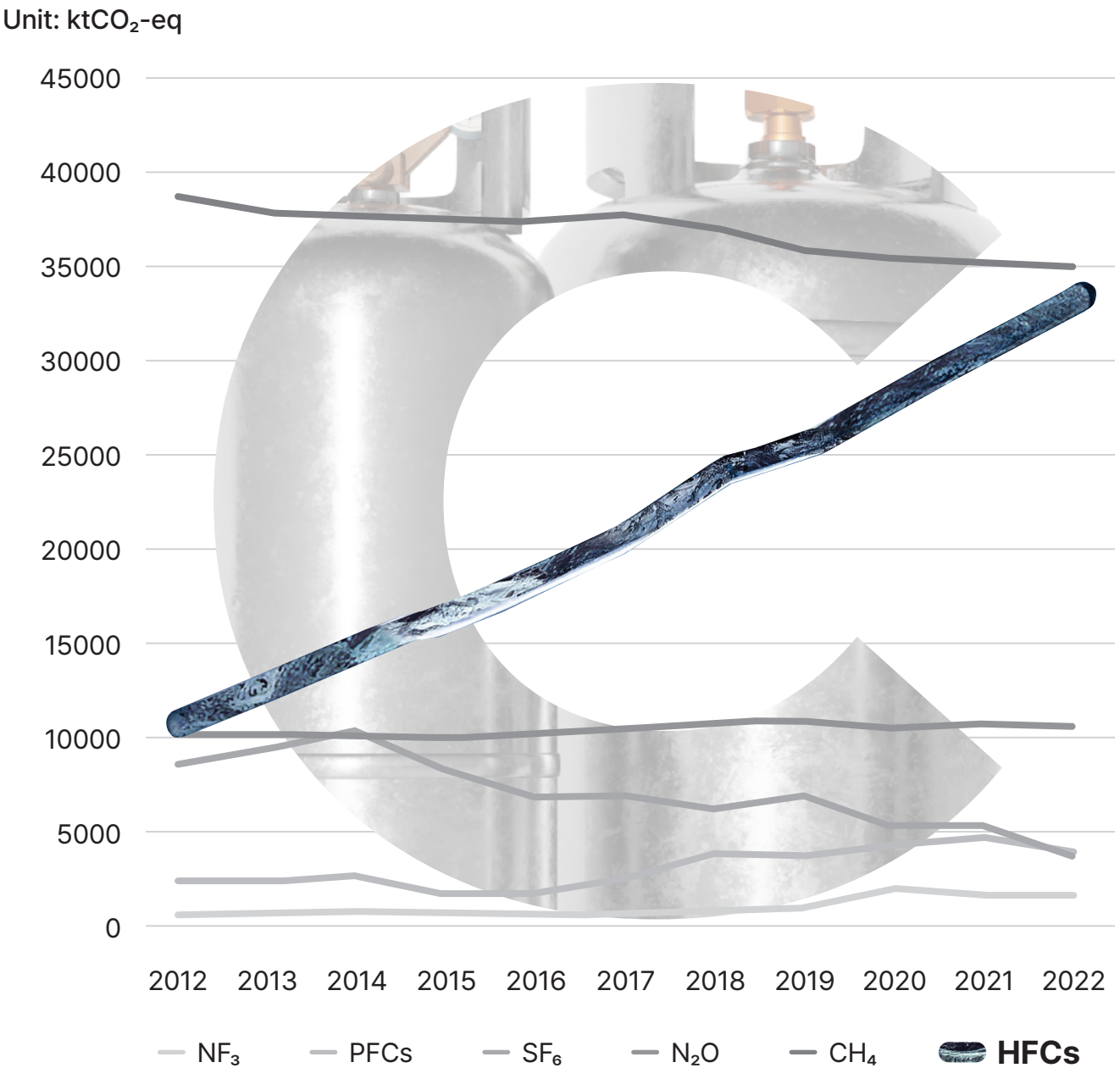
SFO°C
Solutions for Our Climate

° Issue Brief



Laying the Groundwork: Accelerating the HFCs Transition and Lifecycle Refrigerant Management – An HVACR Industry Survey

Focus on the South Korean HVACR Sector

Cover Image

“HFCs, the fastest growing greenhouse gas”

Data source: National Greenhouse Gas Inventory
of South Korea (1990-2022) (IPCC ’06 Guidelines)

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Focus on the South Korean HVACR Sector

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Summary of HVACR Survey Results

Current status of refrigerant use

- Approximately **2/3** of respondents to the present survey stated that they handle HFC refrigerants most often.
- **HCFCs, which is subject to a complete phase out by 2030, still take up a greater share of commonly-used refrigerants than low-GWP alternatives.**

Awareness of refrigerant regulations

- Approximately **4/5** of industry respondents reported having a general understanding of the HFCs production and consumption phase-down schedule under the Montreal Protocol.
- Understanding of the Kigali Amendment is also generally well established within the industry.

Perception of the low-GWP refrigerant transition

- Though the industry is aware of the HFCs reduction schedule, survey results reveal **no specific transition plans to have been made for a majority of respondents' companies.** Even companies with transition plans say it could take up to five years to complete the transition to alternative substances.
- Despite this, **respondents' opinion was generally positive with respect to low-GWP refrigerants,** with over half of respondents believing the transition would contribute to improving industry competitiveness.

Perceived barriers and solutions for the low-GWP transition

- Over **3/4** of industry respondents stated they would face either "some", "serious", or "very serious" difficulties replacing HFC-based substances. In terms of costs, most predictions range between an increase of 10% to 50% compared to existing costs.
- Opinions on possible solutions to accelerate the low-GWP transition for industry included the need for financing the equipment needed for the low-GWP transition for companies participating in the current nation-wide GHG emissions trading scheme (K-ETS), and targeted subsidy programs for the replacement of old equipment (financial support measures).

Perceived barriers and solutions for refrigerant recovery

- Survey results reveal there are still **significant regulatory barriers to promoting refrigerant recovery.** In addition, respondents noted a general lack of recovery infrastructure and economic incentives for refrigerant recovery.
- Opinions on possible solutions include promotion of education and certification systems for training refrigerant recovery specialists, in addition to establishing a system and certification body for recycled refrigerants (structural policy measures).

I. Survey Background, Purpose and Desired Outcomes

Background

Hydrofluorocarbons (HFCs) are non-carbon dioxide (non-CO2) greenhouse gases the emissions of which are currently increasing at a faster rate than any other major greenhouse gas in South Korea. Notably, HFCs became the primary cause of the increase in total national GHG emissions for year 2021 (the data for which was officially released in 2024, taking into consideration the 3-year gap in national GHG emissions accounting). Currently, HFCs account for 4.5% of total national GHG emissions, and are expected to continue increasing into at least the mid-2030s.

HFCs are primarily consumed in South Korea as refrigerants in HVACR equipment (71% of total domestic HFCs). According to surveys conducted to date, HFCs and their predecessor, HCFCs are used in roughly 95% of refrigeration and air conditioning equipment in South Korea today.

Furthermore, the recovery rate of refrigerants from refrigeration and air conditioning equipment that has reached the end of its service life is less than 1%. The need to address the lack of policies and to eliminate management gaps in refrigerant handling throughout the product lifecycle—from use to recovery, recycling, and proper disposal—has become increasingly urgent in combination with accelerating the transition away from HFCs in new and present equipment.

In December of last year, the government announced the "Roadmap for Improved Management of HFCs to Reduce Greenhouse Gas Emissions" (hereafter referred to as the "Roadmap"), and discussions are ongoing on how to achieve a fast and effective refrigerant transition that takes into account the entire lifecycle of refrigerants.

Purpose

This industry survey was conducted to assess industry perceptions related to the government work pillars of "promoting the transition to products with low global warming potential (GWP)" and the establishment of a "comprehensive management system for refrigerants", both outlined in the "Roadmap" released last year. The survey's purpose is to inform policy stakeholders about the challenges faced by the domestic refrigeration and air conditioning industry—which is a major producer and consumer of refrigerants—in transitioning to alternative refrigerants, while at the same time highlighting the need for HFCs reduction as a key environmental and industrial transition issue that the South Korean government must urgently address.

Amid ongoing uncertainty regarding clear support measures for transitioning to alternative substances and the direction of policies related to refrigerant regulations, it is anticipated that the results of this survey, which reflect the current state and opinions of the domestic HVACR industry, will provide a basis for swiftly advancing the transition to HFC-free refrigerants for the country.

Desired Outcomes from the HVACR Survey

Policy Outcomes

- Forming industry consensus on issues hindering the transition to alternative refrigerants and the establishment of a lifecycle refrigerant management system, as well as policy alternatives, through extensive consultation with industry stakeholders
- Establishing policy grounds for government ministries to swiftly promote the transition to low-GWP refrigerants and the establishment of a lifecycle refrigerant management system by deriving recommendations backed by industry opinions

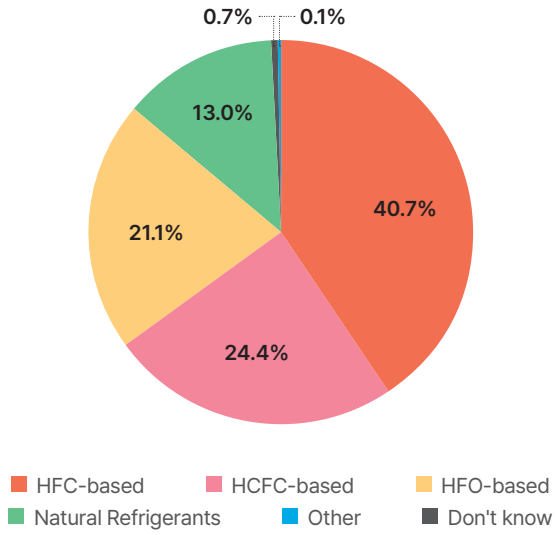
Social / Economic Outcomes

- Raising awareness among industry stakeholders about the importance of switching to low-GWP refrigerants, thereby promoting the importance of such a transition and enhancing societal acceptance of measures to address the climate crisis
- Stimulating the growth of the domestic market for HFC-free alternative refrigerants by informing stakeholders that the transition to HFC-free refrigerants will become inevitable in the future

II. Survey Results 1: Current Status of Refrigerant Use

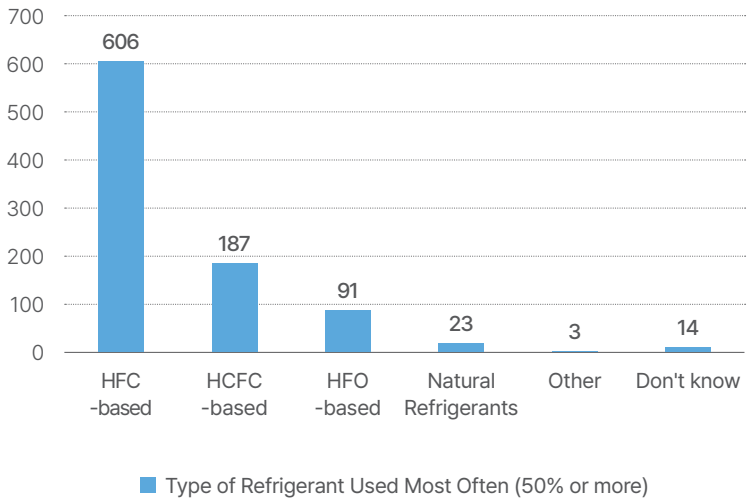
Q. What types of refrigerants are used in the refrigeration and air conditioning equipment handled by your company? (Select all applicable refrigerants)

HFC-based refrigerants were cited as being used most often by domestic HVACR industry stakeholders. HFCs were selected more than twice as often as the second and third most popular substances. Natural refrigerants accounted for a low percentage compared to other substances—even compared with HCFCs.



Q. Which refrigerant does your company primarily use (50% or more of the time)? (Select one)

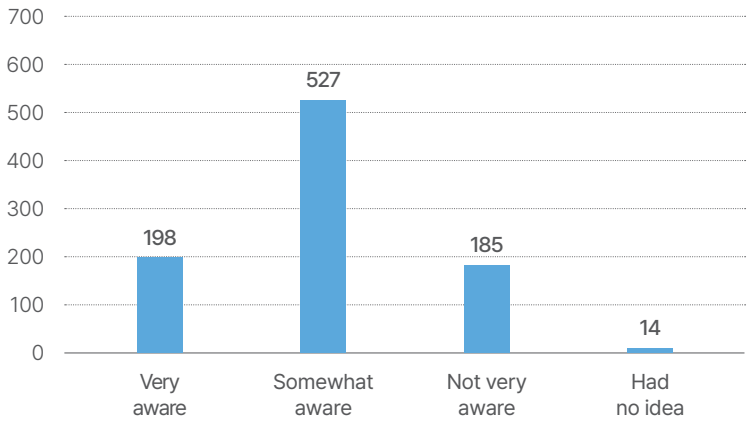
HFC-based refrigerants account for the majority (more than 50%) of refrigerants currently in use by industry stakeholders, with HCFC refrigerants ranking a distant second (more than three times fewer than HFC-based refrigerants). This suggests that no substance has yet successfully replaced HFC-based refrigerants in South Korea.



III. Survey Results 2: Awareness of Refrigerant Regulations

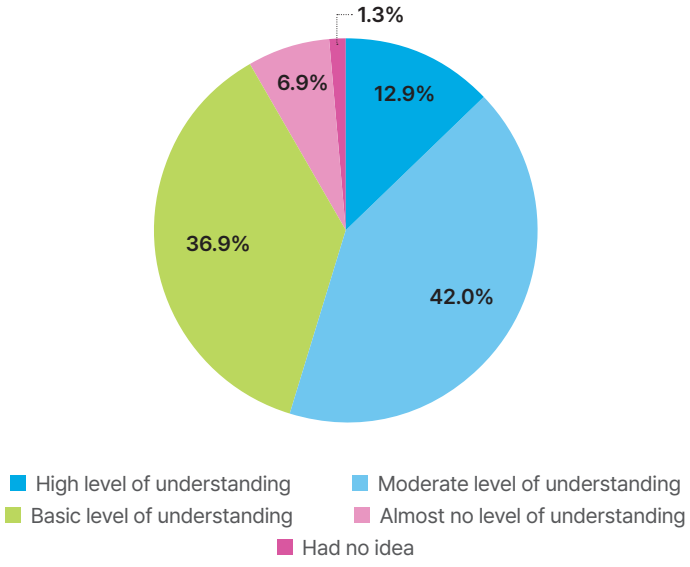
Q. Were you aware that production and consumption of HFC/HCFC substances are regulated under international law (Kigali Amendment/ Montreal Protocol)?

A majority of respondents (57%) answered that they were "somewhat aware" of the fact that HFC/HCFC substances are regulated under international law. Those who answered that they were "very aware" outnumbered those who answered that they were "not very aware".



Q. How well do you understand the relevant contents of the Kigali Amendment (such as the schedule for phasing down HFCs)?

Results show that the majority of respondents already have a general level of understanding regarding the Kigali Amendment and the reduction schedule for HFCs. Only a small number of respondents—less than 10%—indicated that they had little to zero understanding of its contents.

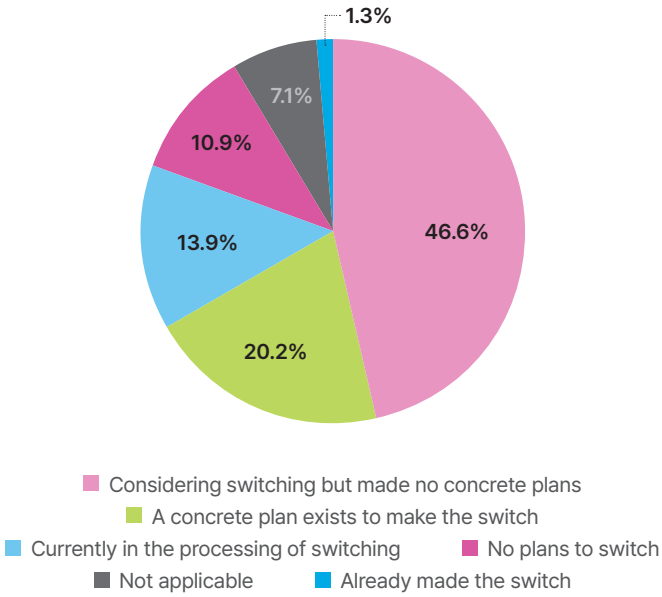


IV. Survey Results 3: Perception of the Low-GWP Refrigerant Transition

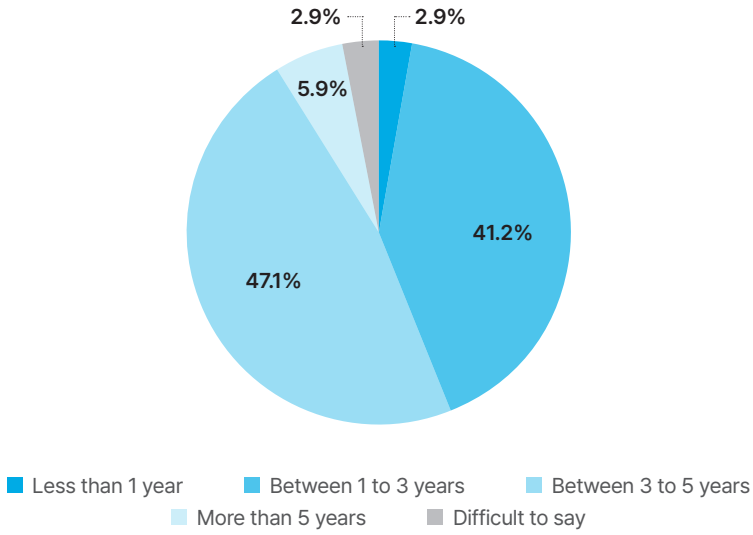
Q. Does your company have plans to switch to low-GWP refrigerants in the future? If so, when do you plan to complete the transition?

Despite general awareness of the production and consumption phase-down of HFCs at the international level, survey results show that a majority of industry stakeholders said they made no specific transition plans at their respective companies, with the majority stating that it could take up to five years to complete their respective refrigerant transitions.

→ Plans to switch to low-GWP refrigerants in the future



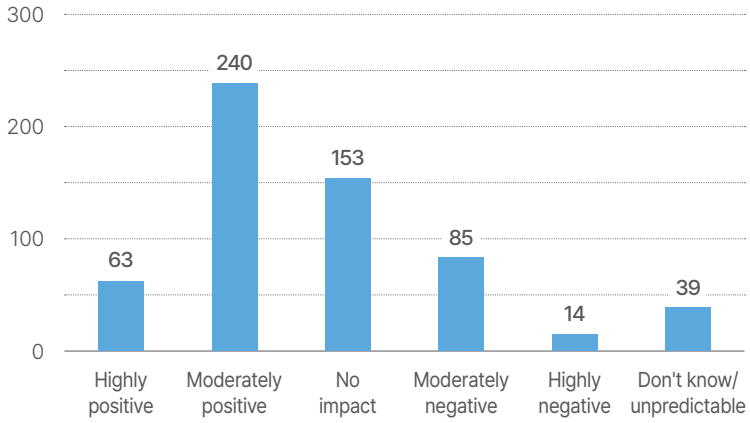
→ Average amount of time predicted for the switch to occur



Q. How do you expect the use of low-GWP refrigerants to affect the competitiveness of your products/services?

Even so, more than half of industry stakeholders responded that the refrigerant transition would have a "positive impact" (high or moderate) for their business. This was notably three times higher than the number of respondents who answered that it would have a "negative impact" (high or moderate).

This result serves to indicate that the transition to low-GWP refrigerants is perceived not only as a regulatory requirement but also as a new growth opportunity for stakeholders in the HVACR industry.

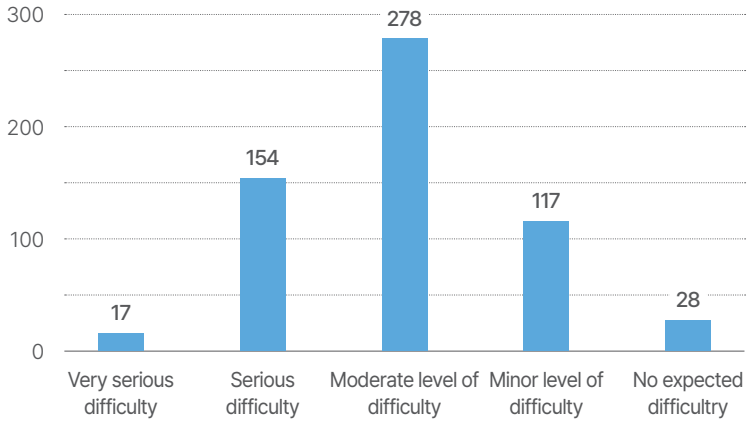


V. Survey Results 4: Perceived Barriers and Solutions for the Low-GWP Transition

Q. If the replacement of HFCs in products is mandated gradually starting from 2027, how difficult do you expect this to be for your company?

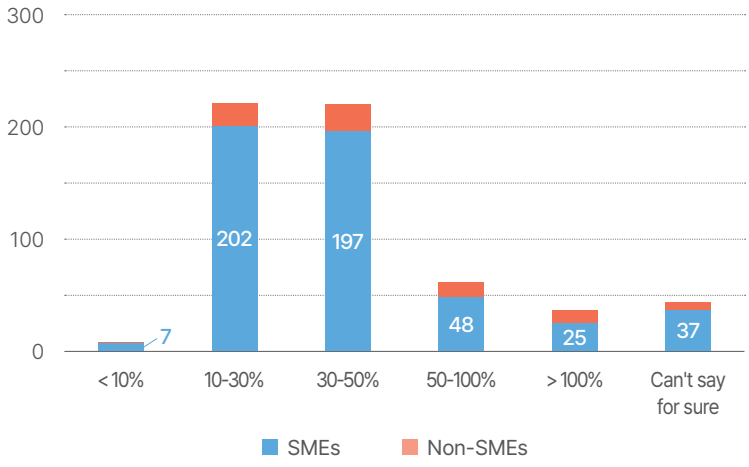
The earliest mandated date of transition—according to the "schedule for switching to low-GWP substances by product group" included in the "Roadmap"—is year 2027 for South Korea. When the extent of difficulties expected to be encountered was surveyed, over 3/4 of all respondents answered that they would face "moderate", "serious", or very serious" difficulties.

This suggests that even while the industry recognizes the refrigerant transition as an opportunity, it may prove challenging for the industry to take up the low-GWP transition voluntarily without any policy support.



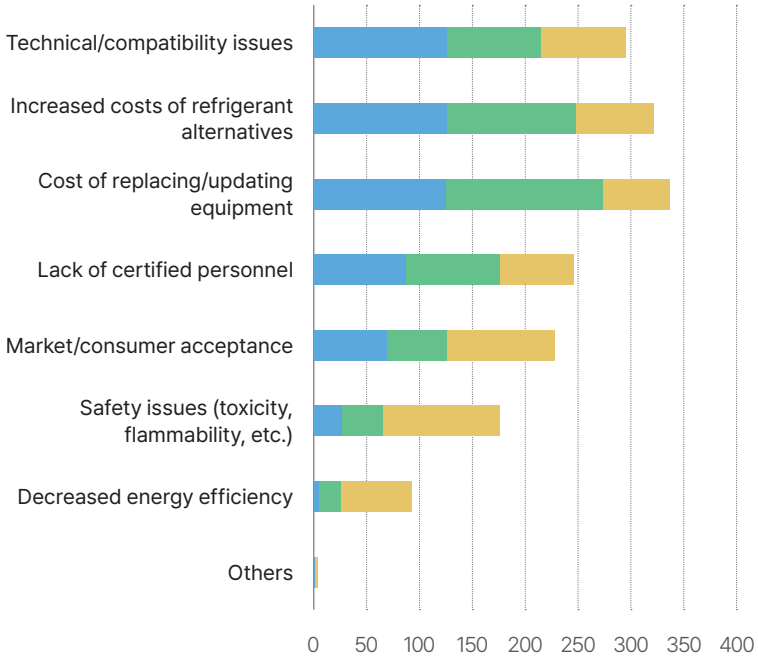
Q. What are the predicted cost increases associated with switching to low-GWP substances compared to existing ones? (only for those who answered they will encounter at least "some" difficulties)

The domestic HVACR industry, which consists mainly of small and medium-sized enterprises (SMEs), may face difficulties in switching to alternative substances due to increased costs (equipment modification, human resources, etc.). The majority of respondents said they expect costs to increase anywhere between 10% to 50% compared to existing levels.



Q. If you anticipate difficulties, what are your main concerns? (Pick top 3 most important[1])

Alongside technical/compatibility issues, cost issues were ranked as the biggest concerns (2nd and 1st respectively) that could prevent respondents' companies from switching to low-GWP substances. Although not included in the top 3 choices, concerns about the increasing costs of alternative refrigerants also appear to be a major factor. Safety issues (toxicity, flammability, etc.) of some alternative substances were also raised as significant potential barriers.

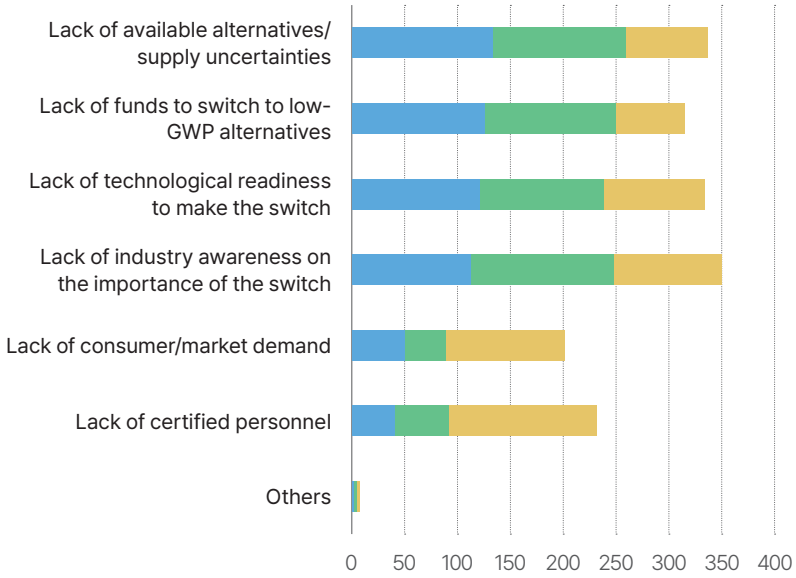


	1st Choice	2nd Choice	3rd Choice
Technical/compatibility issues	**127**	88	80
Increased costs of refrigerant alternatives	126	122	73
Cost of replacing/updating equipment	125	**149**	63
Lack of certified personnel	87	89	69
Market/consumer acceptance	69	57	102
Safety issues (toxicity, flammability, etc.)	26	39	**110**
Decreased energy efficiency	5	21	67
Others	1	1	2

1 Applicable for all "top 3 most important" questions: the "top 3" choices were compiled through a systematic process of asking survey respondents to select their top 3 choices for each challenge and policy recommendation (low-GWP, and refrigerant recovery) among the choices given, with the most frequently selected choices for each rank being summed up to derive the overall top 3 rankings.

Q. What do you think is the biggest barrier for the industry in switching to alternative materials with low global warming potential? (Pick top 3 most important)

The lack of compatible low-GWP substances/supply uncertainties was cited as a potential major barrier to the industry's switch to HFC-alternatives in the medium to long term. This reflects concerns that HFC-alternatives, which have limited domestic supply and rely heavily on imports, may be vulnerable to supply chain disruptions. Additionally, even if alternative materials were to be available, a lack of specialized and certified personnel to handle them properly could exacerbate challenges for the industry.



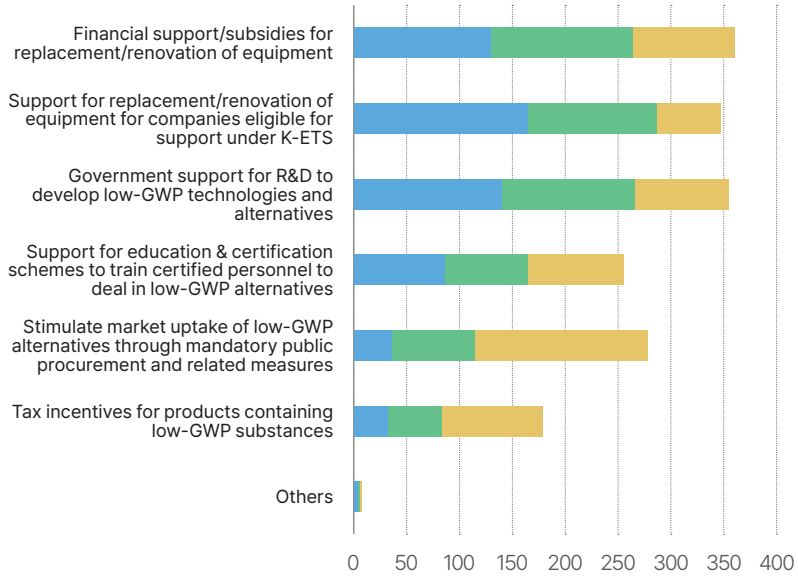
	1st Choice	2nd Choice	3rd Choice
Lack of available alternatives/ supply uncertainties	**135**	125	77
Lack of funds to switch to low-GWP alternatives	126	125	65
Lack of technological readiness to make the switch	122	117	96
Lack of industry awareness on the importance of the switch	114	**135**	102
Lack of consumer/market demand	51	39	112
Lack of certified personnel	42	51	**140**
Others	4	2	2

Q. What do you think are the most necessary government policies to promote the transition to low-GWP refrigerants? (Pick top 3 most important)

Support for conversion equipment and subsidies for the replacement of old equipment for eligible companies participating in the emissions trading scheme (K-ETS) were identified as important support measures from an industry perspective.

While expanding the existing emissions trading scheme may be preferable from the point of view of efficiency, it must be noted that many refrigeration and air conditioning companies are currently not subject to emissions allocations and thus are not eligible for support under the ETS framework.

Therefore, it may be prudent to consider designing support policies that take into account the special needs of SMEs in the refrigerant transition. Additionally, respondents also pointed to stimulating market take-up through public procurement measures as a preferable measure.

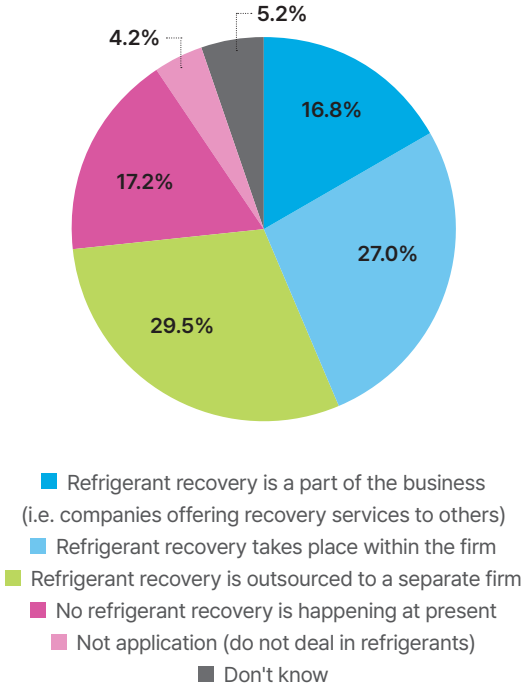


	1st Choice	2nd Choice	3rd Choice
Financial support/subsidies for replacement/renovation of equipment	131	**134**	96
Support for replacement/renovation of equipment for companies eligible for support under K-ETS	**165**	122	61
Government support for R&D to develop low-GWP technologies and alternatives	140	126	89
Support for education & certification schemes to train certified personnel to deal in low-GWP alternatives	86	79	90
Stimulate market uptake of low-GWP alternatives through mandatory public procurement and related measures	36	79	**163**
Tax incentives for products containing low-GWP substances	32	52	94
Others	4	2	1

VI. Survey Results 5: Perceived Barriers and Solutions for Refrigerant Recovery

Q. How does your company recover refrigerants at end-of-life?

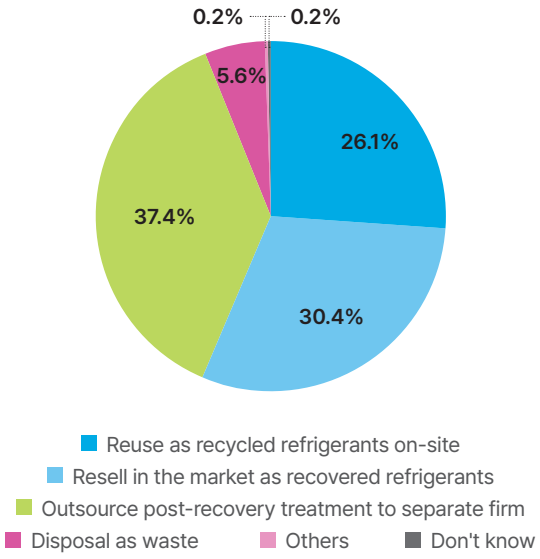
Among refrigerant recovery operators, it was found that a high proportion either outsourced recovery operations to external companies or conducted recovery in-house. The low share of operators directly providing refrigerant recovery services may be attributed to the relatively small scale of these recovery businesses in the country, which may also have resulted in lower response rates compared to companies that outsource recovery operations.[2]



2 According to internal SFOC research, the national refrigerant recovery rate is estimated to be less than 1%. However, the following points should be considered when interpreting the survey results: 1) This survey was conducted among stakeholders representing refrigerant recovery services, such as the Korea Refrigerants Recycling Engineers Center (KRRC), thus the proportion of respondents from companies actually conducting refrigerant recovery may appear higher from the survey results that may not be reflective of the national average. 2) Multiple respondents from the same refrigerant recovery company may have responded to the survey.

Q. What is your method of handling refrigerants after recovery?

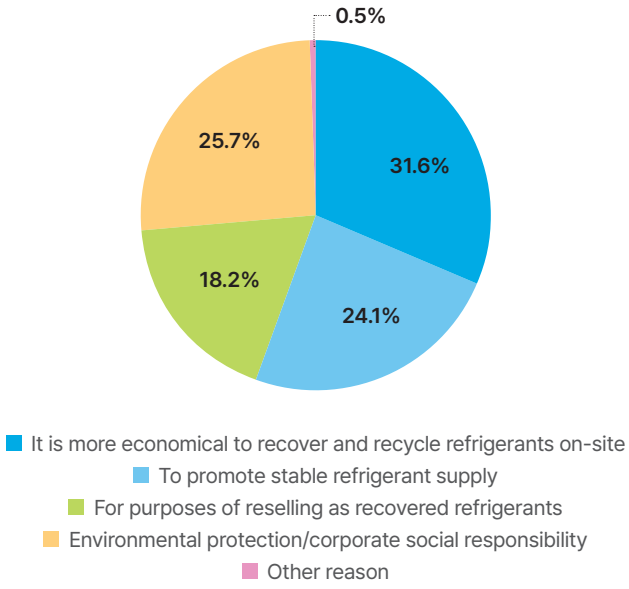
Among the methods for handling refrigerants after they have been recovered, outsourcing the task of end-of-life management to a specialized operator was found to be the most common. Only a small number of respondents answered that they "directly dispose of it as waste," suggesting that a larger share of respondents' companies may be seeking economic benefits by reselling or reuse of the recovered refrigerants.



Q. If your company is currently engaged in refrigerant recovery, what is the main reason for doing so?[3]

It is notable that the choice "It is more economical to recover and recycle refrigerants on-site" ranked first, indicating that companies may recognize the economic value of recycled refrigerants. “To promote a stable refrigerant supply” also appears to be an important reason for companies that
recover refrigerants.

More than 25% of respondents cited “environmental protection/ corporate social responsibility” as the main reason for refrigerant recovery, suggesting that these companies recognize the importance of implementing refrigerant recovery for purposes of environmental protection.

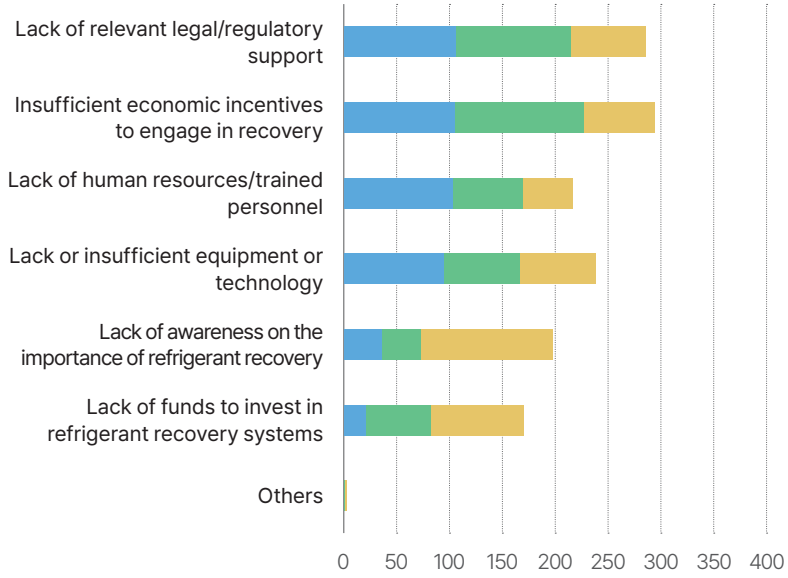


3 Nationwide, there may only be a few businesses where it is economically viable to successfully recover refrigerants and sell them as recovered refrigerants or reuse them within the company. However, it should be noted that this result may have been derived whereby several employees from a few companies specializing in refrigerant recovery responded to the survey at the same time.

Q. What do you think is the biggest barrier to effective refrigerant recovery? (Pick top 3 most important)

Results reveal there are still significant policy challenges in promoting refrigerant recovery. While several innovative refrigerant recovery companies exist at the domestic level, the overarching legal and regulatory framework to promote such activities lags behind these first movers, and there is a perceived lack of economic incentives as relates to refrigerant recovery.

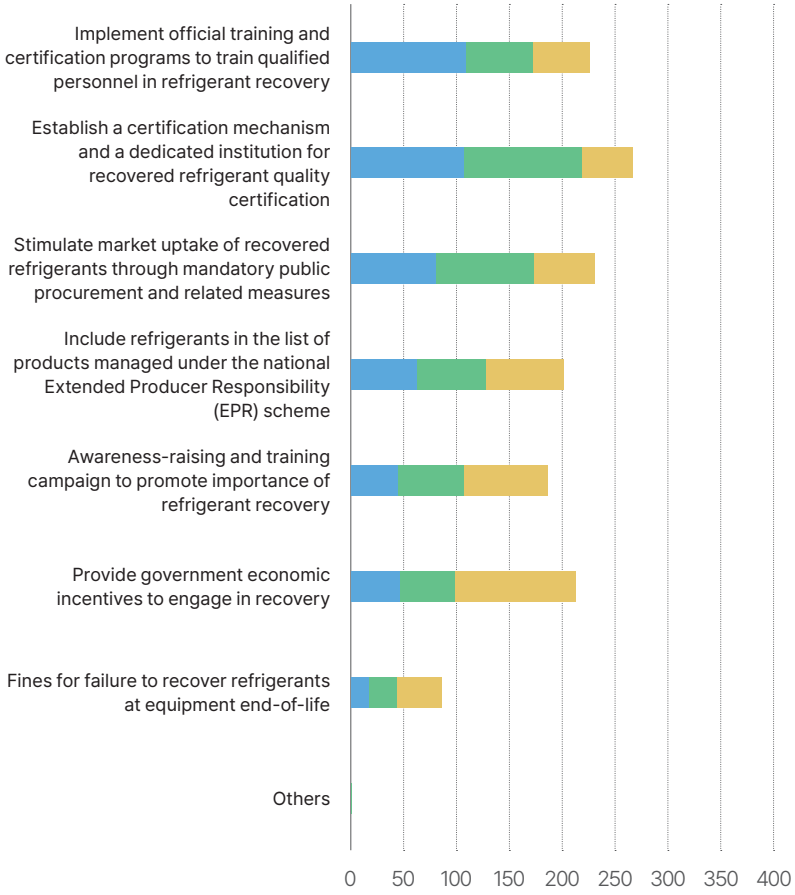
Additionally, raising awareness and promoting understanding of the importance of recovery across the entire domestic HVACR industry was cited as a key barrier that would need to be addressed.



	1st Choice	2nd Choice	3rd Choice
Lack of relevant legal/regulatory support	**109**	107	70
Insufficient economic incentives to engage in recovery	105	**123**	67
Lack of human resources/trained personnel	103	68	46
Lack or insufficient equipment or technology	95	72	72
Lack of awareness on the importance of refrigerant recovery	36	38	**125**
Lack of funds to invest in refrigerant recovery systems	22	61	88
Others	0	1	2

Q. What do you think are the most necessary government policies for promoting the effective recovery of refrigerants? (Pick top 3 most important)

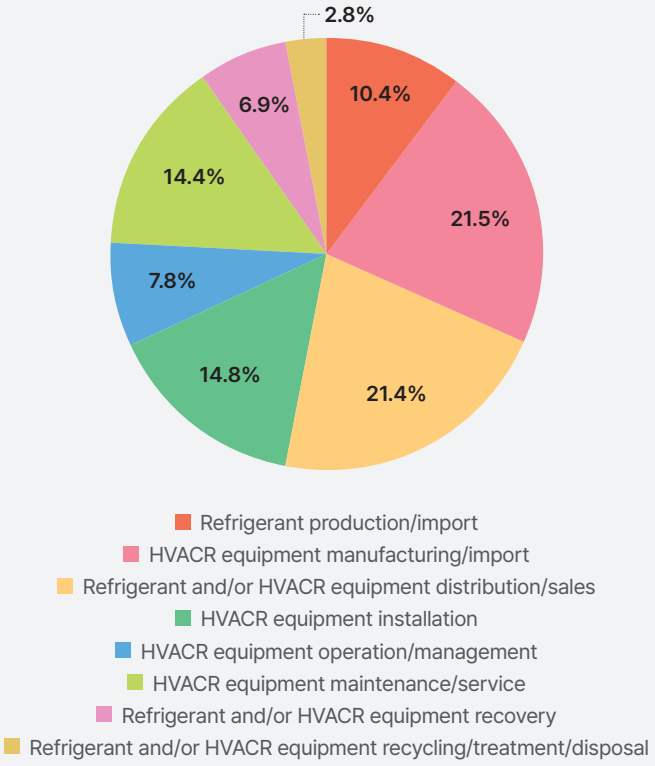
The establishment of education and certification systems for training specialized personnel in refrigerant recovery was identified as the most necessary policy from the point of view of HVACR industry stakeholders. This appears to reflect the characteristics of domestic refrigerant recovery facilities, which are predominantly micro-, small- and medium-sized enterprises and employ a large number of non-specialized, non-regular workers. The establishment of a quality certification body for recycled refrigerants ranked second among necessary policies, which may be seen as the first step toward ensuring the marketability of recovered refrigerants. Provision of government incentives ranked third.



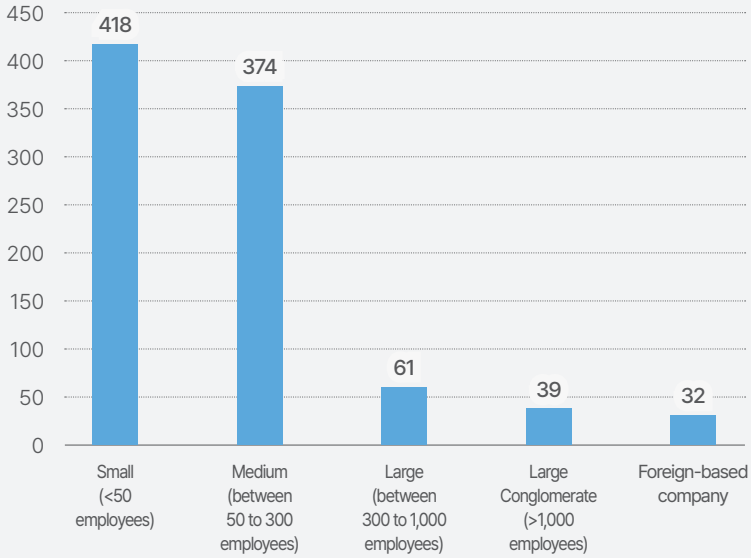
	1st Choice	2nd Choice	3rd Choice
Implement official training and certification programs to train qualified personnel in refrigerant recovery	**109**	64	53
Establish a certification mechanism and a dedicated institution for recovered refrigerant quality certification	107	**111**	49
Stimulate market uptake of recovered refrigerants through mandatory public procurement and related measures	81	92	58
Include refrigerants in the list of products managed under the national Extended Producer Responsibility (EPR) scheme	63	64	74
Awareness-raising and training campaign to promote importance of refrigerant recovery	45	62	79
Provide government economic incentives to engage in recovery	47	51	**114**
Fines for failure to recover refrigerants at equipment end-of-life	18	26	42
Others	0	0	1

Appendix 1: Company Respondent Information

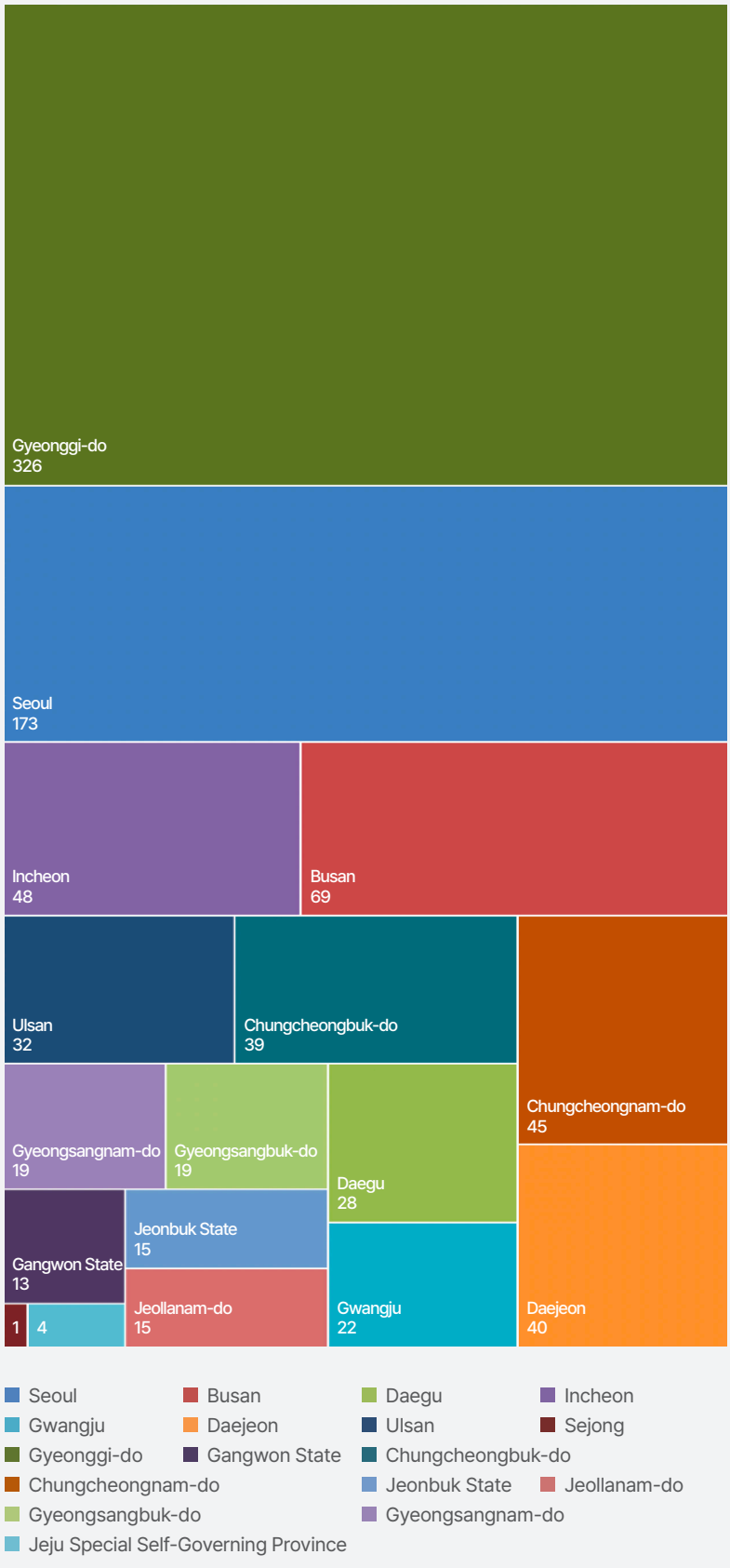
Q. What part of the HVACR industry value chain is your company responsible for?



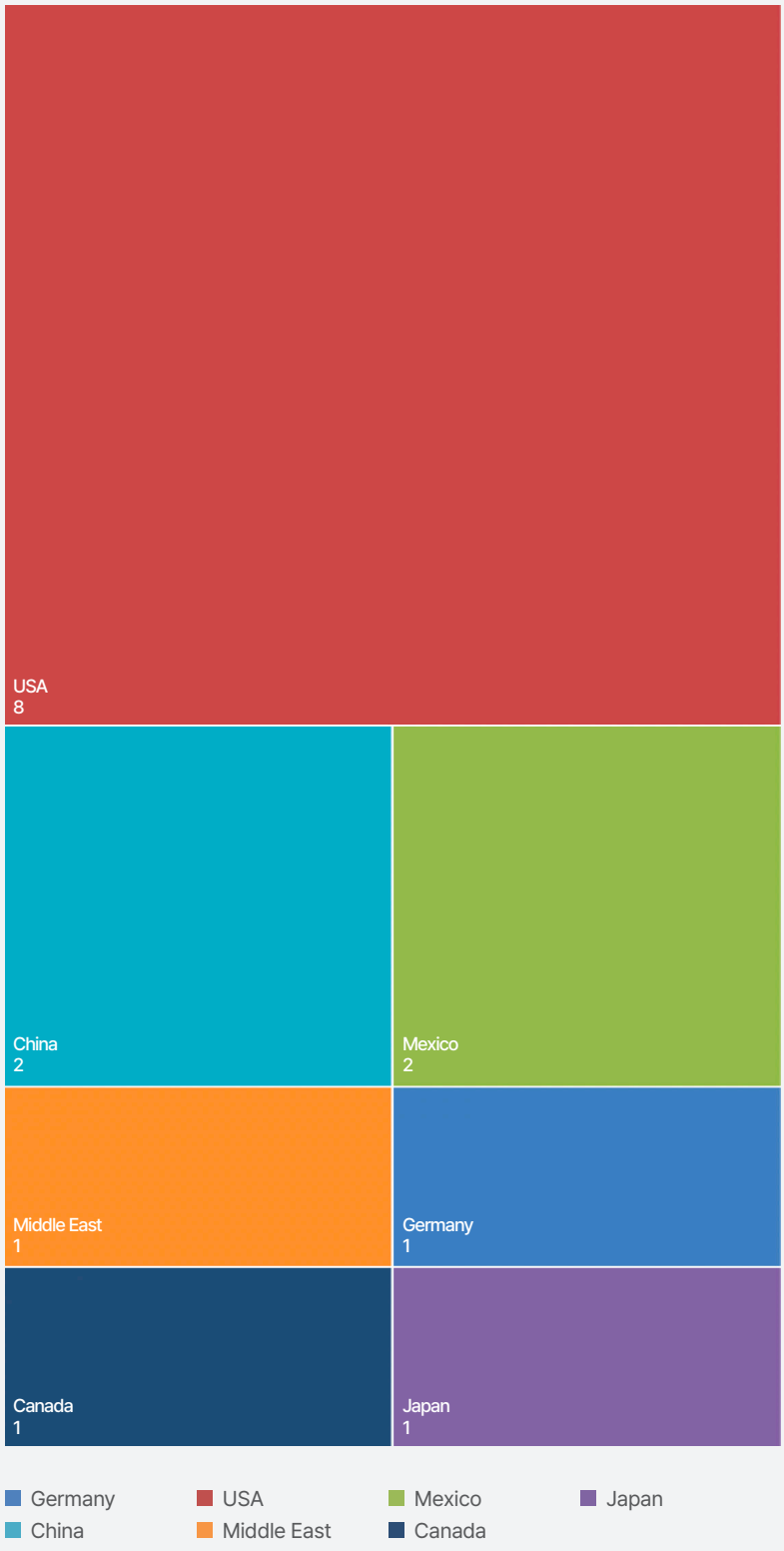
Q. How big is your company? Are you a domestic or foreign company?



Q. Where is your company (headquarters or main office/factory) located? (Domestic companies only)



Q. Where is your company (headquarters or main office/factory) located? (Foreign-based companies only)



Appendix 2: Survey Methodology

Survey target audience:	HVACR industry stakeholders/professional engaged in the production /manufacturing/import, distribution/sales, installation, operation/ management, maintenance/service, recovery, recycling/treatment/ disposal of refrigerants, refrigeration and air conditioning equipment within South Korea.
Survey duration:	May ~ June 2025
Survey distribution channels and methods:	1) Distribution through specialized HVACR media outlet "Kharn/ColdChain News" Newsletter (Modality: Online) 2) Distribution through partnership with HVACR-related Industry Associations (Modality: Online) - Participating Industry Associations: The Society of Air-Conditioning and Refrigerating Engineers of Korea (SAREK), Korea Energy Engineers Association (KOEEA), Korea Refrigeration and Air-conditioning Industry Association (KRAIA), Korea Refrigerants Recycling Engineers Center (KRRC)
Survey design and structure:	The single survey was categorized into **Type A: Low-GWP Refrigerant Transition** and **Type B: Refrigerant Recovery Promotion**, and during the survey period, the two types were integrated into a single questionnaire and distributed together via a dedicated web platform. **Type A** consisted of a total of 14 questions with a focus on low-GWP refrigerants, and **Type B** consisted of a total of 12 questions with a focus on refrigerant recovery. Questions related to general company characteristics, current refrigerant use status, and awareness of refrigerant regulations were included in both Types—namely, with 7 questions that overlap—bringing the number of distinct questions to 19 overall. At the beginning of the survey, each respondent was asked to select the part of the HVACR value chain their company operates in (multiple selections allowed), and the survey Type was determined based on the selected part of the value chain. **Type A** value chain parts included: refrigerant production/import, HVACR equipment manufacturing/import, and refrigerant or HVACR equipment distribution/sales. **Type B** value chain parts included: HVACR equipment installation; HVACR equipment operation/management; HVACR equipment maintenance/service; HVACR equipment recovery; and HVACR equipment recycling/treatment/

disposal. If a respondent's industry fell under one or more parts of the value chain listed in both Type A and Type B (e.g., a company engaged in both refrigerant sales and refrigerant recovery), the survey questions for Type A and Type B were combined into **Type C** that contained questions from both Types (i.e. total of 19 questions). Data from all Types were compiled and analyzed together after the end of the survey period. This brief is based on the combined results of all three Types.

Survey participation:

The total number of respondents to the survey was 924, with 450 respondents for **Type A**, 330 respondents for **Type B**, and 144 respondents for **Type C** (Type A + B).

Index: Full List of Survey Questions

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