

CARB Technical Working Group Meeting: Morning Session – Stationary Refrigeration

Tuesday, August 6, 2019 – 9:00 a.m. to 11:30 a.m.
Sierra Hearing Room, CalEPA Headquarters
1001 I Street, Sacramento, CA 95814

Remote Attendance:

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Call-In Number: (888) 557-8511
Participant Passcode: 4399126

REGULATORY PROPOSAL: CARB is proposing a global warming potential (GWP)¹ limit of 150 for new stationary refrigeration systems containing more than 50 pounds of refrigerant, starting January 1, 2022. These types of systems are commonly used in three main end-use sectors: commercial refrigeration (e.g., supermarkets, grocery stores), industrial process refrigeration, and cold storage warehouses.

CARB invites all interested parties to attend the technical workgroup meeting in person or remotely. The stakeholder input CARB receives will aid the development of the regulatory proposal and the required regulatory impact analyses. CARB also considers stakeholder input on a continual basis. Stakeholders wishing to provide input may request a separate meeting with CARB staff or request to present information at the meeting (time limits may apply) by contacting Richie Kaur at richie.kaur@arb.ca.gov.

MEETING PURPOSE:

- Provide an overview of the regulatory process
- Provide an overview of the required Standard Regulatory Impact Assessment (SRIA)²
- Discuss the following topics (details on pages 2 – 5):
 1. Economic impacts
 2. Definitions in the regulatory text
 3. Feasibility of the 150 GWP limit for new and existing facilities
 4. Feasibility of including a GWP limit on refrigeration/process chillers
 5. Seek input on regulatory alternatives

In addition, CARB welcomes comments on other issues relevant to this rulemaking that may not be specifically identified in this document.

¹ 100-year global warming potential values as given in or calculated from IPCC's Fourth Assessment Report (AR4) values.

² More information: http://www.dof.ca.gov/Forecasting/Economics/Major_Regulations/

- Economic Impacts.** CARB assumes that the cost associated with transitioning to new <150 GWP technology, as required under the proposed regulation, would ultimately be passed on to end-users in California. CARB seeks feedback on estimated baseline costs and the incremental costs for technologies which can meet the limit. See Tables 1 and 2. **NOTE:** All cost estimates in this document are representative or average ranges based on stakeholder inputs and / or published materials.

A. Commercial Refrigeration

The commercial refrigeration sector mainly includes retail outlets e.g., supermarkets, grocery stores and some other facilities which include, but are not limited to, hotels, amusement parks, merchant wholesalers etc. According to end-user reported data in CARB's Refrigerant Management Program (RMP)³, there are approximately 4,600 commercial refrigeration facilities using nearly 21,000 refrigeration systems. All commercial refrigeration facilities combined contain nearly 11 million pounds of high-GWP refrigerants banked inside their systems.

Table 1. Baseline¹ and Added² Cost (%) for Compliance in the Commercial Refrigeration Sector

End-Use/Equipment Type Category	Baseline Equipment \$	Added Cost Range (%)	Baseline Installation \$	Added Cost Range (%)	Baseline Routine Maintenance \$/year	Added Cost Range (%)	Baseline Refrigerant \$/lb.	Added Cost Range (%)	Added Electricity \$/year
Commercial Refrigeration, Retail – Supermarkets	600,000 to 1M	15% to 20%	250,000 to 450,000	-10% to +10%	5,000 to 7,000	TBD	5 to 10	-30% to -50%	Potential Savings
Commercial Refrigeration, Retail - Grocery Stores	200,000 to 300,000	15% to 20%	90,000 to 140,000	-10% to +10%	2,000 to 3,000	TBD	5 to 10	-30% to -50%	Potential Savings
Commercial Refrigeration, Other	30% lower than retail								Potential Savings

¹ Baseline costs: Costs of traditional HFC DX systems

² Added costs: Incremental costs for low-GWP systems (e.g., CO₂ transcritical, ammonia/CO₂ cascade, micro-distributed propane systems, HFO cascades) above the baseline costs.

³ Refrigerant Management Program: <https://ww2.arb.ca.gov/our-work/programs/refrigerant-management-program>

Notes about Cost Estimates for Commercial Refrigeration:

Supermarkets – Retail outlets with an average size of approximately 45,000 square feet using an average total refrigerant charge of 3,500 pounds.⁴

- Baseline costs for equipment and installation are based on stakeholder information and published reports⁵. Equipment costs include mechanical equipment (compressors, condensers) as well as fixtures like display cases with a roughly 50-50 cost split between those two categories (based on stakeholder input). Installation costs are approximately an additional 40% to 50% of the equipment costs.
- Baseline maintenance costs for routine inspections are based on 4-6 hours per month of labor at an average \$100/hour⁶.
- Baseline refrigerant costs are based on stakeholder input.
- Electricity costs: There are case studies showing energy efficiency gains for low-GWP systems over traditional HFC systems which can result in electricity savings. However, electricity consumption of stores can vary and be highly dependent on system maintenance and optimization.

Grocery Stores – Retail stores smaller than supermarkets with an average size of 15,000 square feet using an average total refrigerant charge of 900 pounds. Equipment, installation and maintenance costs are estimated to be approximately 60% lower than supermarkets, scaling down by store size.

Other commercial facilities include, but are not limited to, hotels, amusement parks, merchant wholesalers etc. These facilities do not have large display cases like retail outlets, which account for approximately 50% of equipment costs. Thus, conservatively, the equipment cost for non-retail equipment is estimated to be at least 30% lower than retail store equipment of similar refrigerant charge size (accounting for some non-retail facilities that may have small display case-type fixtures).

⁴ https://www.epa.gov/sites/production/files/documents/gc_averagestoreprofile_final_june_2011_revised_1.pdf

⁵ http://www.r744.com/files/Hillphoenix_CO2_ROI_WhitePaper_v10_Oct24_2014.pdf;
https://www.epa.gov/sites/production/files/2015-10/documents/deca_commercial_refrigeration_case_study.pdf

⁶ <https://www.achrnews.com/articles/90611-a-behind-the-scenes-look-at-service-rates>; \$70/hour median value in 2002 adjusted for inflation using CPI calculator

B. Industrial Process Refrigeration (IPR) and Cold Storage Warehouses

The IPR sector covers a wide range of refrigeration facilities used for production and manufacturing of food and non-food items. According to industry stakeholders, cold storage warehouses also fall under the IPR end-use. Based on user-reported data in RMP, nearly 1,800 facilities and 6,400 systems are used for IPR and cold storage. All IPR and cold storage facilities combined contain nearly 4 million pounds of high-GWP refrigerants banked inside them.

According to end-user reported data in RMP, approximately 50% of the systems used in IPR are chillers. Chillers are covered under SB1013 and will be discussed separately (see Page 5 for more details). New, non-chiller IPR and cold storage systems will be subject to the same 150 GWP limit and effective date of January 1, 2022 as commercial refrigeration systems.

Table 2. Baseline and Added Costs (%) for Compliance in the Industrial Process Refrigeration and Cold Storage Sectors

End-Use/Equipment Type Category	Baseline Equipment \$	Added Cost Range (%)	Baseline Installation \$	Added Cost Range (%)	Baseline Routine Maintenance \$/year	Added Cost Range (%)	Baseline Refrigerant \$/lb.	Added Cost Range (%)	Baseline Electricity \$/year	Added Cost Range (%)
Industrial Process Refrigeration and Cold Storage Excluding Chillers ("Large")	800,000 to 1.2M	15% to 20%	200,000 to 300,000	-10% to +10%	5,000 to 7,000	TBD	5 to 10	-30% to -50%	TBD	-10% to -20%
Industrial Process Refrigeration and Cold Storage Excluding Chillers ("Medium/Small")	200,000 to 400,000	15% to 20%	50,000 to 100,000	-10% to +10%	2,000 to 3,000	TBD	5 to 10	-30% to -50%	TBD	-10% to -20%

Notes about costs for IPR and Cold Storage

Based on RMP data, large IPR and Cold Storage facilities have an average charge size of 8,500 pounds (excluding chillers). Medium and small facilities have an average charge size of 1,000 pounds, similar to grocery stores. Equipment cost estimates are based on past stakeholder input. Average installation costs are approximately an additional 25% of the equipment costs. CARB is seeking more current cost data for these end-use sectors from stakeholders.

2. **Definitions in the Regulatory Text.** Since the proposed regulation impacts all new refrigeration equipment, CARB requests feedback on defining the term such that the rule is feasible and enforceable.

Current definition under the 2018 California HFC regulation⁷:

“New Refrigeration Equipment” means:

(1) Any refrigeration equipment that is first installed using new or used components; or (2) Any refrigeration equipment that is modified such that it is: (i) Expanded after the date at which this subarticle becomes effective, to handle an expanded cooling load by the addition of components in which the capacity of the system is increased, including refrigerant lines, evaporators, compressors, condensers, and other components; or (ii) Replaced or cumulatively replaced after the date at which this subarticle becomes effective, such that the capital cost of replacing or cumulatively replacing components exceeds 50 percent of the capital cost of replacing the entire refrigeration system.

3. **Feasibility of the 150 GWP Limit for New and Existing Facilities.** New systems are installed in either newly constructed facilities or used to replace systems in existing facilities. CARB seeks stakeholder input on the feasibility of the 150 GWP limit for all new systems for all three end-uses and all system sizes above 50 pounds.
4. **Feasibility of Including a GWP Limit on Refrigeration/Process Chillers.** Chillers are used extensively in industrial processes (also known as “process chillers”). U.S.EPA’s SNAP Rule 21 adopted in California under SB 1013⁸ includes HFC prohibitions on chillers starting January 1, 2024. In the past, stakeholders have sought clarity on whether those chiller prohibitions apply to process chillers. CARB seeks to clarify its intent of placing a GWP limit of 750 on process chillers, same as the proposed limit for chillers used in comfort cooling.
5. **Seek Input on Regulatory Alternatives.** CARB seeks stakeholder suggestions on any alternative regulatory mechanisms that will help achieve the State’s mandated HFC reduction goal.

⁷ <https://ww2.arb.ca.gov/rulemaking/2018/high-global-warming-potential-refrigerant-emissions-reductions-regulation>

⁸ <https://ww2.arb.ca.gov/resources/fact-sheets/hydrofluorocarbon-hfc-prohibitions-california>