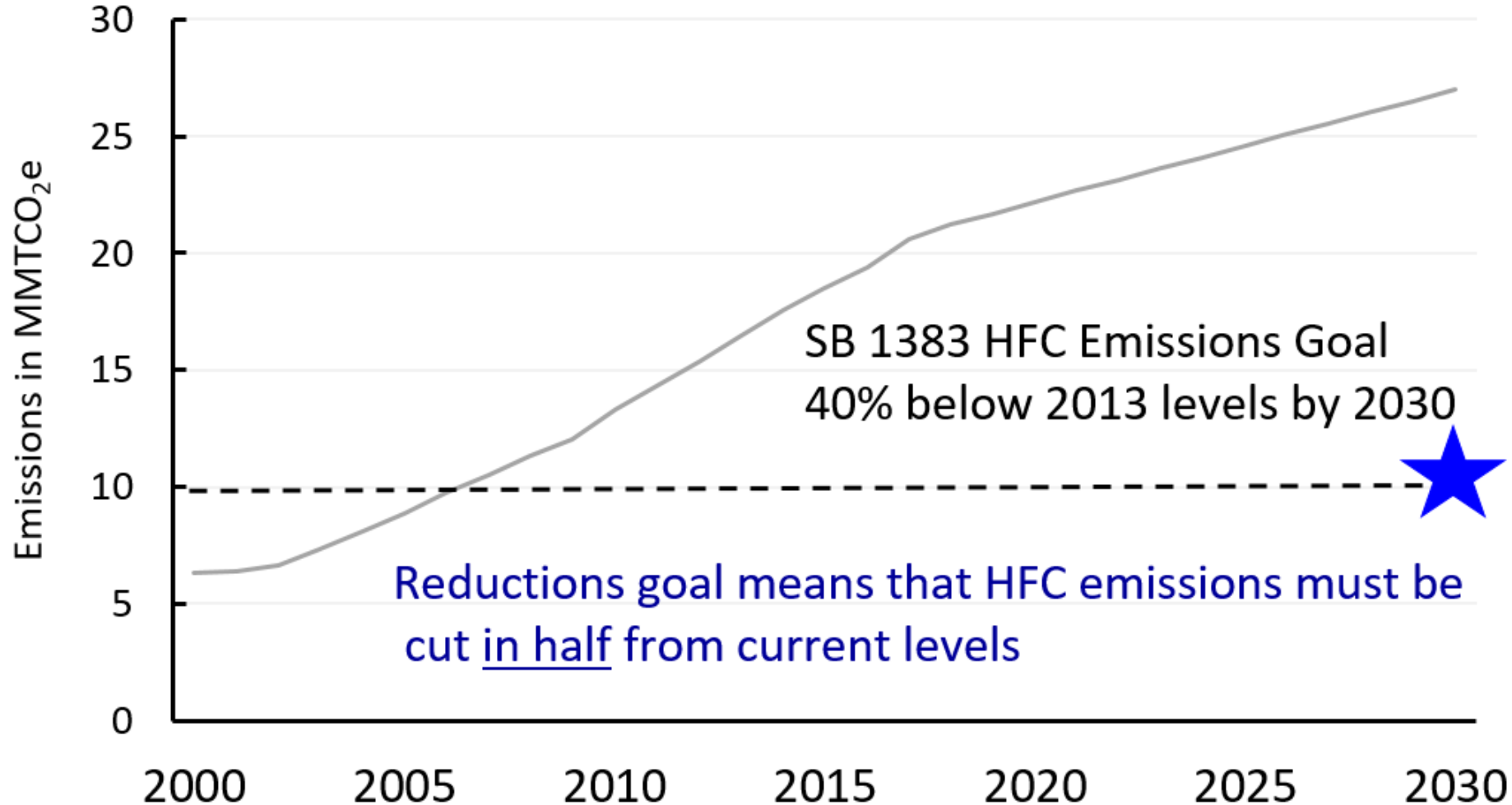
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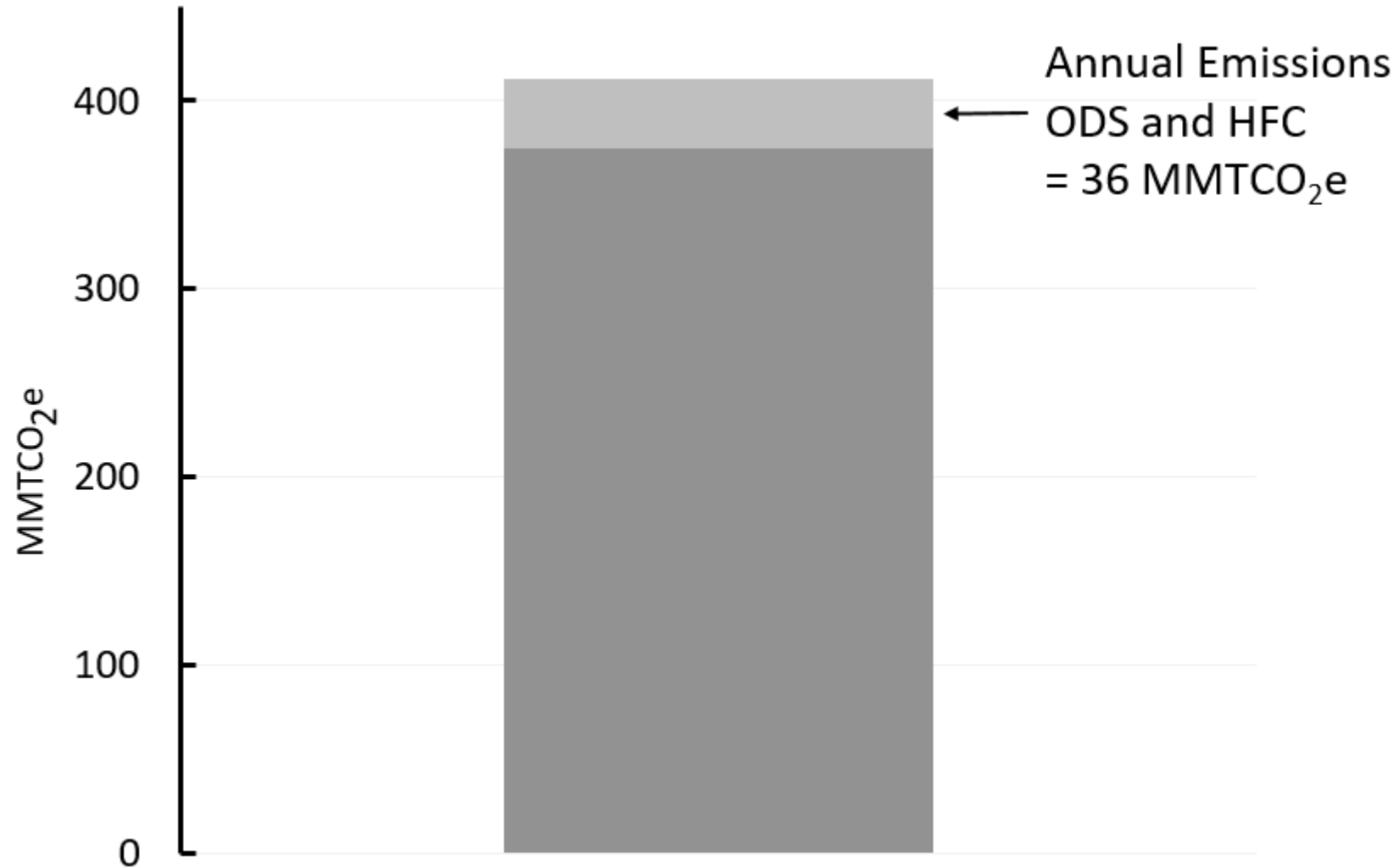


## HFC Emissions in California 2000-2030 (BAU)

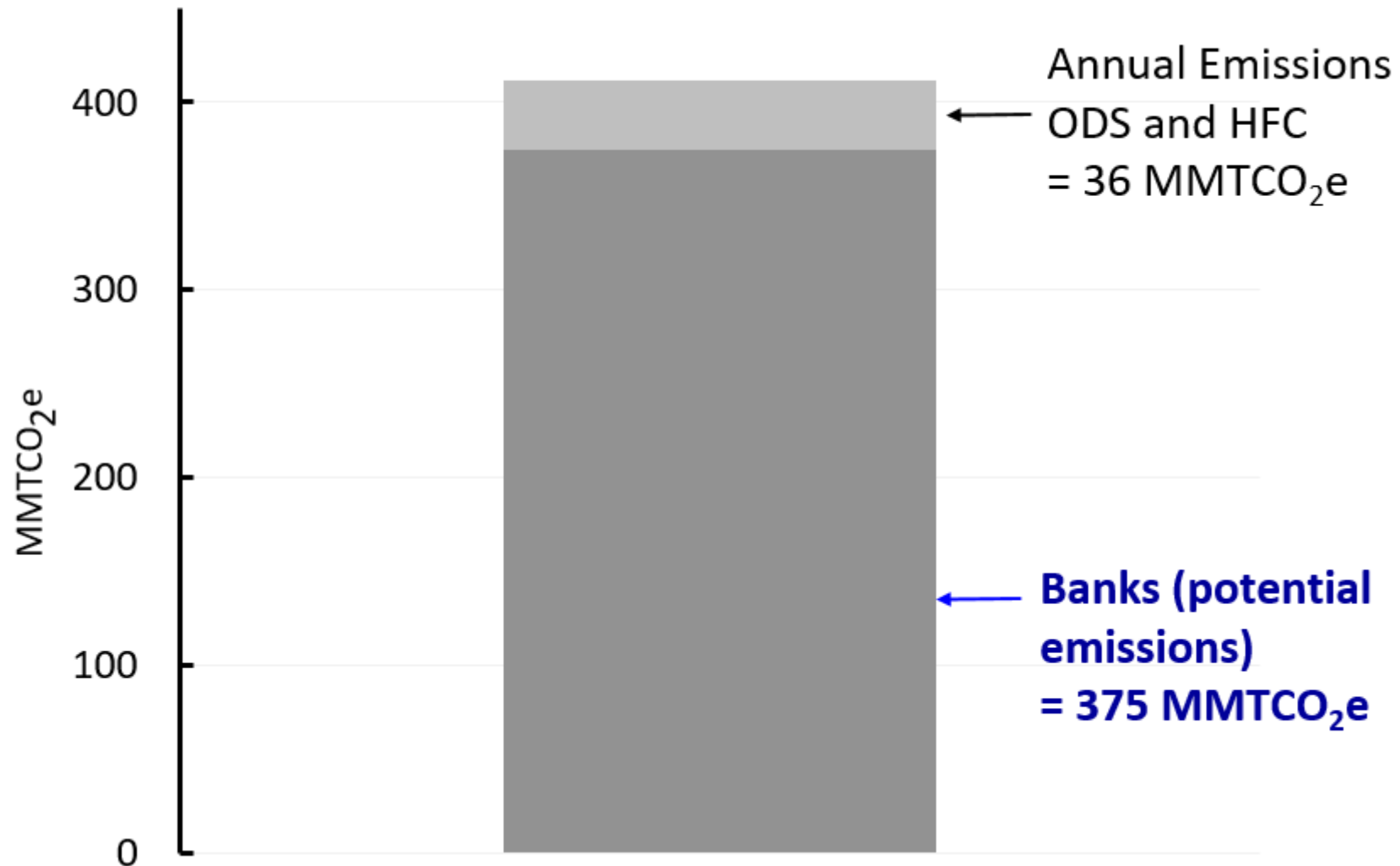




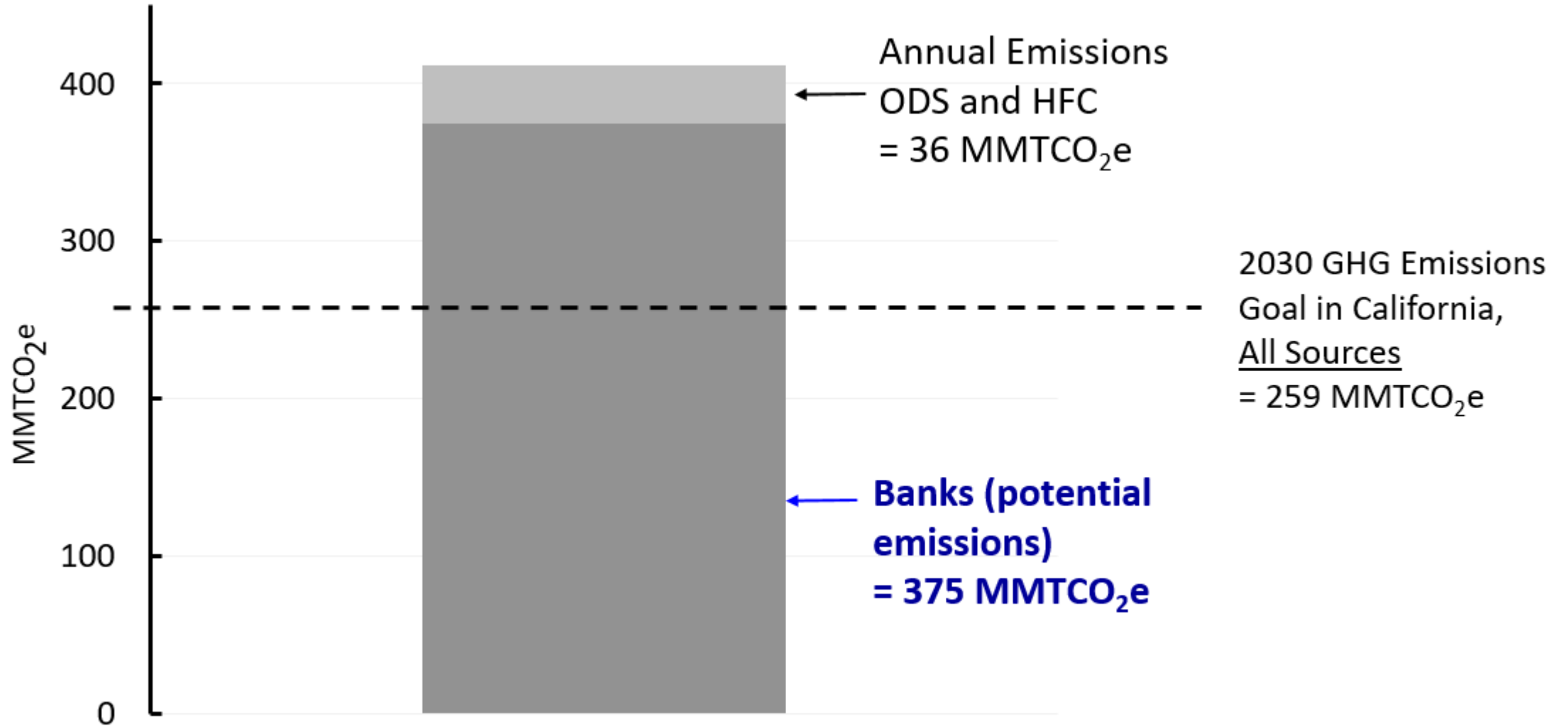
# Annual California Emissions in 2018 compared to the Banks (Installed Base) of HFCs and ODS – Potential Emissions



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# Annual California Emissions in 2018 compared to the Banks (Installed Base) of HFCs and ODS – Potential Emissions



# What is California Already Doing to Reduce HFCs?

# Current HFC and ODS Measures

- **Regulations adopted under AB 32:**
  - Refrigerant Management Program (RMP)
  - Motor Vehicle AC: Advanced Clean Cars low-GWP AC, and Small Can Recycling for DIYers
  - Consumer product aerosol propellants
  - Semiconductor manufacturing F-gas reductions
- **Cap-and-Trade offset protocol** for ODS capture and destruction

# Current HFC Measures (cont.)

**California SNAP Regulation (March 2018) prohibits certain high-GWP HFCs in retrofit and new refrigeration equipment and foam**

- Continues previous U.S. EPA SNAP prohibitions for:
  - Supermarket (retail food) refrigeration
  - Remote condensing units
  - Stand-alone (self-contained) units
  - Refrigerated vending machines
  - Five of 17 foam end-use sectors

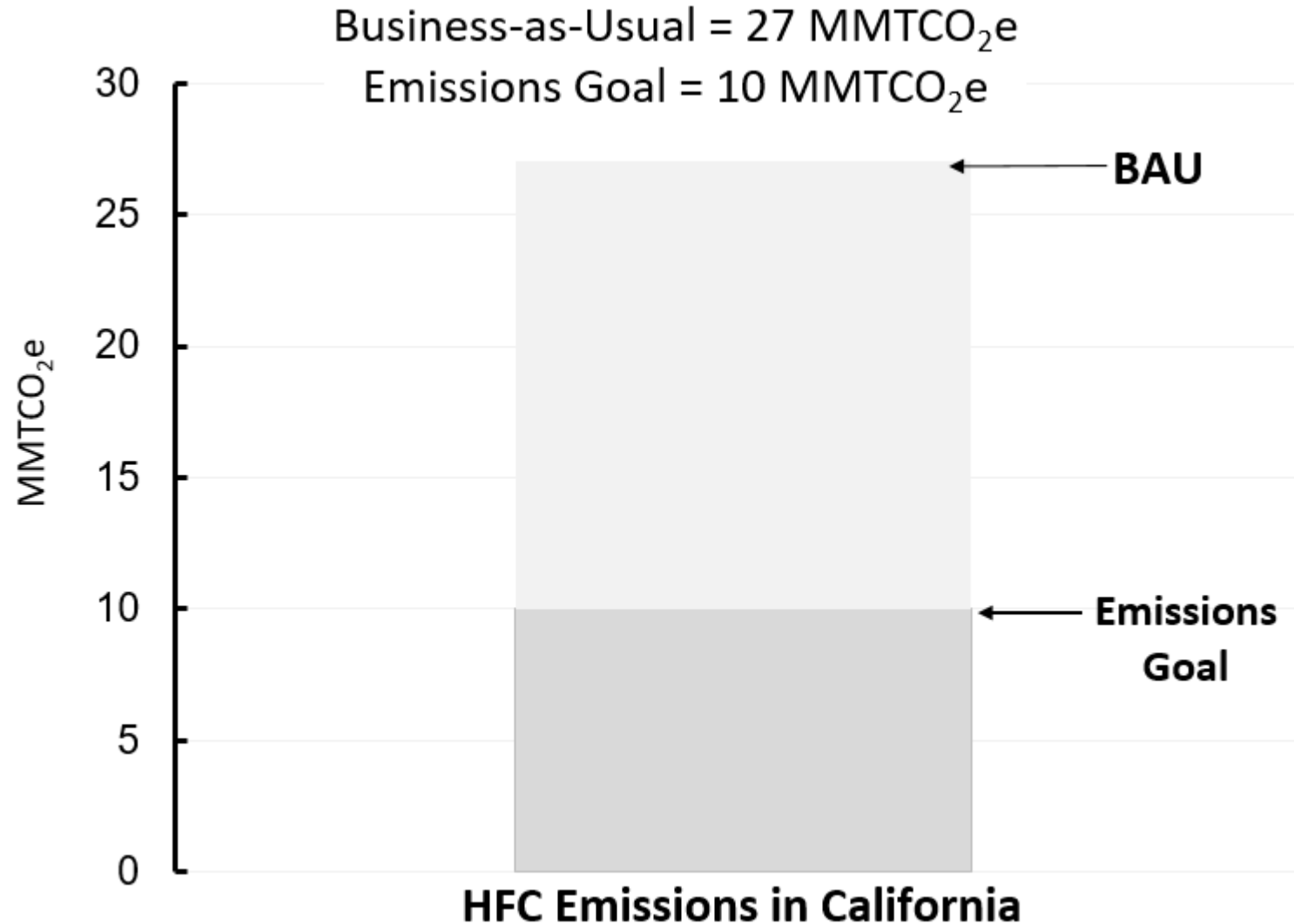
# Current HFC Measures (cont.)



## **SB 1013, the “California Cooling Act” (September 2018)**

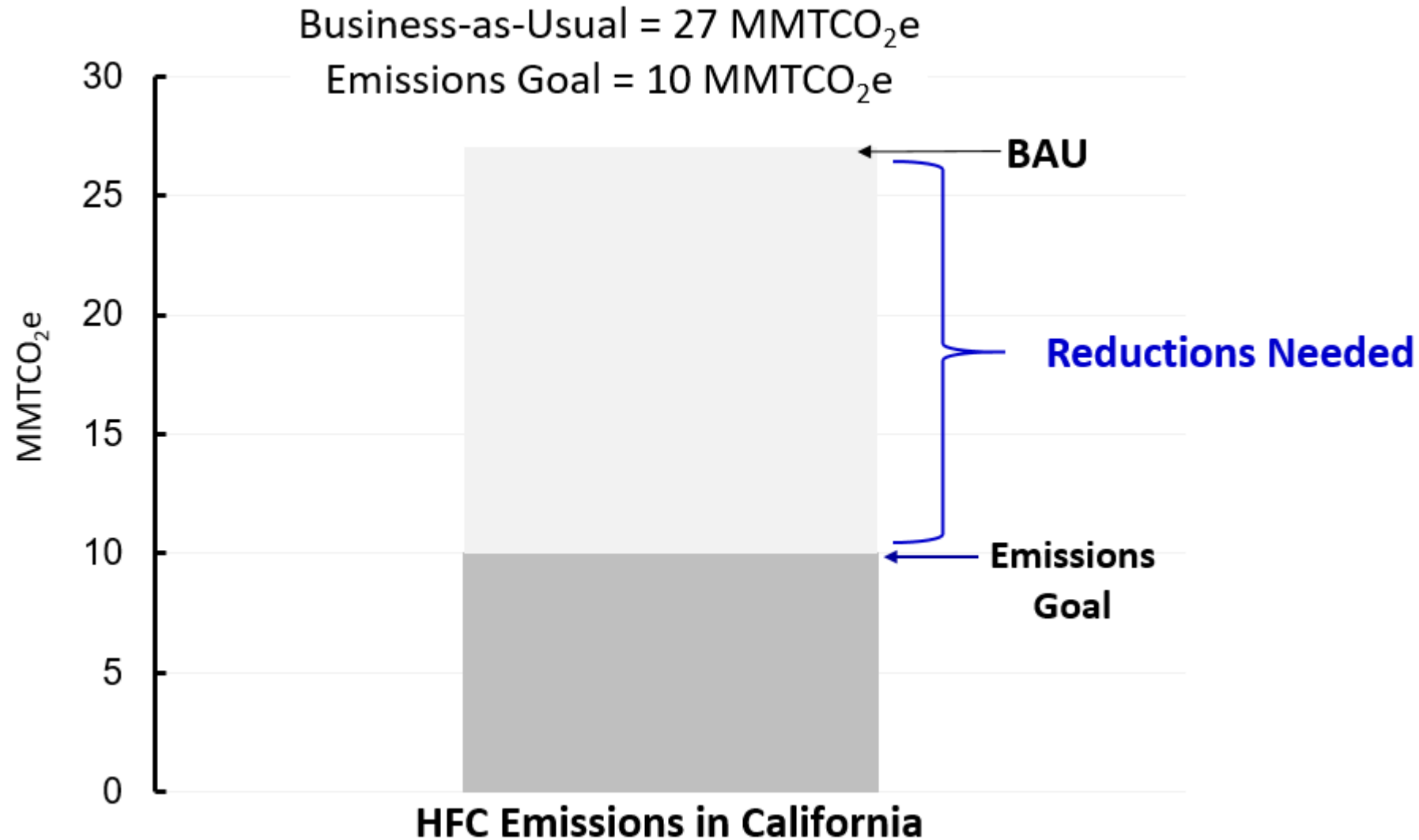
- Adopted SNAP Rules 20 and 21 prohibitions into State law
- Not previously covered in CARB March 2018 regulation: Chillers, residential refrigerator-freezers, 12 of 17 foam end-use sectors, and aerosol propellants
- Establishes an incentive program for low-GWP refrigeration
- MVAC is addressed separately by the Clean Cars Program

# How will California meet SB 1383?

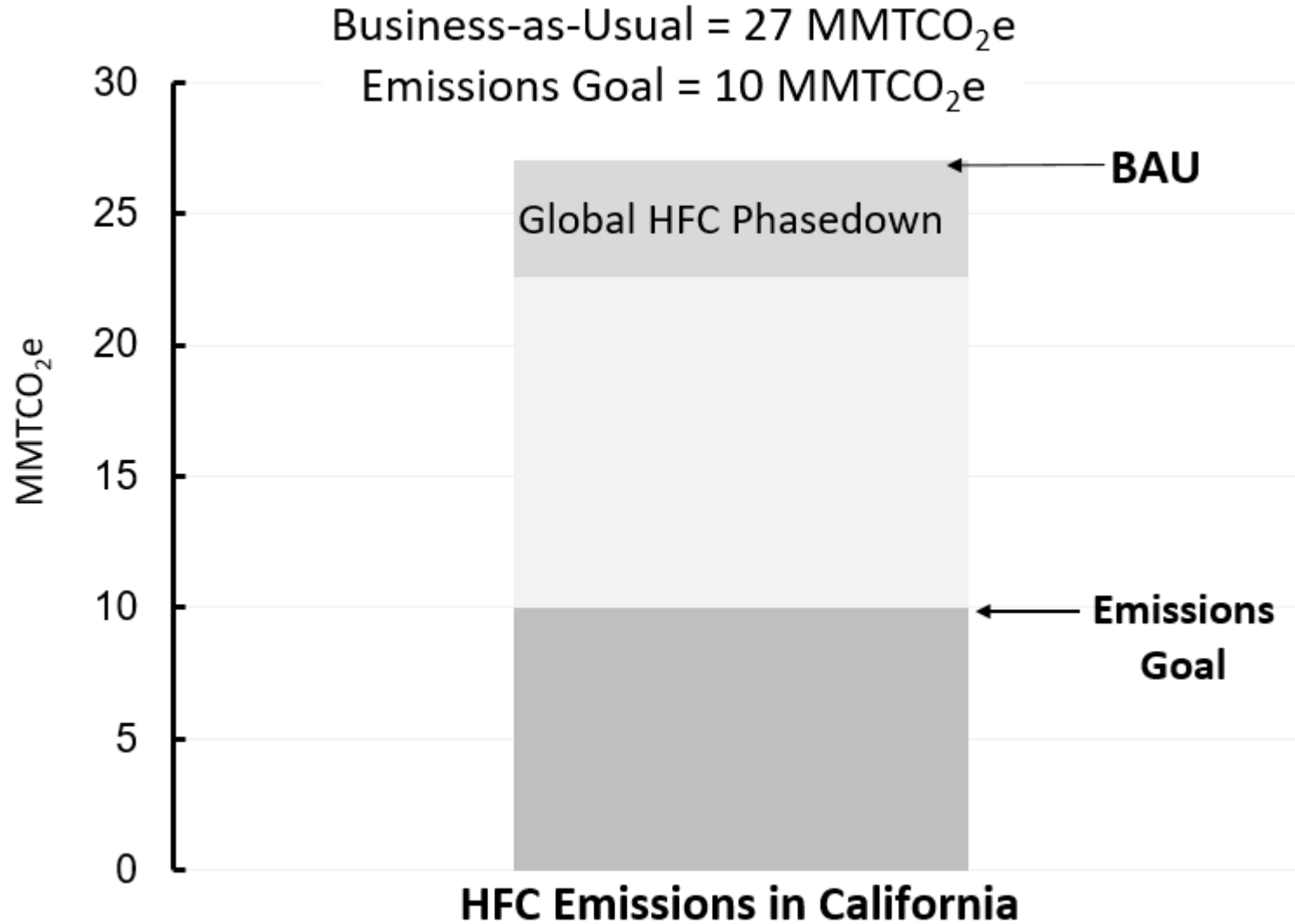




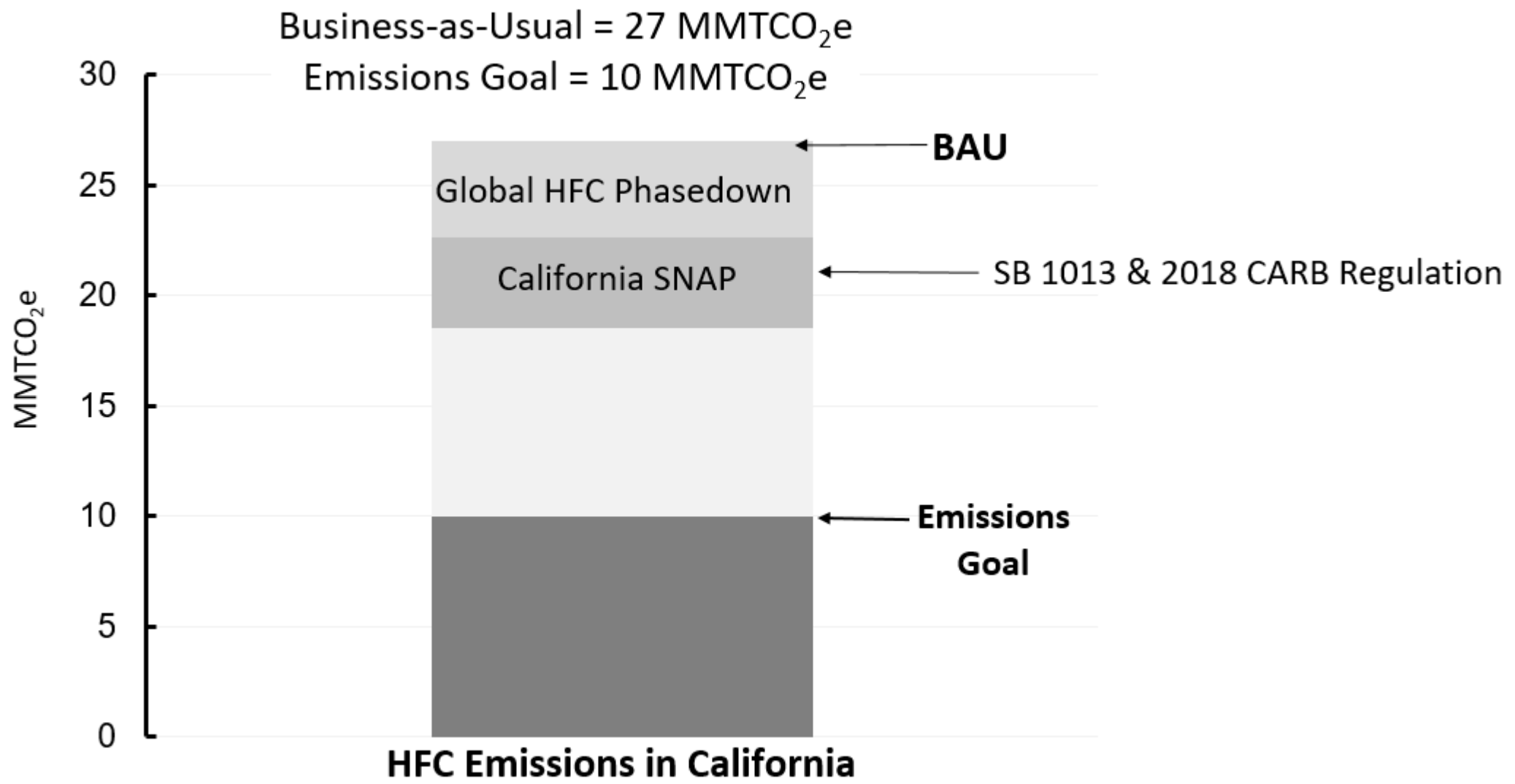
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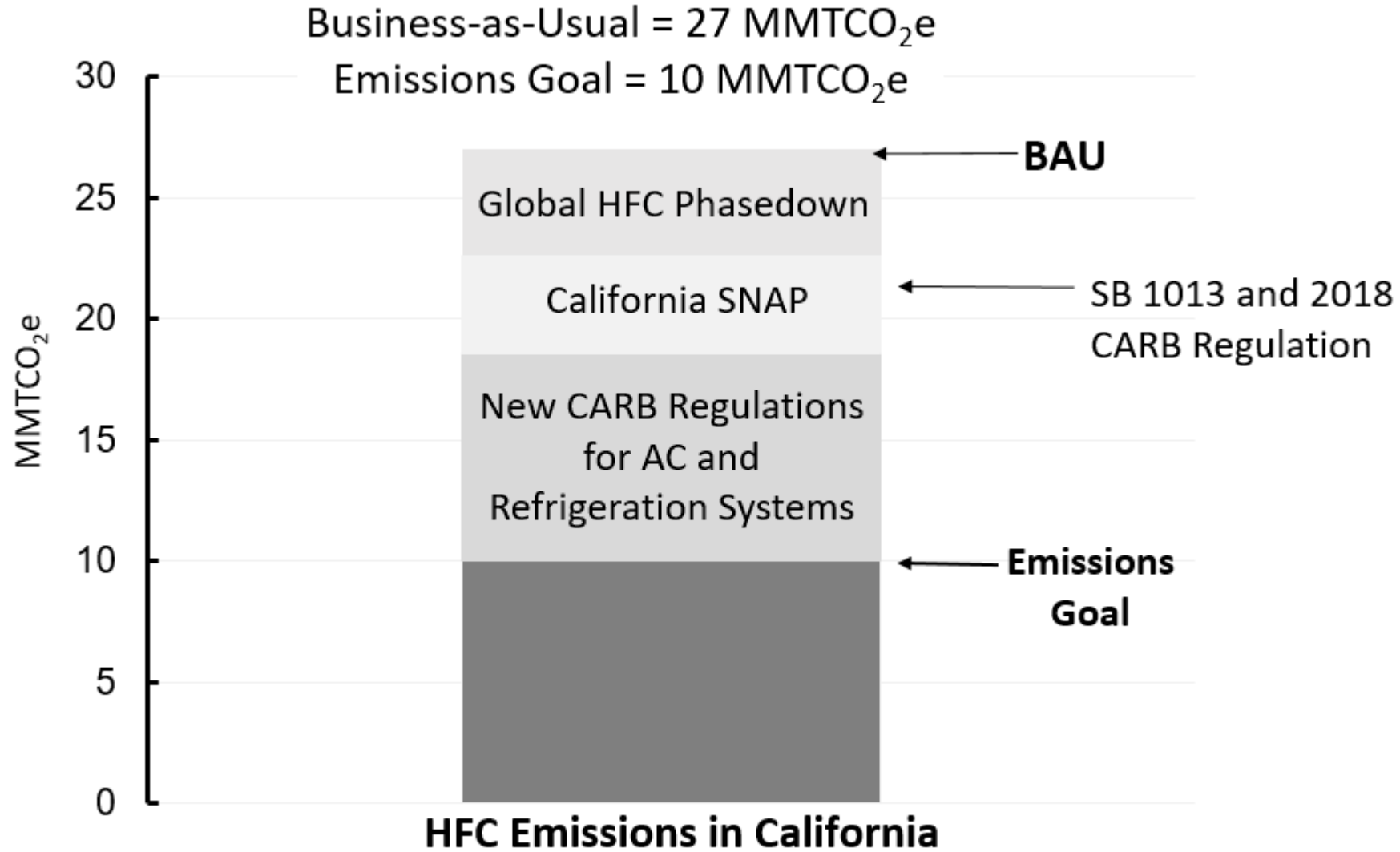
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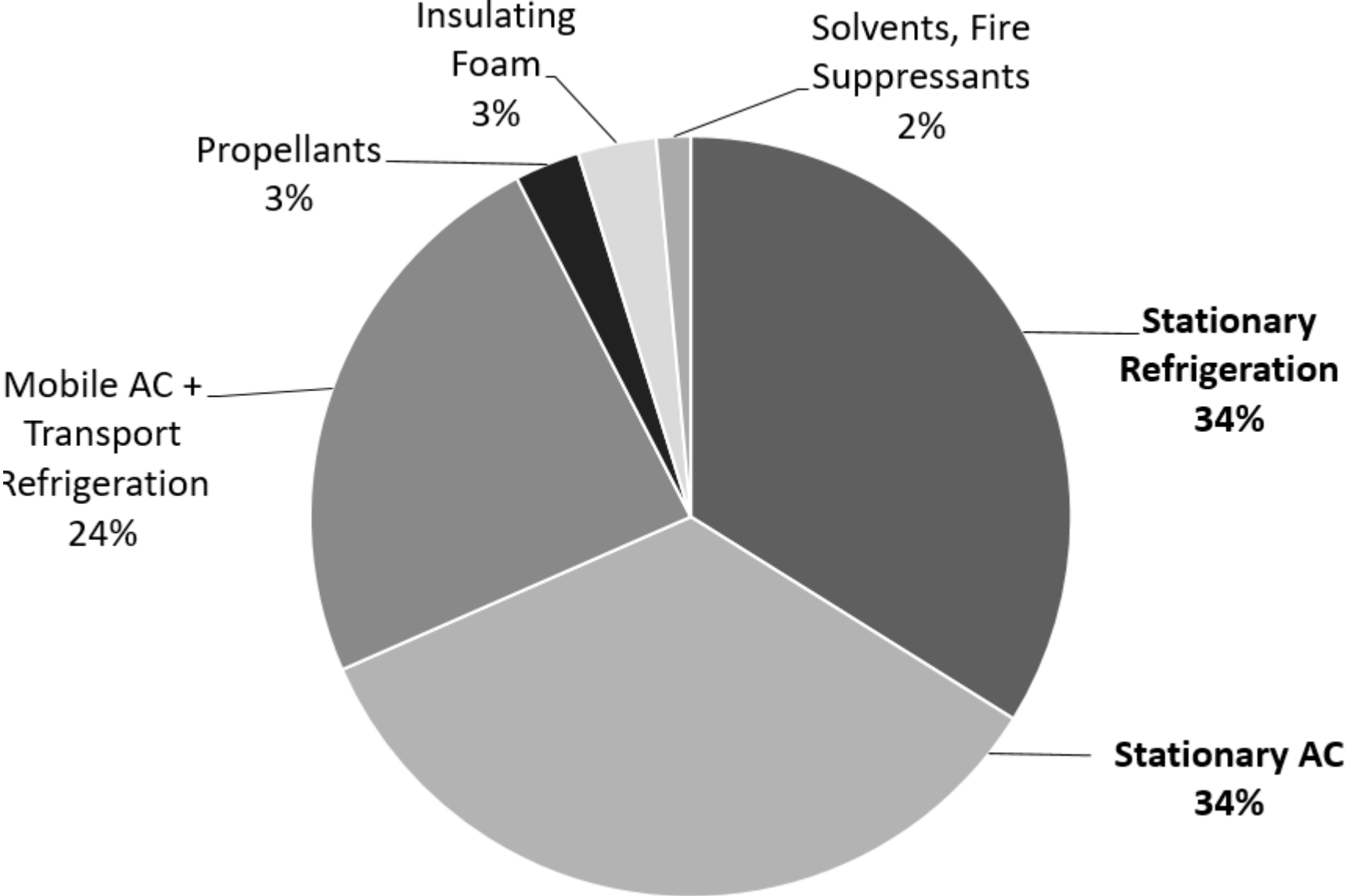


# How will California meet SB 1383?



# **Why Focus on Stationary Refrigeration and Stationary Air-Conditioning?**

# Total HFC Emissions in California in 2018 estimated at 21 MMTCO<sub>2</sub>e – 68% are from Stationary Air Conditioning and Stationary Refrigeration



# CARB Actions Align with Other Countries



- **European Union F-Gas Regulation began January 1, 2016**
  - Prohibitions on high-GWP HFCs in new equipment
- **Canada Has Adopted HFC Prohibitions similar to SNAP**
- **Additional U.S. States Proposing to Adopt SNAP Prohibitions**
  - Delaware
  - Maryland
  - Connecticut
  - New York

# Rulemaking 1

## Stationary Air Conditioning: New System Prohibition



# Industry Agrees to Lower-GWP AC beginning 2023



- Signed by; American Heating & Refrigeration Institute (AHRI) national trade group representing equipment and chemical manufacturers; Natural Resources Defense Council (NRDC); six major manufacturers; and two major chemical companies

September 14, 2018

Chair Mary Nichols  
California Air Resources Board  
1001 I Street  
PO Box 2815  
Sacramento CA 95812

Dear Chair Nichols,

The signatories to this letter support pragmatic, predictable, and cost-effective measures that allow the California Air Resources Board (CARB) to meet the state's hydrofluorocarbon (HFC) emissions reductions target as defined in California Senate Bill 1383 – a 40 percent reduction in 2030 from 2013 levels. The following measures provide industry with certainty and sufficient time to comply with the new obligations.

We support policies to limit use of HFCs in air conditioning technologies provided they include the following. CARB should:

- Implement California Senate Bill 1013 limits on HFCs in air conditioning technologies, namely the bans on certain refrigerants in building chillers in 2024.
- Adopt an additional regulation prohibiting refrigerants with a global warming potential (GWP) in excess of 750 in all new air conditioners of all other types and capacities, excluding those covered by SB 1013, starting January 1, 2023. Implement this prohibition based on the date of manufacture, with a sell-through period of six (6) months.
- Allow the distribution of products from California to other states in which they are legal for sale in cases in which California's regulations differ from those of other states.

In addition to supporting the policies above, we also:

- Support robust enforcement and strong disincentives for non-compliance for HFC measures.

# Industry Agreement

## Request of CARB



- Prohibit refrigerants with a **GWP  $\geq 750$ <sup>1</sup>** in all new air conditioners beginning **January 1, 2023**.
  - Based on date of manufacture
  - 6 month sell-through period
  - Allow distribution through California to other states
- Exclude chillers—Implement the SB 1013 bans on certain HFCs in chillers (2024)

<sup>1</sup>100-Year GWP values from the 4<sup>th</sup> IPCC Assessment Report (AR4)

# Industry Agreement

## Industry Commits to...



- Support robust enforcement and strong disincentives for noncompliance for HFC measures
- Work to complete safety standards and strongly support adoption into building codes as quickly as possible
- Support other states and municipalities adopting HFC prohibitions similar to California
- Support CARB working with CEC to encourage proper installation, commissioning, maintenance and servicing of HVACR systems

# Industry Agreement Benefits



“ We believe these measures balance environmental benefit with minimizing the cost impact on consumers, all while providing adequate time for manufacturers, distributors, and contractors to prepare for a safe and efficient transition to lower-GWP technologies”

“We believe that our recommendations will help continue the tradition of California’s leadership in technology and environmental regulations while providing market certainty which will benefit consumers and the industries that serve them.”

# Rulemaking 1: New AC Rulemaking

- **January 1, 2023** –Prohibit refrigerants with a **GWP  $\geq 750$**  in new residential and commercial AC (excluding chillers)

**Room AC Units**  
*window/wall & portable*



**Packaged Terminal AC/  
Packed Terminal Heat Pumps**



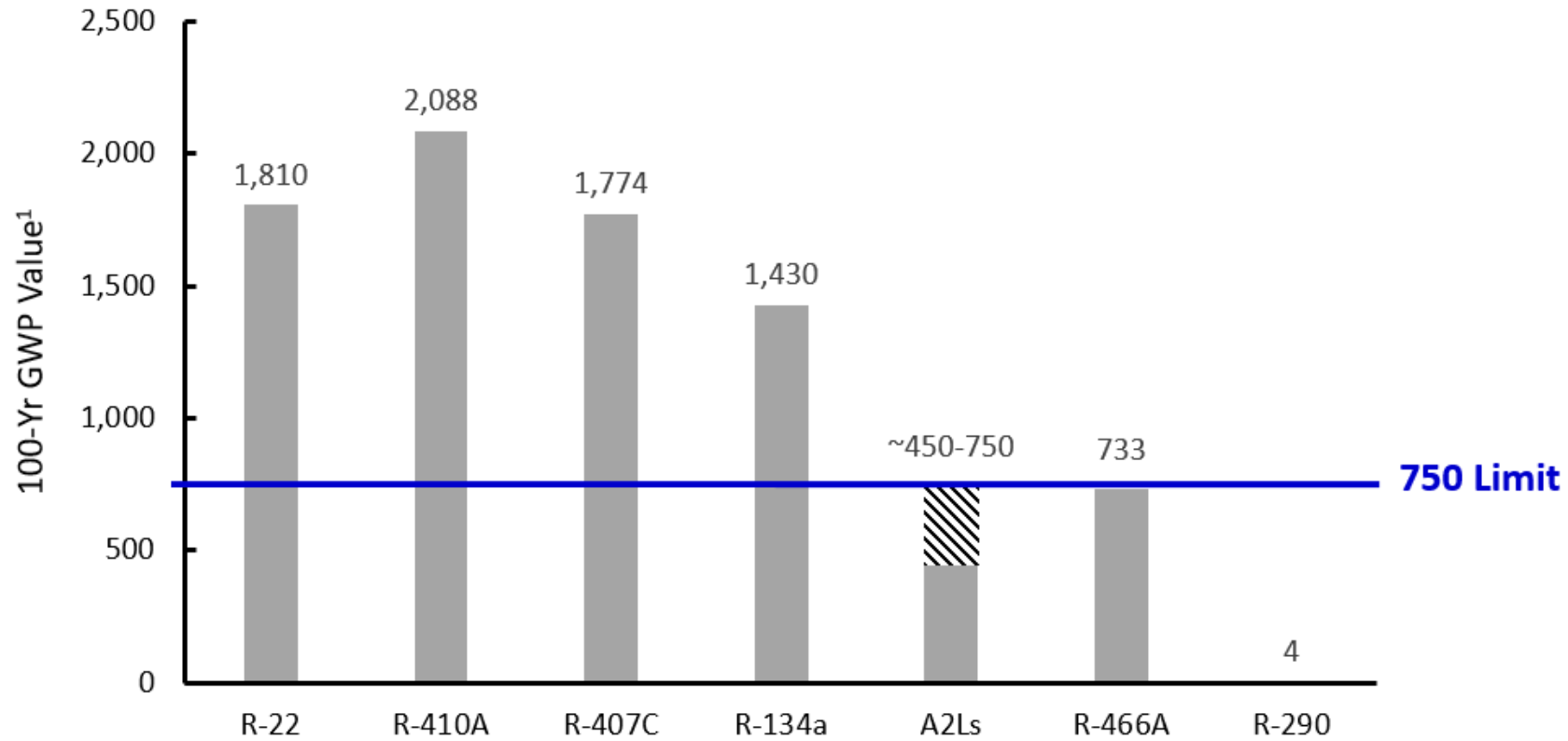
**Other Residential AC  
and Heat Pumps**  
*ducted (central AC) or ductless  
(e.g., mini-splits, multi-splits)*



**Other Commercial AC**  
*rooftop units*



# What are the Refrigerant Options?



<sup>1</sup>100-Year GWP Values are from the 4<sup>th</sup> IPCC Assessment Report (AR4)

■ Being phased out under the Montreal Protocol

■ Refrigerants under 750 GWP

# Residential and Commercial AC Options < 750 GWP



Available
  Pending C&S<sup>1</sup> Approvals
  Under development

Refrigerant	GWP	Room AC	Packaged Terminal AC/Packaged Terminal Heat Pumps	Other Residential AC & Heat Pumps (Central & Split)	Other Commercial AC <sup>2</sup>
A1 HFCs (R-466A)	< 750	□	□	□	□
Mid-GWP A2Ls (R-32)	450-750	■	■	▲	▲
R-290 (Propane)	4	▲	▲		

<sup>1</sup>Codes & standards

<sup>2</sup>This category does not include chillers.

A1: nonflammable
  A2L: slightly flammable
  A3: flammable

# Challenges



- **Codes and Standards**—completion of relevant codes and standards and adopting into building codes
- **Awareness and Training**—service technicians need to be trained to install and service low-GWP refrigerants and systems



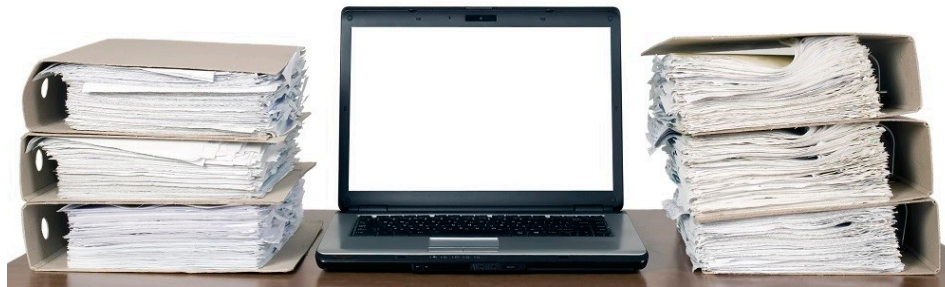
# Who is Affected?

- Stationary AC equipment manufacturers
- Refrigerant manufacturers
- Residential and commercial buildings
- Service technicians



# How Will this Regulation be Enforced?

- Recordkeeping for Manufacturers (Reporting on Request)
- Disclosure or Labeling by Manufacturers
- Auditing by CARB



# What is needed for Rulemaking?



- **Cost Analysis** – completed 6 months prior to board hearing
  - Capital costs, upfront costs and ongoing costs
  - Number of manufacturers and other impacted business in CA
  - Small business impacts
  - Sales in CA (specific equipment lines for CA?)
  - Additional costs to consumers
  - Cost-savings (over what time period?)
  - Baseline
- **Stakeholder input is key**

<b>Next Steps – Preliminary Timeline Stationary AC Rulemaking</b>	
<b>Public workshops and Stakeholder meetings</b>	Winter 2018 – Summer 2019
<b>Economic Impact Assessment</b>	June 2019
<b>Staff Report (ISOR)</b>	October 2019
<b>45-Day public comment opens</b>	October 2019
<b>Board Meeting</b>	December 2019
<b>Regulation Effective Date</b>	January 2023

# Contact Information



## CARB Staff Leads for the Rulemakings:

- **Kathryn Kynett** – AC rulemaking  
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- **Richie Kaur** – Stationary Refrigeration / RMP Amendments rulemaking  
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## Important Links

**CARB HFC Reduction Measures:** <https://ww2.arb.ca.gov/our-work/programs/hfc-reduction-measures>

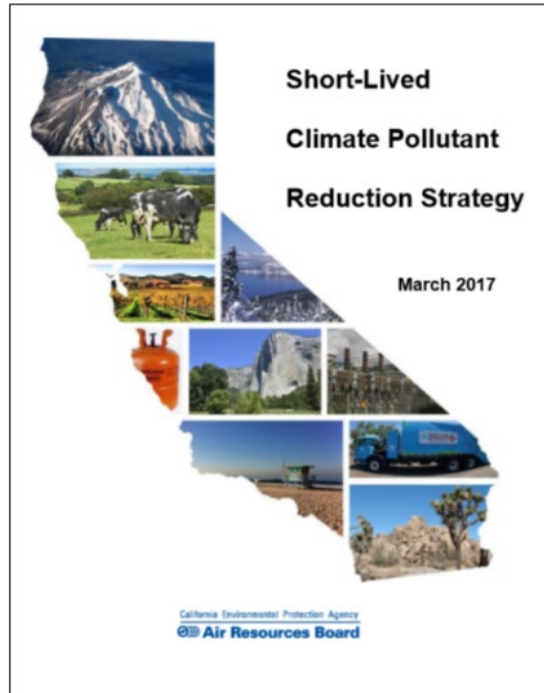
**CARB Refrigerant Management Program:** <https://ww2.arb.ca.gov/our-work/programs/refrigerant-management-program>

# Thank you for your attention!

Questions and comments welcome

Emailed questions: [sierrarm@calepa.ca.gov](mailto:sierrarm@calepa.ca.gov)

# Rulemaking 2: Stationary Refrigeration / RMP Amendments



# Refrigerant Management Program (RMP) Overview



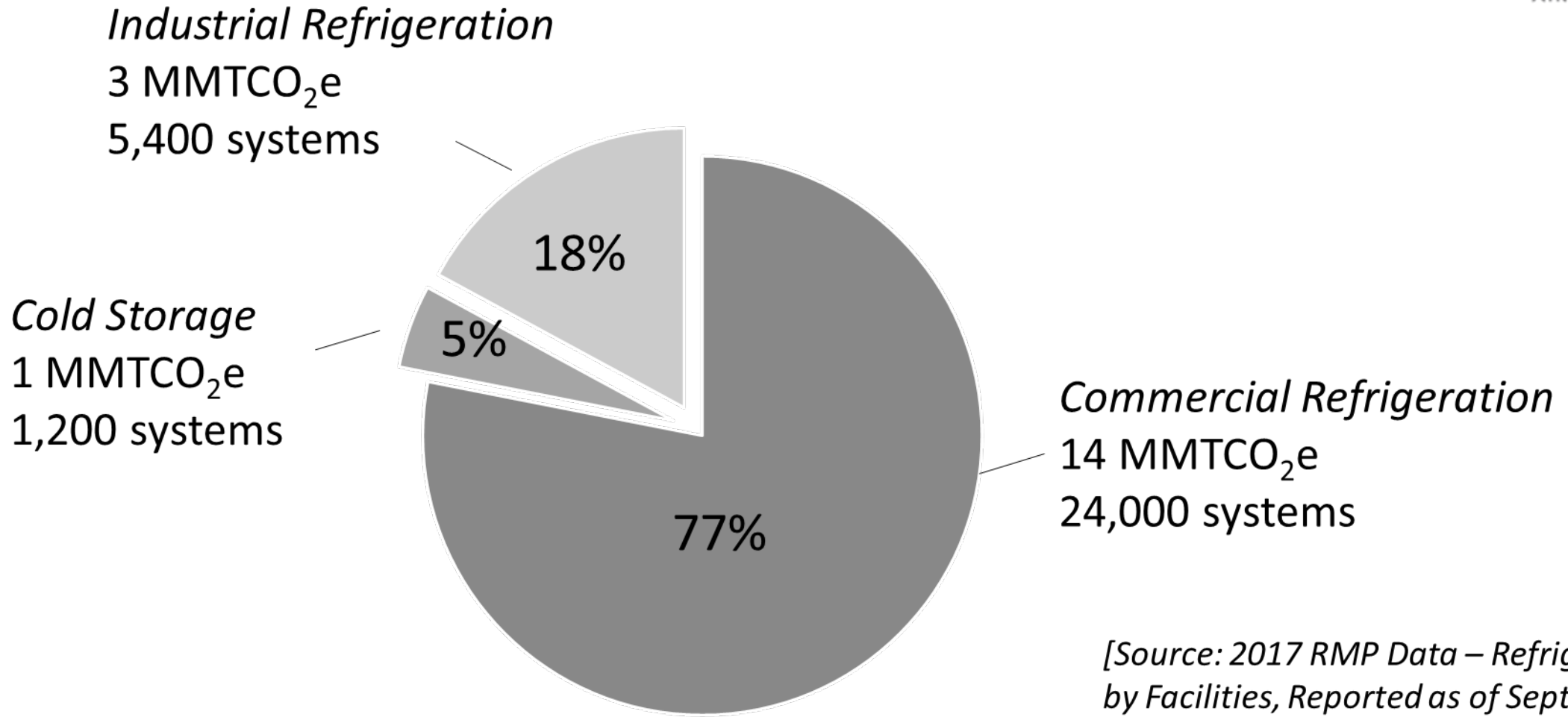
# RMP – Regulated Entities

- Facilities with systems containing > 50 lb refrigerant with a GWP  $\geq$  150
  - Commercial refrigeration – retail outlets (supermarkets, grocery stores, etc.), wholesalers
  - Industrial refrigeration – manufacturing or processing
  - Cold Storage – warehouses, packaging and storage facilities
- Refrigerant distributors and wholesalers
- Refrigerant reclaimers
- Service technicians

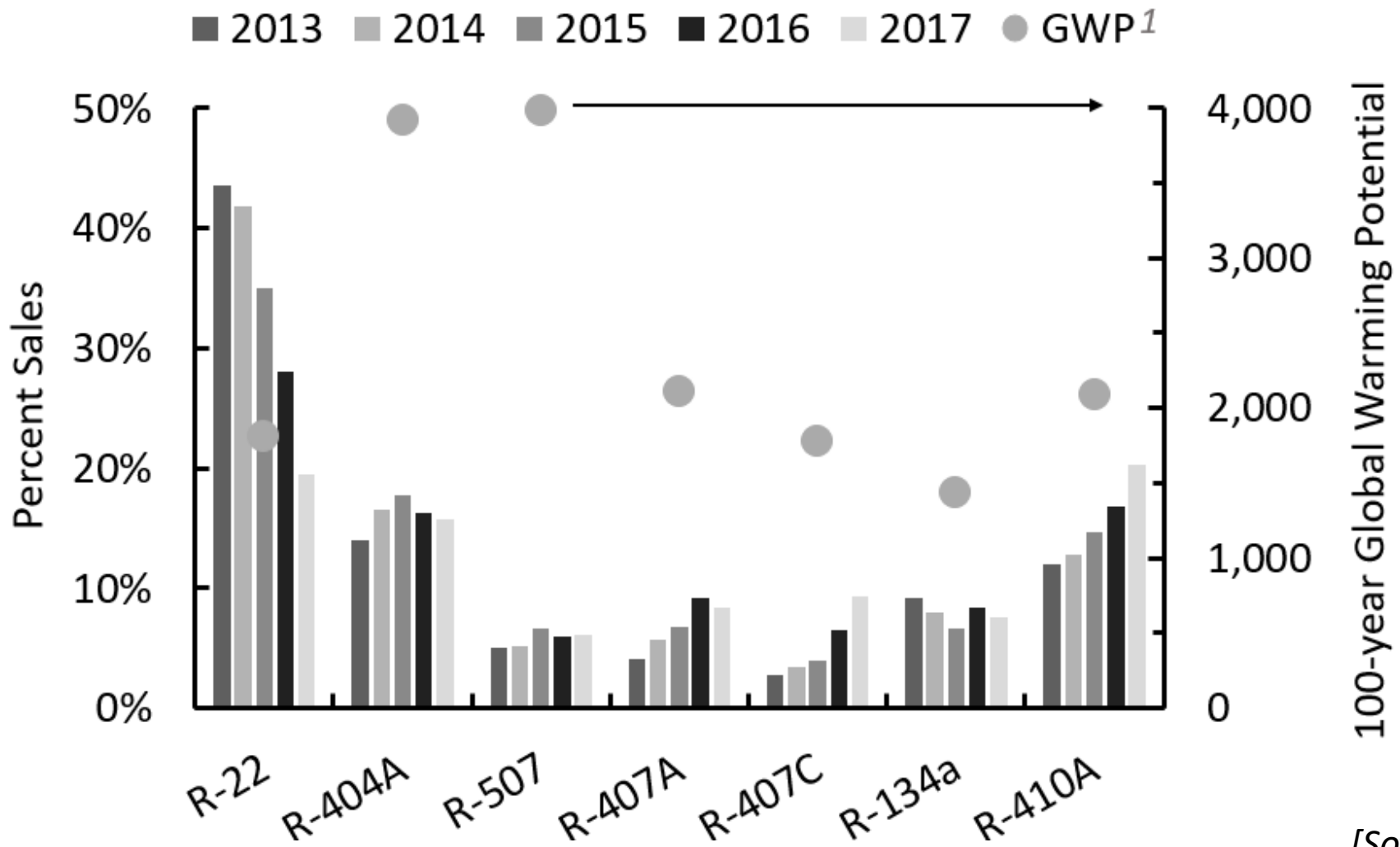
# RMP – Reporting and other Requirements

- Facilities with systems containing > 50 lb refrigerant with a GWP  $\geq$  150
  - Register with CARB
  - Report refrigerant type, full charge, operational status
  - Report refrigerant purchased, used and shipped for reclaim
  - Leak inspections, repair and recordkeeping – depending on system size
- Distributors/wholesalers – report bulk refrigerant purchased, sold and shipped to reclaimers
- Reclaimers – report bulk refrigerant reclaimed (total and in CA), shipped out of state for reclaim and refrigerant destroyed
- Service technicians – certified to conduct leak repairs

# RMP – Full charge contained in systems



# RMP – Refrigerant Sales Trends in California



Annual reported sales for 2013 – 2017 :  
11 – 15 million pounds

7 refrigerants represent an average of 90 % of all sales for 2013 – 2017

<sup>1</sup>100-Year GWP Values are from the 4<sup>th</sup> IPCC Assessment Report (AR4)

[Source: RMP Data – Sales by Distributors / Wholesalers, Reported as of Sept 1, 2018]

# Proposed Rules



1. January 1, 2022: no sales or installation of **new systems** containing a refrigerant with a GWP of 150 or greater (applies to systems containing more than 50 lb of refrigerant)
  - Potential exemption – hybrid systems (case-by-case)
  
2. January 1, 2022: no sales, distribution, or import for use in California, of **virgin refrigerants** with a GWP of 1500 or greater
  - Potential exemption 1 – Reclaimed refrigerants allowed (discussed later)
  - Potential exemption 2 – R-410A for servicing stationary AC
  
3. Some changes to existing RMP regulation
  - Technician requirements
  - Improve clarity
  - Add definitions
  - Align with federal rule 608

# Who are affected by this new regulation?

- Refrigeration equipment manufacturers
- Refrigerant manufacturers
- Refrigerated facilities with systems containing > 50 lb refrigerant
  - Commercial refrigeration - retail food (supermarkets, grocery stores etc.), wholesalers
  - Industrial refrigeration - manufacturing or processing of food and non-food items
  - Cold Storage - warehouses, packaging and storage facilities
- Refrigerant distributors and wholesalers
- Refrigerant reclaimers
- Service technicians

# Reclaimed Refrigerants

CARB is inclined towards allowing use of reclaimed high-GWP refrigerants

- Pros

1. Existing equipment is not stranded
2. Encourages refrigerant recycling and proper recovery practices

- Cons

1. Illicit use of virgin refrigerant in CA imported for other states
2. Illicit purchases across the borders
3. Misuse of virgin refrigerant as reclaimed refrigerant

# Potential enforcement options for reclaimed refrigerants



- Appropriate labeling
- Additional reporting to CARB for reclaimed refrigerants
  - Distributor/Wholesalers, Reclaimers and Facilities
    - Report pounds of each reclaimed refrigerant (GWP > 1500) transacted (purchased, sold, sent for reclaim – as applicable)
    - Provide names, addresses and contact information of all entities involved in the transaction
  - Technician record-keeping
    - Records of reclaimed refrigerant purchases and use in servicing/sales for RMP-regulated systems



# Potential Challenges and Benefits

# Potential Challenges

- Added initial cost for new equipment
- Local permitting agencies must be educated on the low-GWP refrigerants
- Energy efficiency concerns for the hottest climates
- Service technicians need to be trained to install and service low-GWP refrigerants and systems

# Benefits

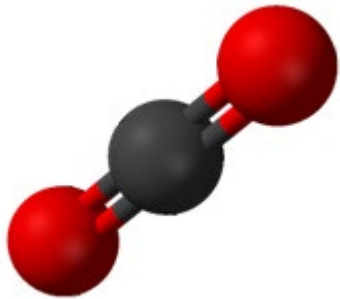


- Reduction of regulatory requirements  
(RMP-exempt below GWP 150, only a one-time registration required)
- Provides regulatory certainty
- Cheaper refrigerants (especially natural)
- Cost of low-GWP systems will decrease with increased number of installations and upcoming HFC phasedown
- Improved energy efficiency as technology continues to progress
- Sustainable, low-emission business practices

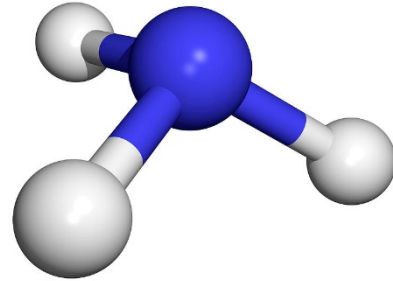
If California requires low-GWP refrigerants, which refrigerants can be used?

low-GWP: GWP < 150

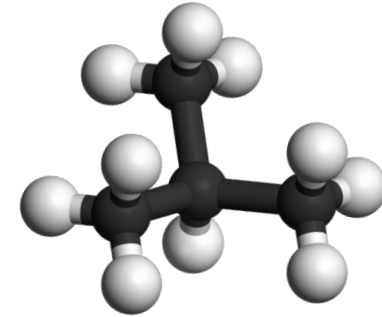
# Some current and potential low-GWP options for refrigeration



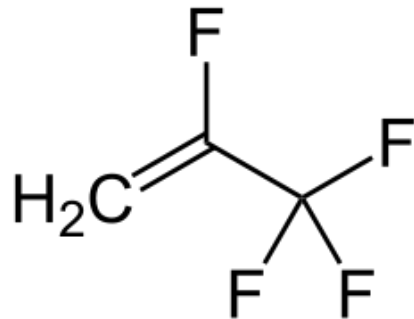
**Carbon Dioxide (R-744)**  
**GWP = 1**



**Ammonia (R-717)**  
**GWP = 0**



**Hydrocarbons (HC): Propane (R-290), isobutane (R-600a)**  
**GWP < 5**

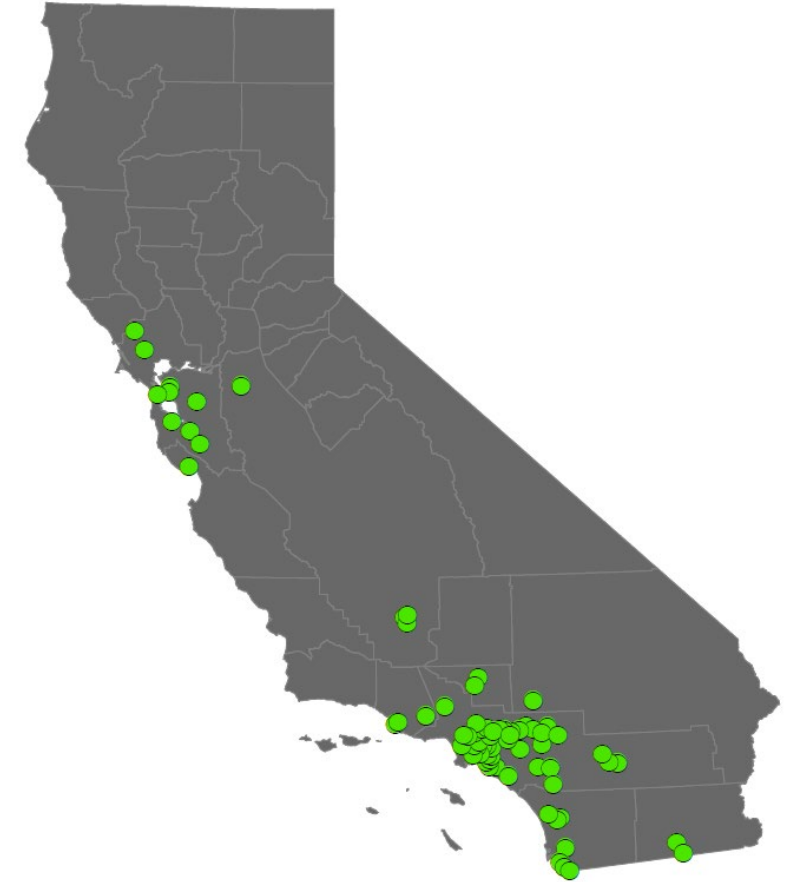


**HFOs (GWP ≤ 10)**

Hydrofluoro-olefins (HFOs) are HFCs that have unsaturated bonds and break down quickly in the atmosphere resulting in no ozone-depleting and little global warming.

# Current low-GWP systems being used in California

End-Use Sector	System Sizes	Low-GWP Options Currently Available
Supermarkets and grocery stores	Large ( $\geq 2000$ lb)	transcritical CO <sub>2</sub> (t-CO <sub>2</sub> )
	Medium (200 – 2000 lb)	t-CO <sub>2</sub> , HC/CO <sub>2</sub> , NH <sub>3</sub> /CO <sub>2</sub>
	Small (50 – 200 lb)	t-CO <sub>2</sub>
Cold storage warehouses and Industrial refrigeration	Large ( $\geq 2000$ lb) Medium (200 – 2000 lb)	<i>Majority already use NH<sub>3</sub></i> others: NH <sub>3</sub> /CO <sub>2</sub> , HFO



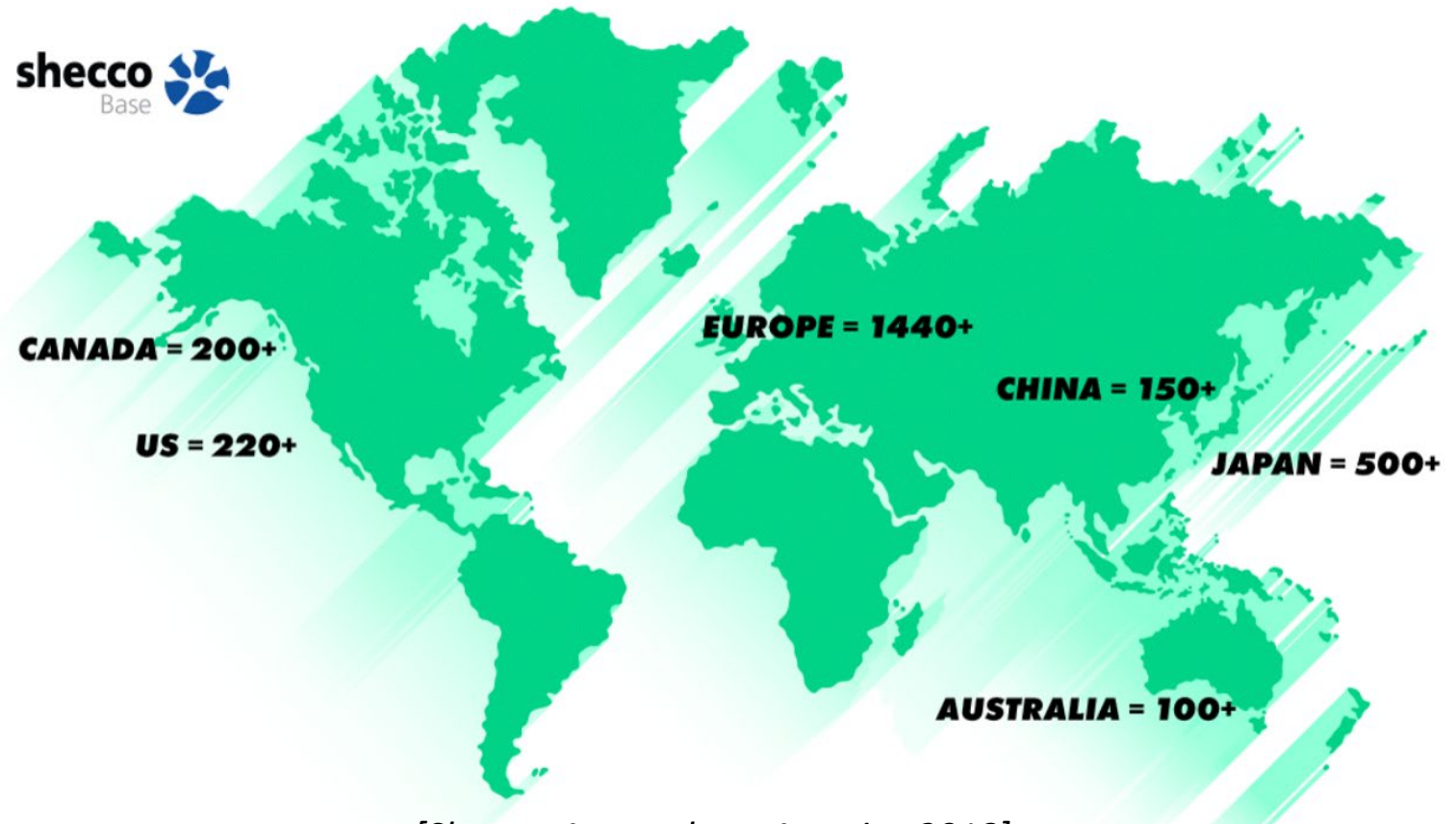
70+ supermarkets in California using low-GWP refrigerants in 2018

# The global transition to low-GWP refrigerants is underway...

- Ammonia has been used for cold storage and industrial refrigeration for 150 years
- Toxicity-related safety concerns have been addressed by using low charge systems

## *Low charge ammonia installations around the world*

shecco  
Base 

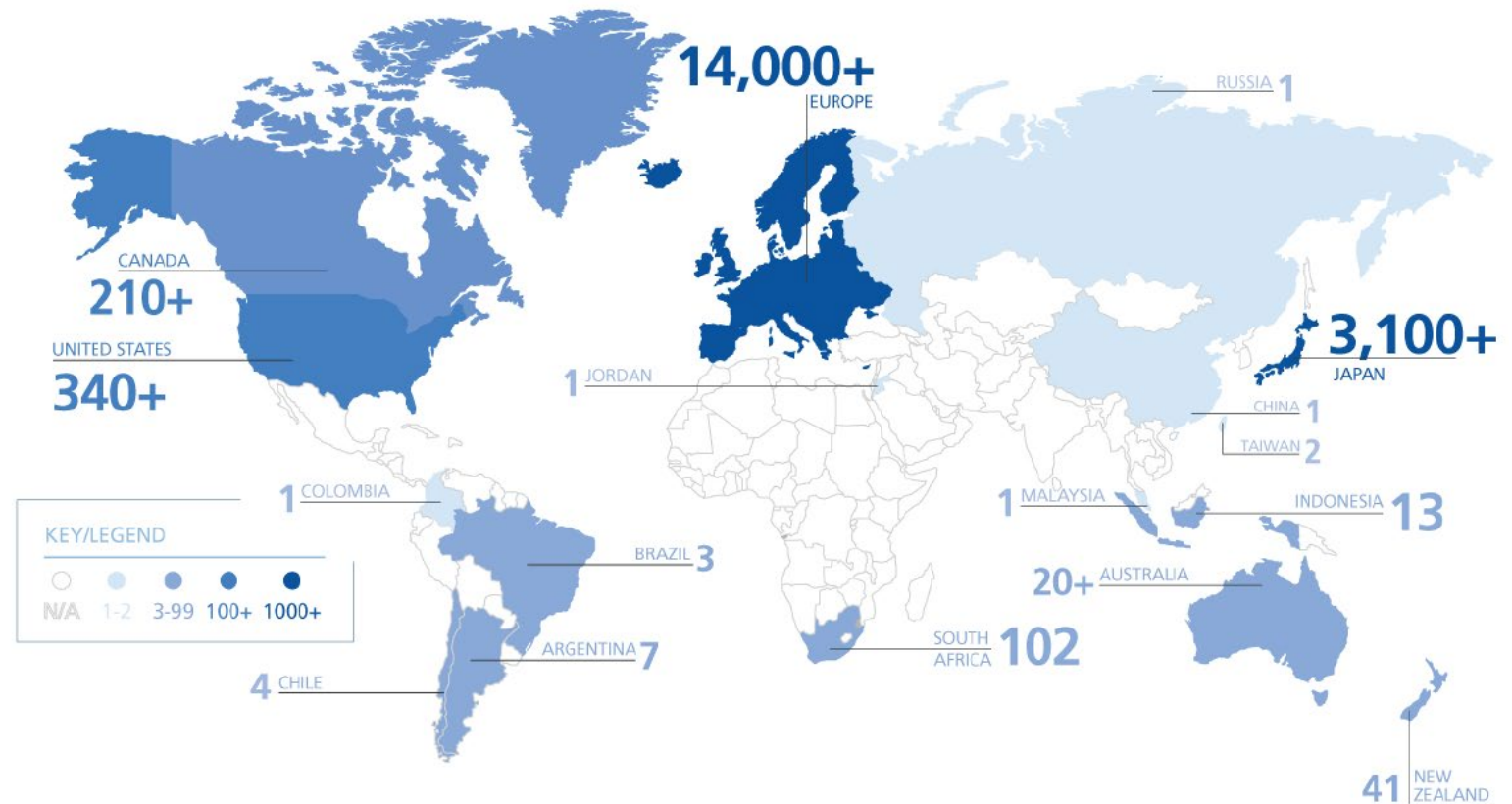


*[Shecco, Atmosphere America 2018]*

# The global transition to low-GWP refrigerants is underway...



- European Union (EU) has implemented similar HFC reduction measures
- Japan, Canada and Australia have HFC phase-down regulations
- Other U.S. states are planning to follow in CA's footsteps
- Low-GWP refrigeration technology is growing quickly across all climate zones, including high ambient temperatures



**Number of transcritical CO<sub>2</sub> Stores Across the Globe (Feb 2018)**

*[Shecco, Atmosphere America 2018]*



# Some manufacturers are selling low-GWP systems in the U.S.



<b>Equipment Manufacturer</b>	<b>Type of Equipment or Sector of Use</b>	<b>Distribution Area</b>
HillPhoenix	Industrial/commercial refrigeration display cases, walk-ins, CO <sub>2</sub> transcritical and cascade systems	North America, Europe
Carrier	Commercial refrigeration	North America
Hussmann Corporation	Display cases and refrigeration systems	U.S., Mexico, Australia, New Zealand, China
Johnson Controls	Refrigeration systems, air-conditioning and transport refrigeration systems	Global
Star Refrigeration	Industrial and commercial refrigeration	U.S., Europe

# Incentive Funding

# Incentive funding for low-GWP technologies



- SB 1013 directed the creation of an incentive program
- Reduction of SLCPs, especially HFCs, is highlighted in CARB's Three-Year Investment Plan
  - Presentation to the Board on November 15<sup>th</sup>
- **Stakeholder feedback on investment priorities is welcome**
- Aligned with the Investment Plan, the Administration's Budget proposal for FY2019-20 will be released in early January 2019
- Legislature decides the final budget around mid-2019

# Timeline for the Rulemaking

## Next Steps – Preliminary Timeline

### Stationary Refrigeration/RMP Amendments Rulemaking

<b>Public workshops and Stakeholder meetings</b>	1 <sup>st</sup> workshop: October 2018
	Technical working group meetings Late 2018 – Mid 2019
<b>Economic Impact Assessment</b>	September 2019
<b>Staff Report (ISOR)</b>	February 2020
<b>45-Day public comment opens</b>	February 2020
<b>Board Meeting</b>	March 2020
<b>Regulation Effective Date</b>	January 2022

# Technical Working Groups – Some topics to be discussed



- Challenges faced – Learn from experiences of supermarkets and other facilities that have already made the transition to low-GWP systems
  - Costs – Get inputs from equipment manufacturers and early adopters
  - Service technician training – Understand the current training programs
  - Safety – Ongoing education and awareness, where applicable
  - Other topics suggested by stakeholders
- 
- Please contact us if you are interested in participating in these working groups.

# CARB Rulemaking Process

# Overview of CARB Rulemaking



- **Regulation Development**
  - Stakeholder Engagement
  - Internal Consultation (Economics, Enforcement, Small Businesses, Environmental Justice, CEQA)
- **Standardized Regulatory Impact Assessment** (if total economic impacts exceed \$50 million)
- **Notice Package**
  - Economic Impact Assessment
  - Staff Report (Initial Statement of Reasons - ISOR)
  - Proposed Regulation Order
  - 45-Day Notice
- **45-Day Public Comment Period**
- **Board Hearing**
- **15-Day Changes**
- **Final Statement of Reasons (FSOR)**
- **Adoption**



# Comments and Questions



We appreciate your feedback.

- During this meeting, webcast viewers can submit questions and comments to:  
[sierrarm@calepa.ca.gov](mailto:sierrarm@calepa.ca.gov)

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## Important Links

**CARB HFC Reduction Measures:** <https://ww2.arb.ca.gov/our-work/programs/hfc-reduction-measures>

**CARB Refrigerant Management Program:** <https://ww2.arb.ca.gov/our-work/programs/refrigerant-management-program>

# Thank you for your attention!

Questions and comments welcome

Emailed questions: [sierrarm@calepa.ca.gov](mailto:sierrarm@calepa.ca.gov)