



Global policy trends for natural refrigerants

ATMOsphere Australia

Sydney

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Marc Chasserot

Group CEO, shecco

CALIFORNIA





California: leading with most ambitious climate change legislation in North America.

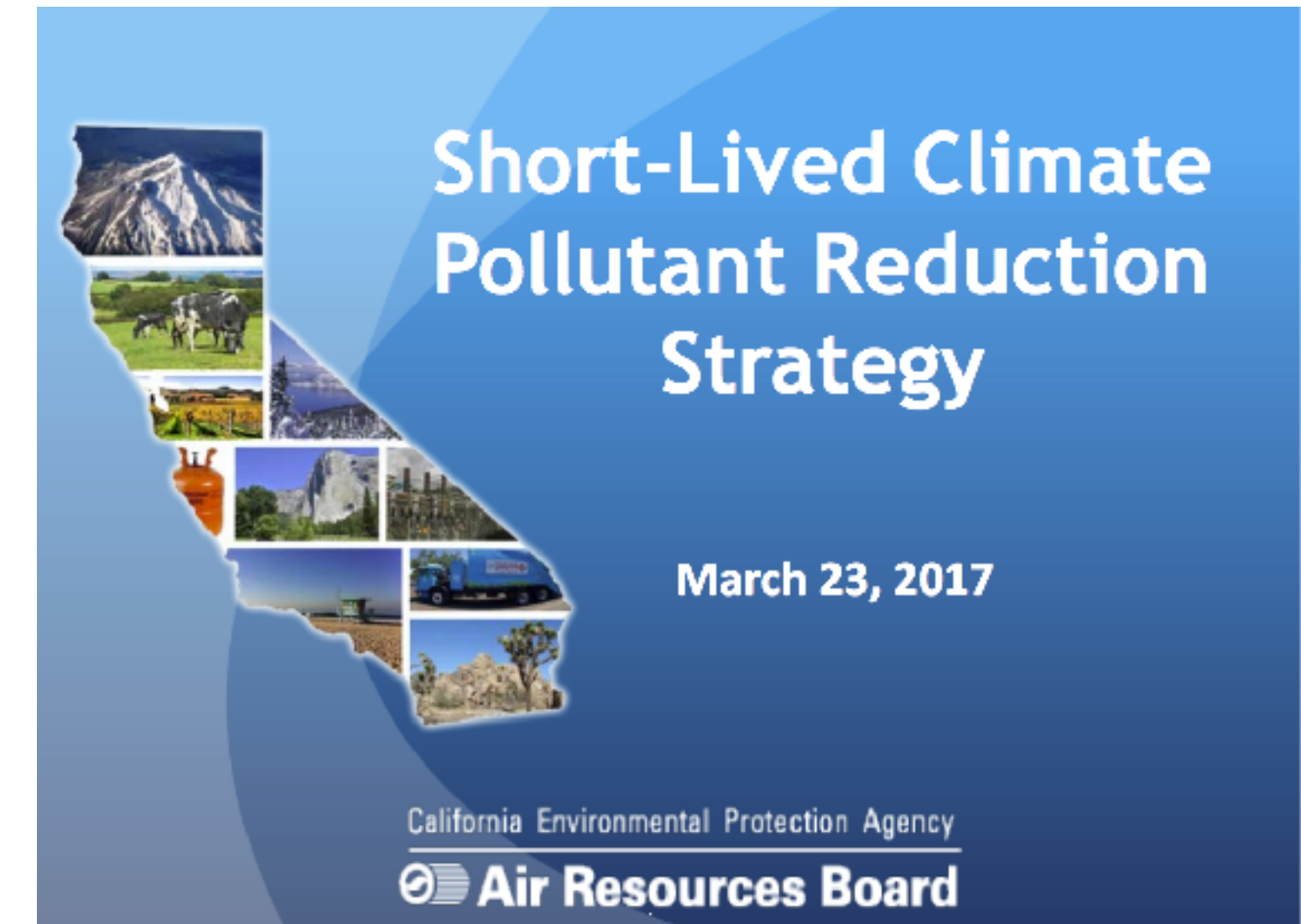
On HVAC&R:

- Regulating HFC emissions since 2011
- **Prohibition on sale of new refrigerants with high GWP (>2500) as of 2020:**
- **High GWP refrigerant prohibitions in new stationary systems:** GWP > 150 in refrigeration (as of 2021)
- **Financial incentives (tbc):** to motivate early adopters of low GWP refrigeration in commercial refrigeration





- The California Air Resources Board (CARB) **approved** the Short-lived Climate Pollutant Reduction Plan on **23 March 2017**
- Plan to curb harmful super pollutants brings California closer to achieving its goal of reducing greenhouse gas emissions by **40%** by 2030.
- Methane, HFCs and black carbon under the remit of the SLCP Strategy
- Aim to reduce HFCs 25% below business-as-usual emissions by 2020
- Opportunities to increase uptake of natural refrigerant-based HVAC&R solutions





Next steps:

- **Air Resources Board** currently conducting a Scientific Assessment to investigate effective measures for low-GWP alternatives
- Workshop to take place at ATMO America (San Diego, 5-7 June) to get input from Industry



UNITED STATES FEDERAL LEVEL & CANADA





New US Administration under Trump: what it means for the Industry?

- Head of EPA (Scott Pruitt): leading advocate against action on climate change
- Head of DOE (Rick Perry): ties to oil sector, climate sceptic

Open questions / risks

- Ratification of Paris Agreement?
- Ratification of Kigali Amendment?
- Role of EPA in enforcement of legislation?
- Investment in renewables, climate change programmes?
- Future of Clean Air Act?





Cuts to the EPA, **GreenChill** and other energy efficiency programs expected.

“The purpose of the proposed program cuts is to “[free up] resources from voluntary programs to re-prioritize funding for programs tethered to statutes.”

– Julia Valentine, EPA spokesperson

NB. GreenChill has helped to reduce refrigerant emissions (HFCs and HCFCs) from 25% to 12.5%





Section 612 of the Clean Air Act (CAA), EPA's Significant New Alternatives Policy (SNAP) program reviews substitutes within a comparative risk framework.

- SNAP program lists alternatives and substitutes for refrigerants (amongst other things)
- Listing low-GWP refrigerants and de-listing high-GWP HFCs in a number of applications
- September 2016 SNAP published a rule to prohibit the use of certain high GWP fluorinated gases (R404A, R410A, R134a, and R407C).





**HFC phase-down
planned until 2030**

**Nation wide carbon
pricing in 2018**

Canada's Proposed GWP Limits, by Product

PRODUCT	USE	DATE	MAXIMUM GWP OF REFRIGERANT
Stand-alone medium-temperature refrigeration system with internal temperature at or above 0°C.	Commercial or industrial	Jan.1 2020	700
	Residential	Jan.1 2025	150
Stand-alone low-temperature refrigeration or industrial system with internal temperature of less than 0°C but not less than -50°C.	Commercial or industrial	Jan.1 2020	1,500
	Residential	Jan.1 2025	150
Centralized refrigeration system with a capacity greater than 20 kW, maintaining an internal temperature greater than or equal to -50°C.	Commercial or industrial	Jan.1 2020	1,500
Condensing unit with a capacity less than or equal to 20 kW, maintaining an internal temperature greater than or equal to -50°C.	Commercial or industrial	Jan.1 2020	2,200
Chiller that has a compressor, an evaporator and a secondary coolant (not an absorption chiller).	Commercial or industrial	Jan.1 2025	700
Mobile refrigeration system	Commercial or industrial	Jan.1 2025	2,200

CHINA

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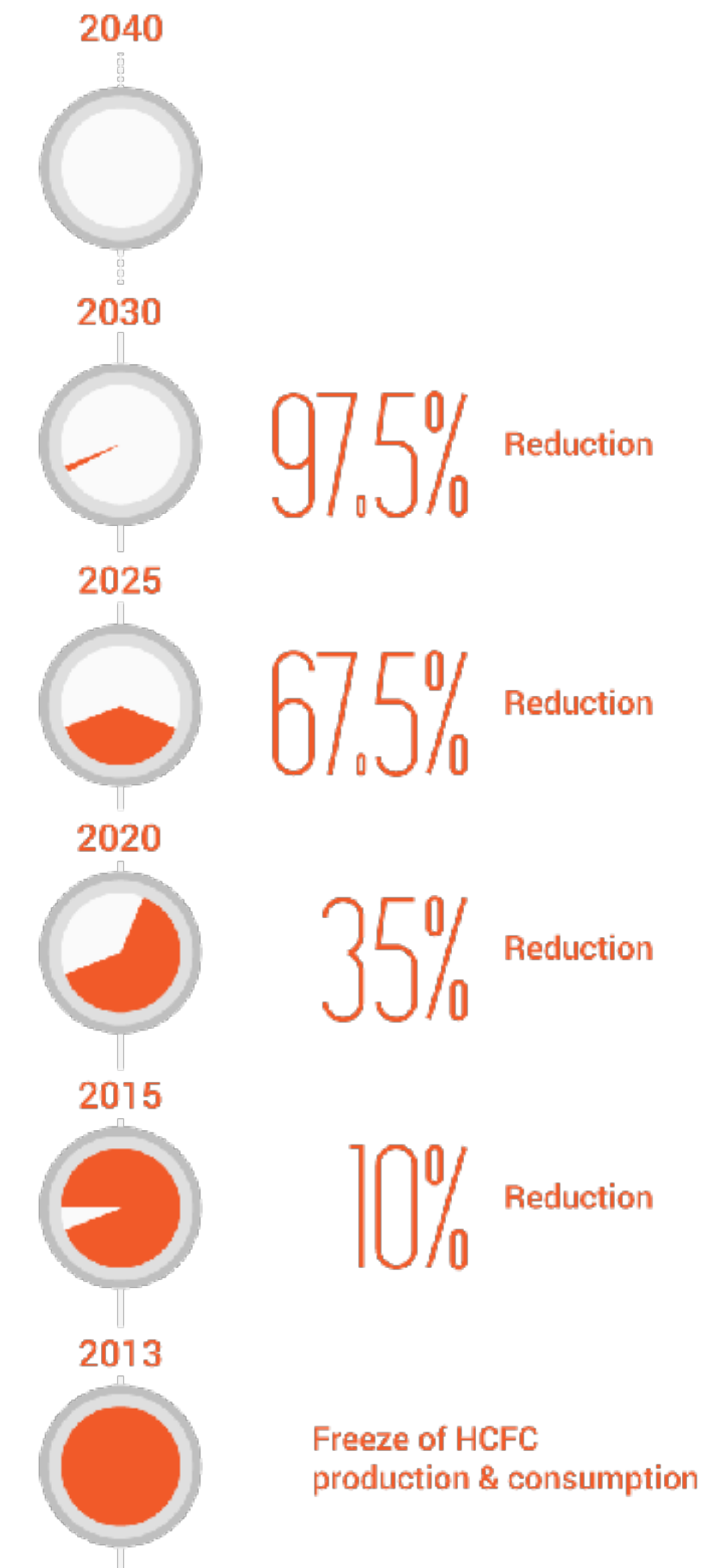


- Air pollution and air quality has become a priority for the Chinese Government
- China signed and ratified the Paris Agreement
- At MOP28 China put forward a Conference Room Paper to reviews **standards** (IEC 60335-2-40)
- Chinese Government currently reviewing list of acceptable alternatives to HCFCs before final publication: opportunity to leapfrog to natural refrigerants
- Updated list of recommended substitutes for R22 in refrigeration systems: Propane, Isobutane, CO₂, NH₃.

CHINA - HCFCs PHASE DOWN SCHEDULE



- Phase-out of **production and consumption of HCFCs by 2030** = global impact
- Revised **Environmental Protection Law in 2015**, after 25 years = increasing accountability of polluters and government for environmental issues
- Increasing **government support for natural refrigerants** in several sectors, especially room AC, heat pumps, commercial & industrial refrigeration

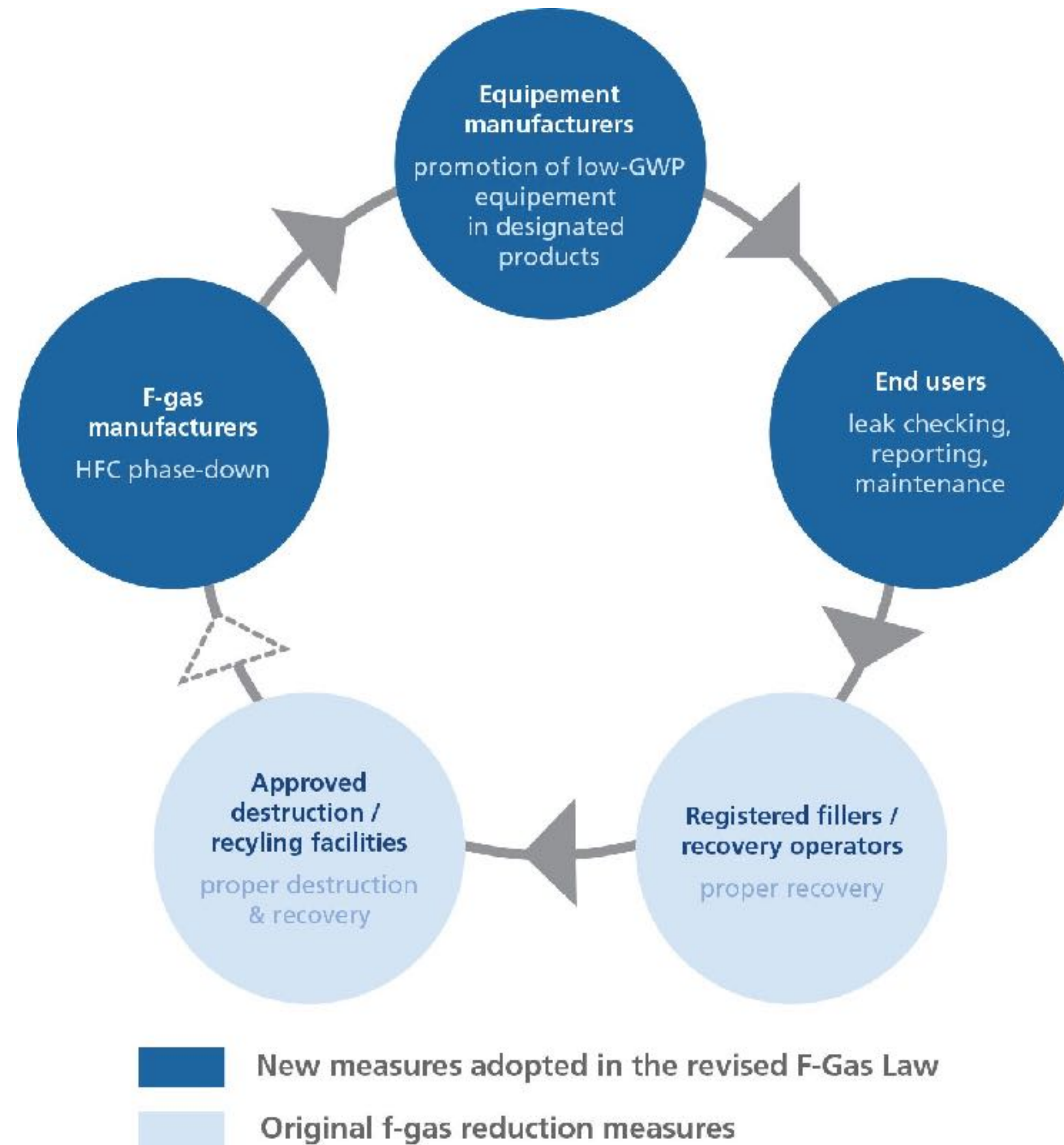


JAPAN

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JAPAN: REVISED F-GAS REGULATIONS

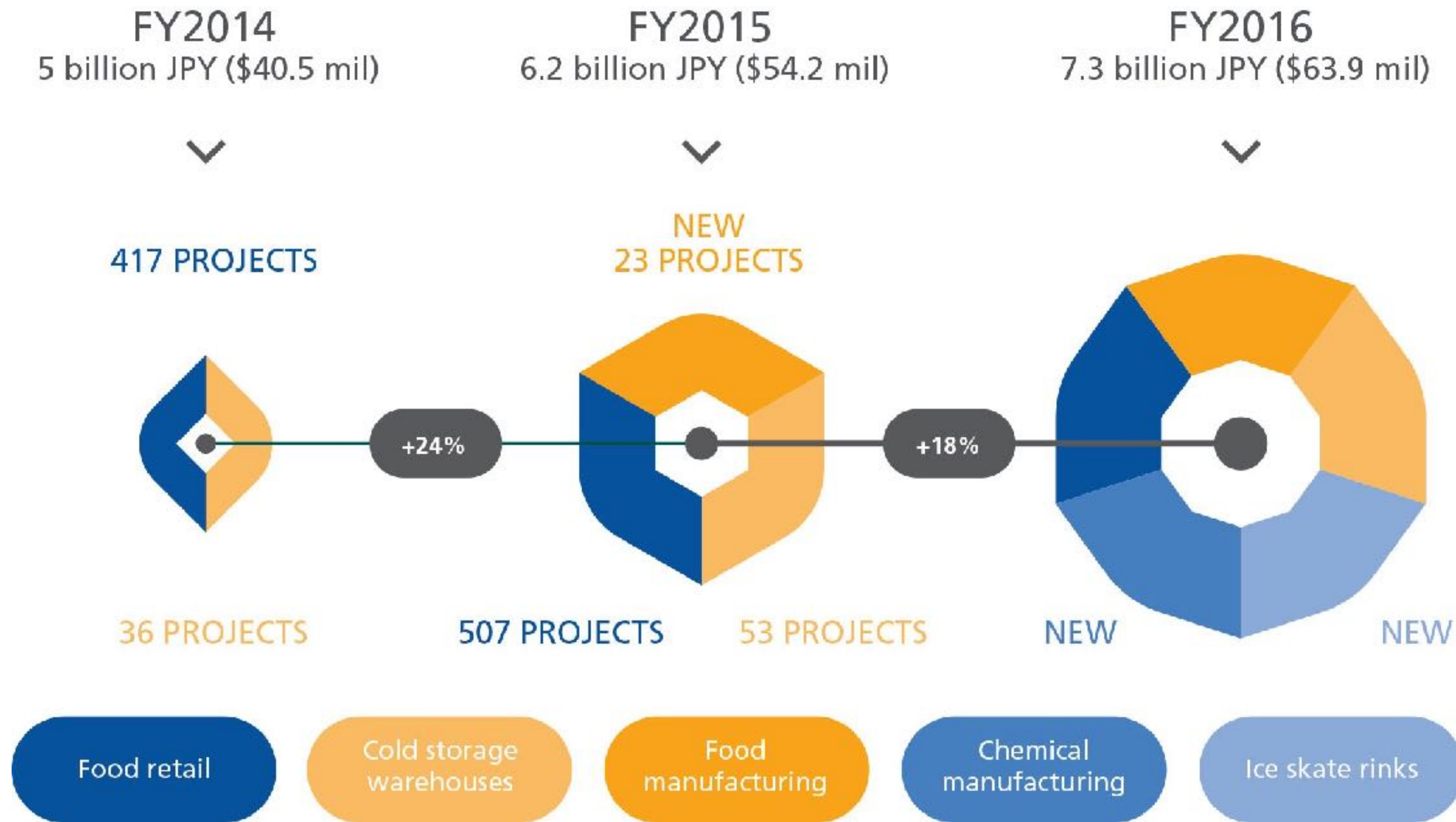


JAPAN: TARGETS PER APPLICATION



Designated products	Present refrigerant (GWP)	Target value (GWP)	Target year
 room air conditioning	R410a (2090) R32 (675)	750	2018
 commercial air conditioning (offices & stores)	R410a (2090)	750	2020
 condensing units and refrigeration unit > 1.5kW	R404a (3920) R410a (2090) R407c (1774) CO ₂ (1)	1500	2025
 cold storage warehouse (above 50,000 m ³)	R404a (3920) NH ₃ (0)	100	2019
 mobile air conditioning	R134a (1430)	150	2023

JAPAN: SUBSIDIES INCREASING... BUT CHANGING FOCUS



For FY2017, strong focus on Industrial refrigeration (Cold storage, warehouses)

EUROPE

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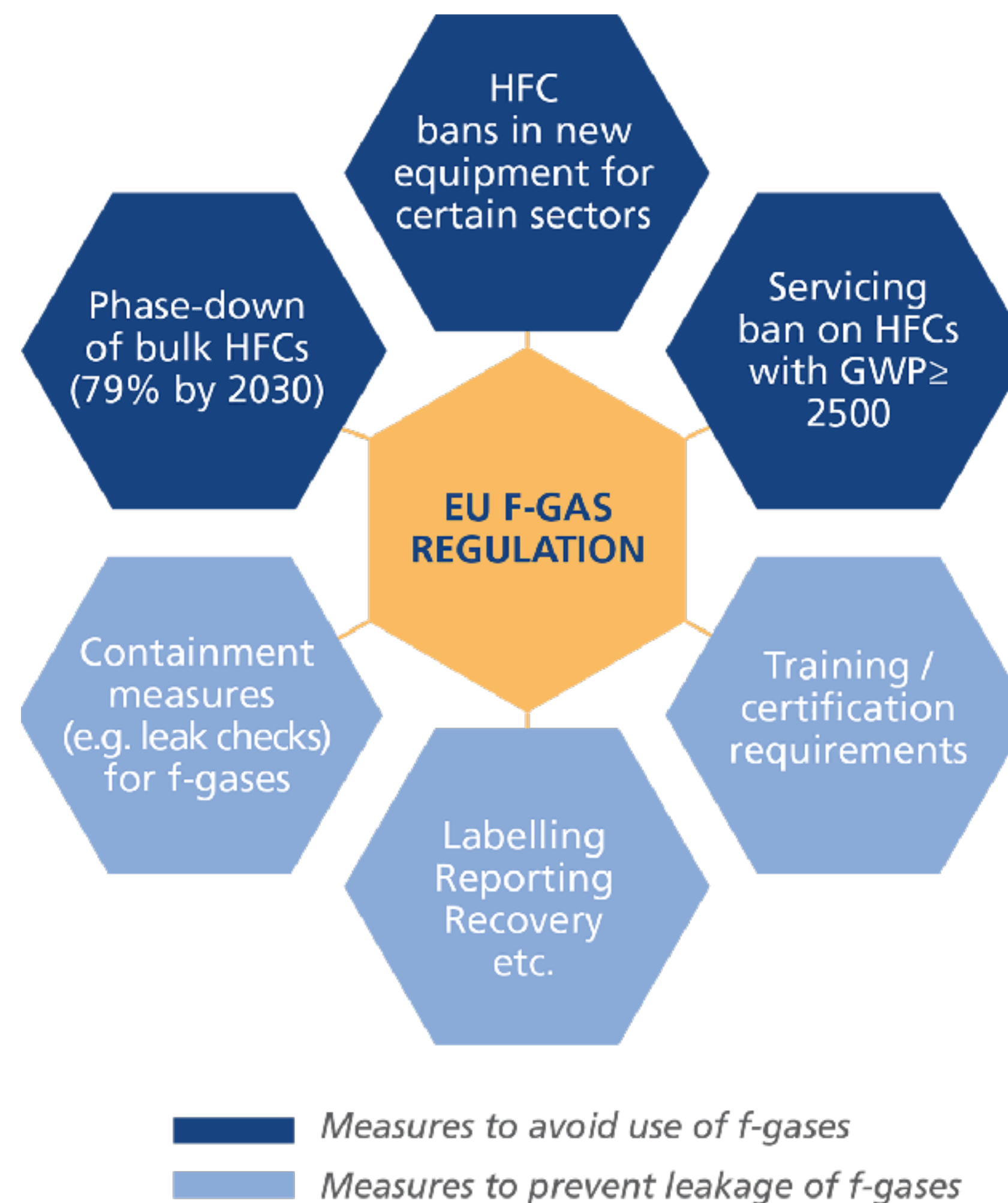
Key elements of the F-Gas Regulation

Entered into force in 2015


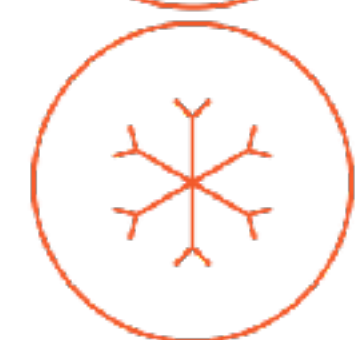
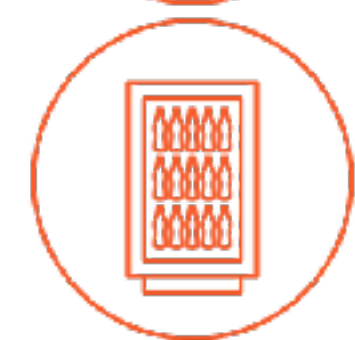



Introduced a number of measures to limit F-gas emissions

Aims to reduce HFC emissions by 79% by 2030 (compared to 2009-2012)

= the average GWP of HFCs will have to fall from today's 2,000 to about 400 by 2030 across all sectors





	Sector	GWP limit	Year
	Domestic refrigeration	150	2015
	Stationary refrigeration (except < -50°C)	2500	2020
	Hermetically sealed commercial refrigeration	150	2022
	Centralized commercial refrigeration ($\geq 40\text{kW}$), except in the primary refrigerant circuit of cascade systems where f-gases with a $\text{GWP} < 1500$	150	2022
	Movable room AC	150	2020
	Single split AC (< 3kg of f-gases)	750	2025



Report reveals early effects of the EU F-Gas Regulation

Looks at the **impacts on the European businesses** (qualitative & quantitative analysis)

Evaluates the **effects on other legislative frameworks**, incl. Montreal Protocol





Report: F-Gas Regulation shaking up the HVAC&R Industry (by shecco for Green Group in the European Parliament)

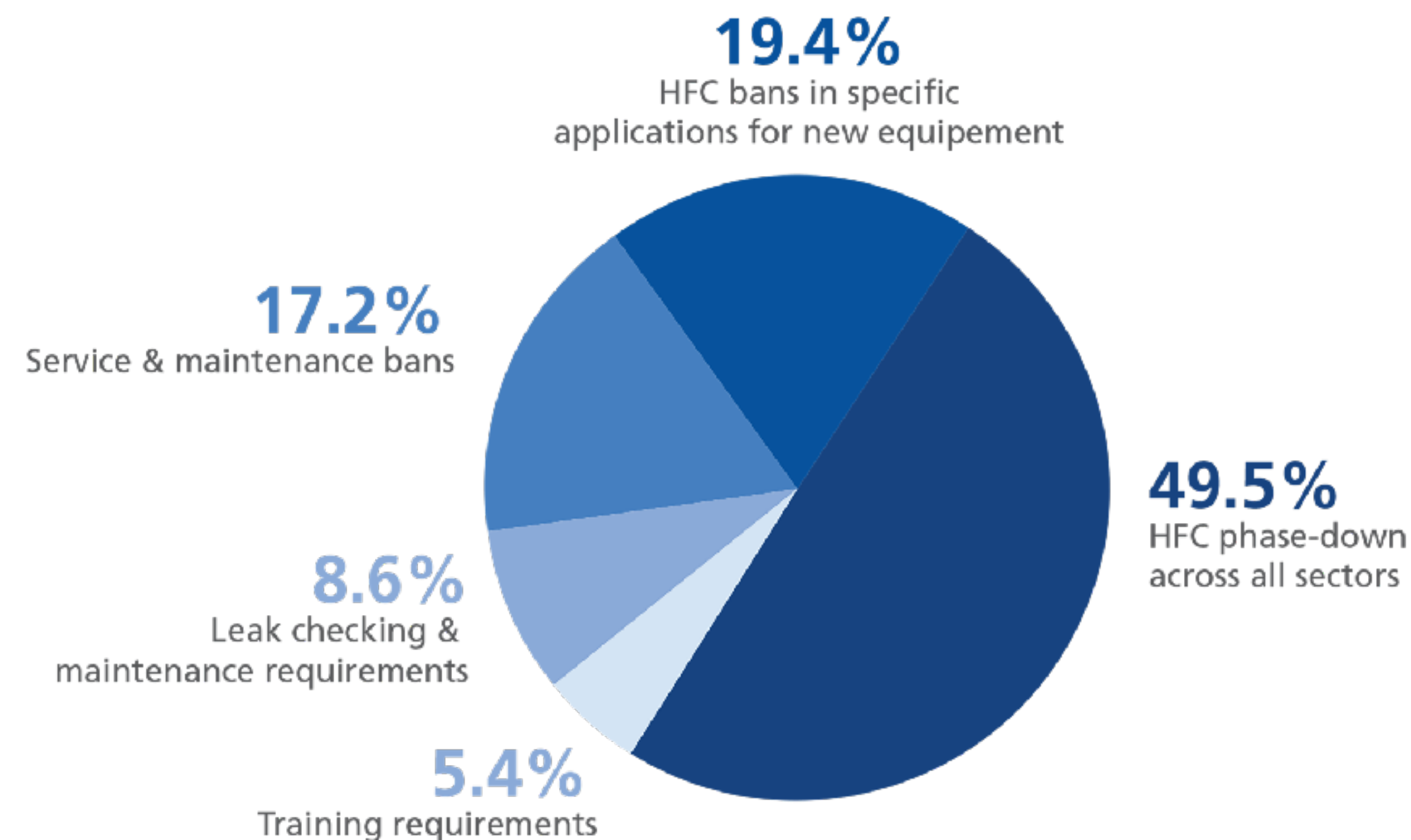
230 industry representatives participated in survey for the F-Gas Report

Industry took **early action**: 73% of respondents before the F-Gas Regulation came into force

HFC phase-down is seen as the most significant game-changer for the industry overall

Sector-specific HFC bans seen as the most effective measure driving the industry forward

F-Gas Regulation measures that the industry believes to have the most significant impact on HFC reduction



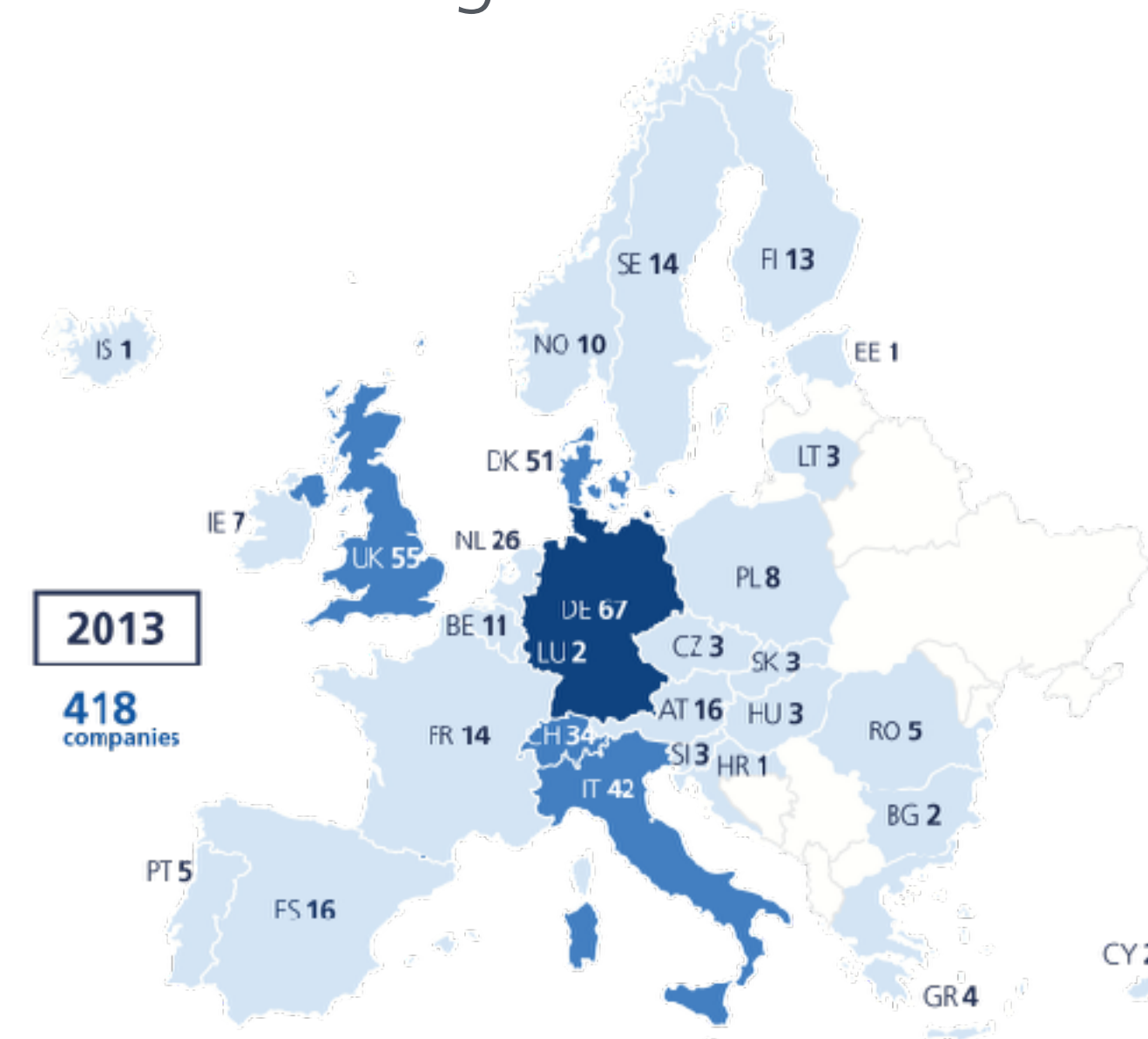
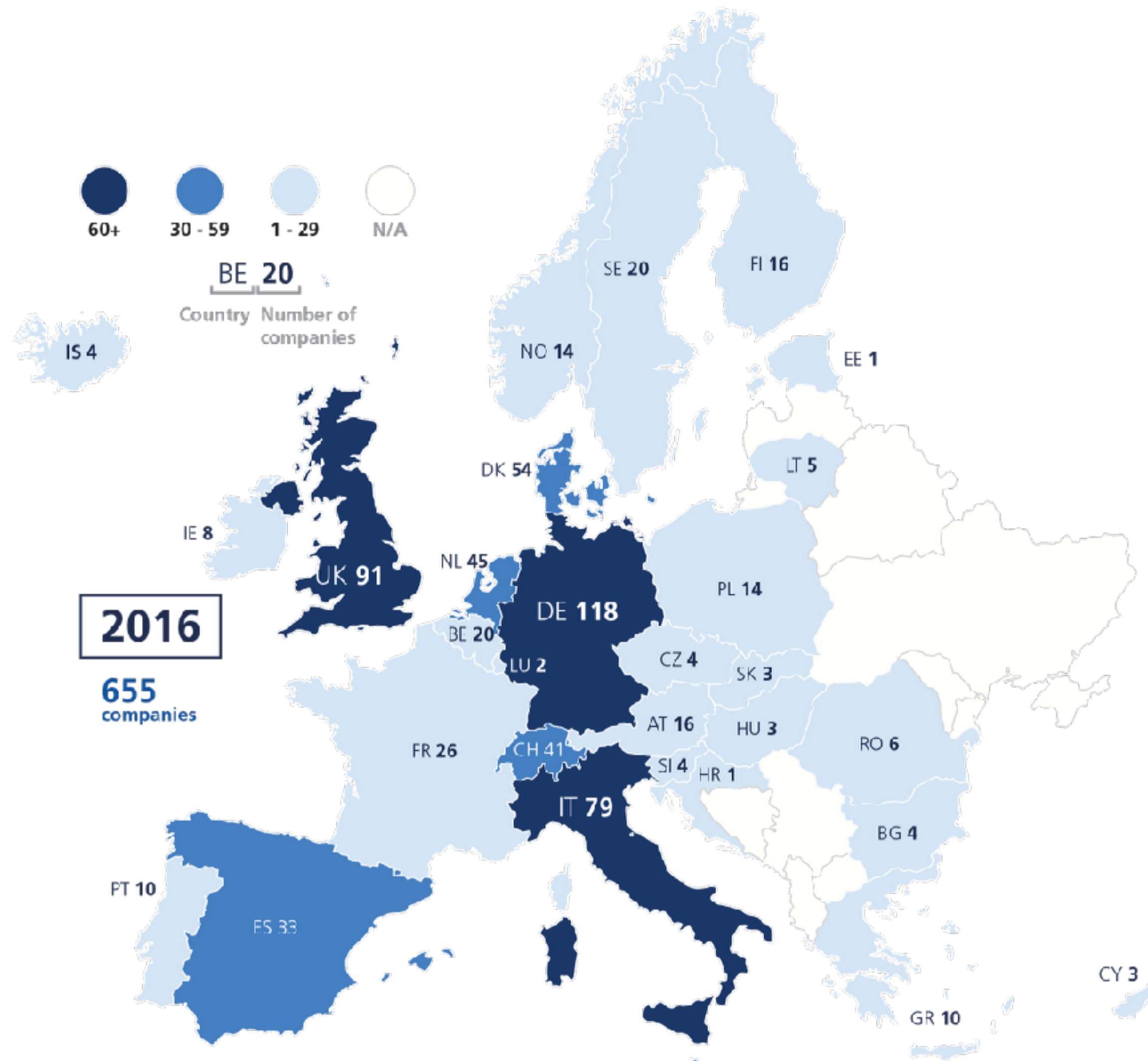
EUROPE: INDUSTRY WORKING WITH HFC ALTERNATIVES GROWING



F-Gas Report survey: **Over 650 companies** work with natural refrigerants (HFC alternatives) in the EU, Norway, Switzerland and Iceland

Southern European countries are increasingly investing in this technology

First-movers were able to benefit from their competitive advantage across the EU and beyond





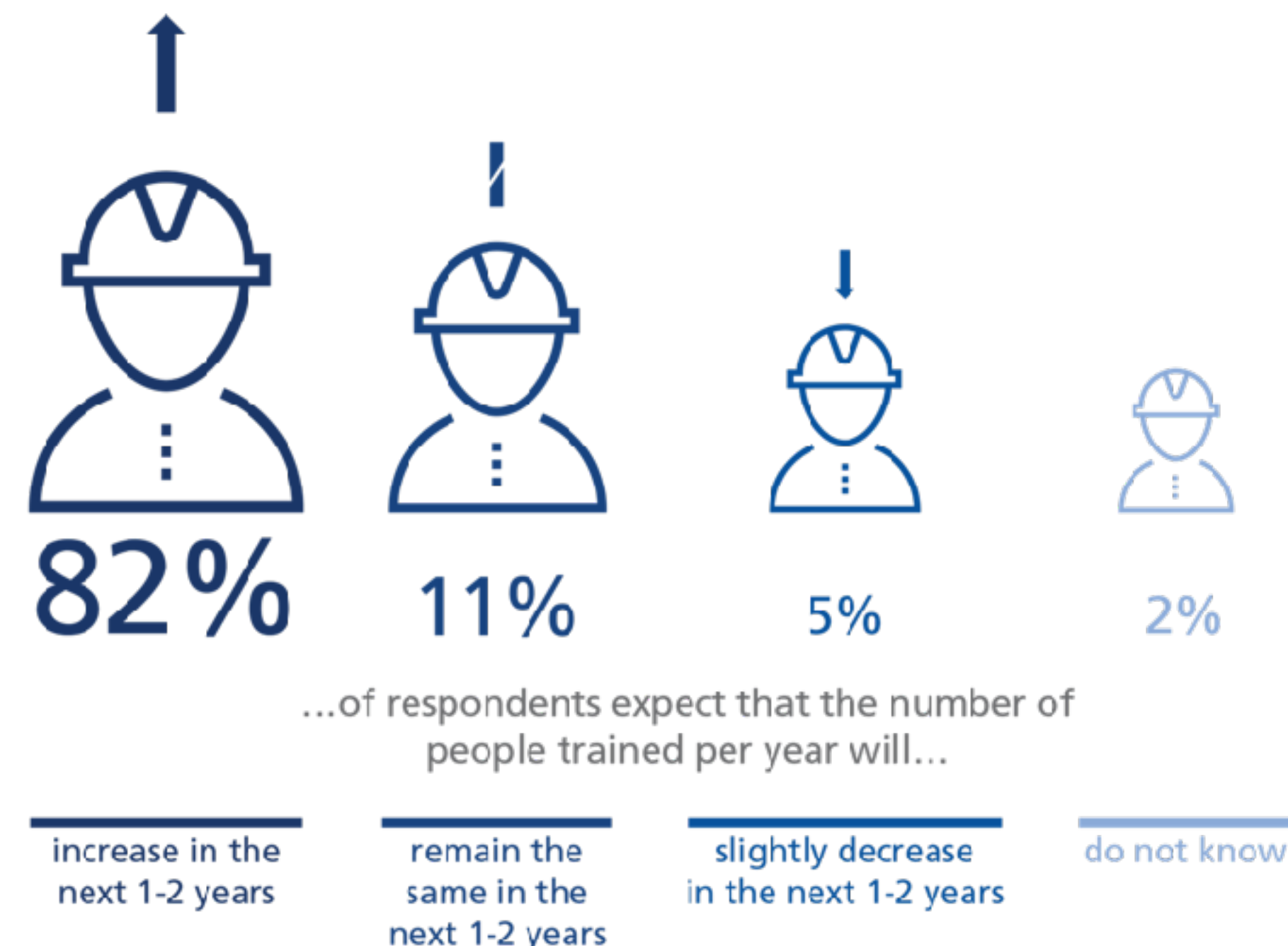
Recent survey in Europe:

Out of a total of 160,000 technicians in Europe, **8,000 - 10,000 received training on natural refrigerants in 2015**

Close to **200 companies in Europe** offer training related to natural refrigerants

4 in 5 industry experts expect the **number of people trained in HFC alternatives will grow** in the next 1-2 years

Industry expectations on the growth of trained technicians in HFC-free technology





Next Steps

Review process of the Regulation kicked off end 2016

Review may result in **extended list of HFC bans** in other applications

European Commission currently considering options. In November 2016 it published reports on:

- standards
- training





- Winter Package “Clean Energy for all Europeans” on 30 November 2016
- Aims to cut CO₂ emissions by 40%, increase energy efficiency by 27% and increase up to 27% the share for renewable energy by 2030.
- Ecodesign Working Plan 2016-2019 released on 30 November 2016
- Energy Efficiency Labelling has been adopted by the Council of the European Union on 21 March 2017.



GLOBAL INITIATIVES





Changing the HVAC&R Industry globally?





Kigali Amendment: the most practical step towards mitigating climate change.

- Positive signal to the market: HFCs on their way out **globally**
- Global phase down will span the next 30 years
- Phase-down affecting 18 substances - average GWP of 2500
- Multilateral Fund to come up with guidelines for Finance
- If fully implemented, it could stop global warming by 0.5 degrees
- Exemptions for high-ambient temperature countries still remain on the table

KIGALI AMENDMENT: LISTED SUBSTANCES TO PHASE DOWN



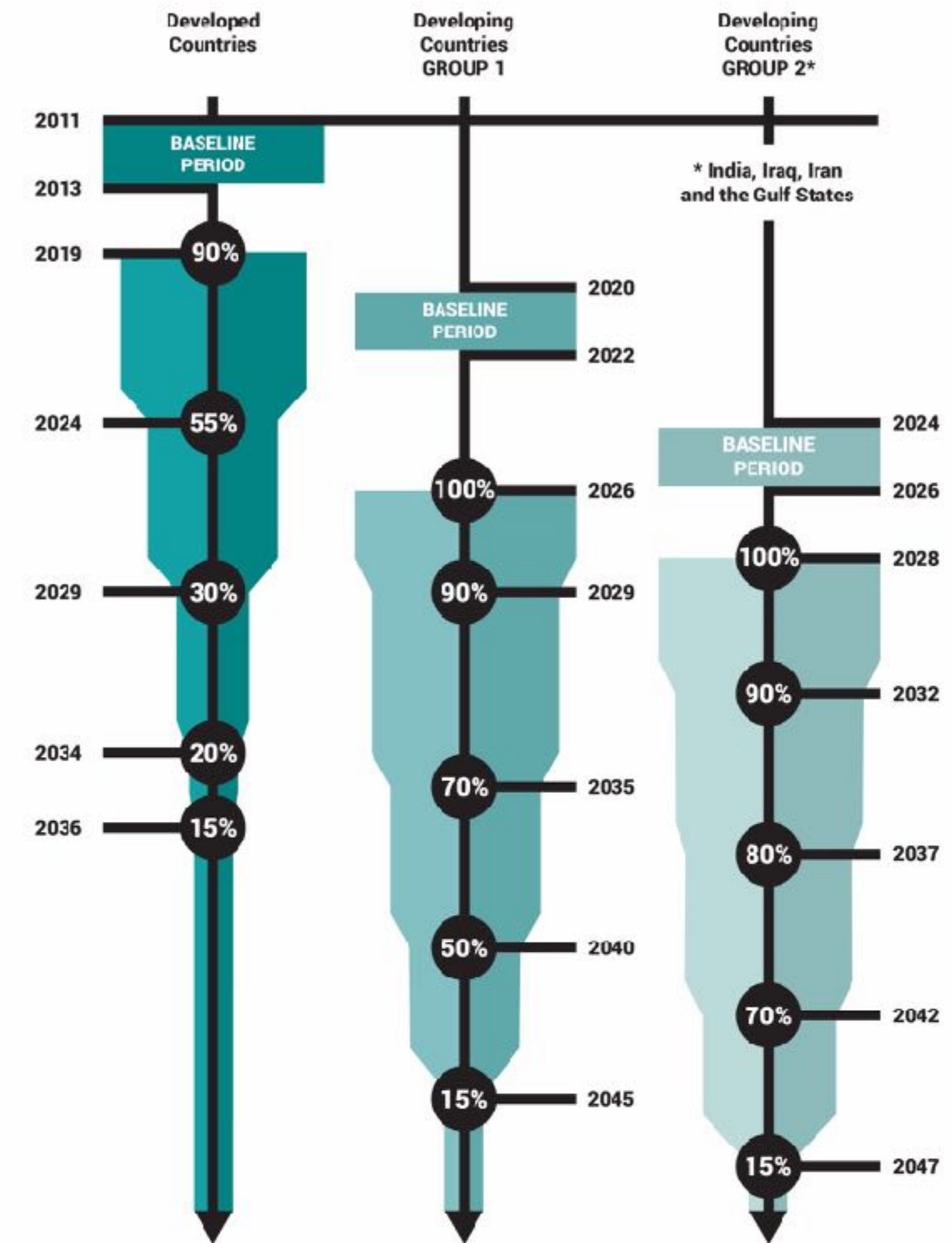
Group		100-year Global Warming Potential
<i>Group I</i>		
CHF_2CHF_2	HFC-134	1,100
CH_2FCF_3	HFC-134a	1,430
CH_2FCHF_2	HFC-143	353
$\text{CHF}_2\text{CH}_2\text{CF}_3$	HFC-245fa	1,030
$\text{CF}_3\text{CH}_2\text{CF}_2\text{CH}_3$	HFC-365mfc	794
$\text{CF}_3\text{CHF}_2\text{CF}_3$	HFC-227ea	3,220
$\text{CH}_2\text{FCF}_2\text{CF}_3$	HFC-236cb	1,340
$\text{CHF}_2\text{CHF}_2\text{CF}_3$	HFC-236ea	1,370
$\text{CF}_3\text{CH}_2\text{CF}_3$	HFC-236fa	9,810
$\text{CH}_2\text{FCF}_2\text{CHF}_2$	HFC-245ca	693
$\text{CF}_3\text{CHFCHFCF}_2\text{CF}_3$	HFC-43-10mee	1,640
CH_2F_2	HFC-32	675
CHF_2CF_3	HFC-125	3,500
CH_3CF_3	HFC-143a	4,470
CH_3F	HFC-41	92
$\text{CH}_2\text{FCH}_2\text{F}$	HFC-152	53
CH_3CHF_2	HFC-152a	124
$\text{CH}_3\text{CH}_2\text{F}$	HFC-161	12

KIGALI AMENDMENT: LISTED SUBSTANCES TO PHASE DOWN



Phase-down until 2047

No definition of low GWP
= lack of clarity regarding
alternatives





Entry into force: By 1 January 2019 latest (following ratification by 20 parties to the Montreal Protocol)

Key topics: standards (initiated by China), access to finance, exemptions

Next Key Meetings

11-14 July 2017: Workshop on **standards for low GWP alternatives** to HFCs (Bangkok, Thailand)

20-24 November: 29th Meeting of the Parties of the Montreal Protocol (Montreal, Canada)



Ratification of the Kigali Amendment to the Montreal Protocol

- Marshall Islands as the first country to deposit its instruments of ratification (2 March 2017), followed by Mali (31 March 2017)
- European Commission published its draft decision paving the way for the Council of the EU to ratify the Kigali Amendment to the Montreal Protocol (2 February 2017)
- New f-gas legislation introduced in Australia amending the Ozone Protection and Synthetic Greenhouse Gas Management (OPSGGM) Act by adding an HFC phase-down plan (30 March 2017)



Standard IEC 60335-2-89 currently recommends charge limit of Hydrocarbons at 150 grams

International Electrotechnical Commission (IEC) working group on household and similar electrical appliances currently reviewing safety standards

Agreement on recommended limit expected by 2018: raising the limits to 500 grams likely

26 Working Group members (including Germany, NZ, Japan, US)

If limit is raised, national standards will need a review in turn

Potentially opening up further opportunities to hydrocarbons globally