MINISTRY OF AGRICULTURE AND ENVIRONMENT
DEPARTMENT OF CLIMATE CHANGE · VIET NAM

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The Refrigerant Circular Economy at a Crossroads: Ten Years after Kigali, Will Refrigerant Banks Become Future Emissions or Valuable Resources?

Viet Nam's approach to data-driven Lifecycle Refrigerant Management (LRM)

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Policy Foundations - Circular Refrigerant Management in Viet Nam

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LAW

Law No. 72/2020/QH14 – Law on Environmental Protection.

DECREES

Decree No. 06/2022/ND-CP – On greenhouse gas emission mitigation and ozone-layer protection.

Decree No. 45/2022/ND-CP – Regulating administrative penalties in the field of environmental protection.

Decree No. 119/2025/ND-CP – Amending and supplementing provisions of Decree 06/2022/ND-CP.

Decree No. 83/2026/ND-CP – Amending and supplementing provisions of Decree 06/2022/ND-CP and Decree No. 119/2025/ND-CP

Decree No. 110/2026/ND-CP – Regulating recycling and waste treatment responsibilities of producers and importers (EPR) for refrigeration and air-conditioning equipment.

CIRCULARS

Circular No. 01/2022/TT-BTNMT – Detailing implementation of the Law on Environmental Protection on climate change response.

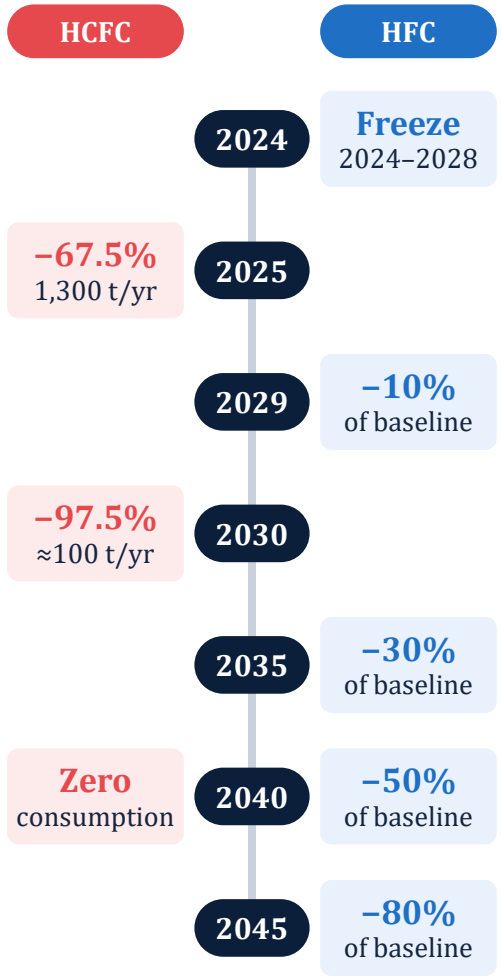
Circular No. 20/2023/TT-BTNMT – National technical regulation on collection, transport, storage, recycling, reuse and treatment of controlled substances (QCVN 76:2023/BTNMT).

Circular No. 08/2025/TT-BNNMT – Amending and supplementing Circular 01/2022/TT-BTNMT.

DECISION

Decision No. 496/QD-TTg – Promulgating the National Plan for management and phase-out of ozone-depleting substances and controlled greenhouse gases.

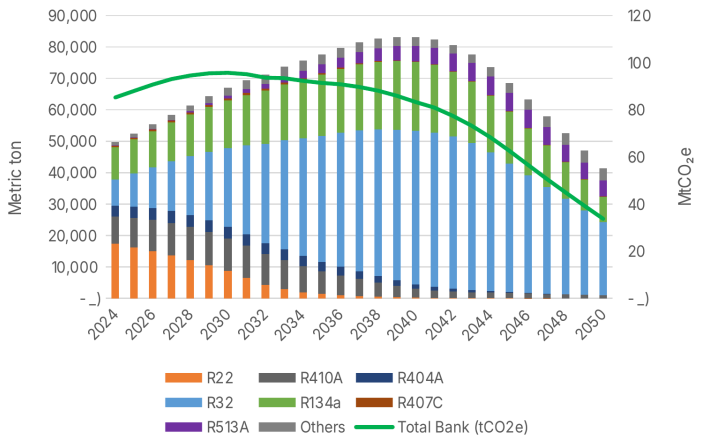
PHASE-OUT ROADMAP



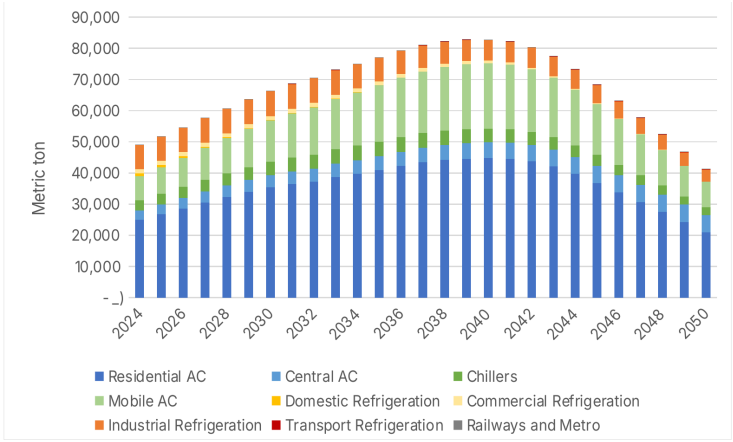
Viet Nam's Refrigerant Inventory - Key Findings

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National refrigerant bank overview (2024–2050)



Total refrigerant bank by sector (2024–2050)



49,072 t

installed HCFC/HFC bank in 2024

85.2 $MtCO_2e$

potential climate impact, peaking at 95.7 in 2030

< 0.1%

recovery rate: nearly all gas is vented

560 → 2,059 t

recoverable end-of-life gas per year, 2024 to 2050

Key findings

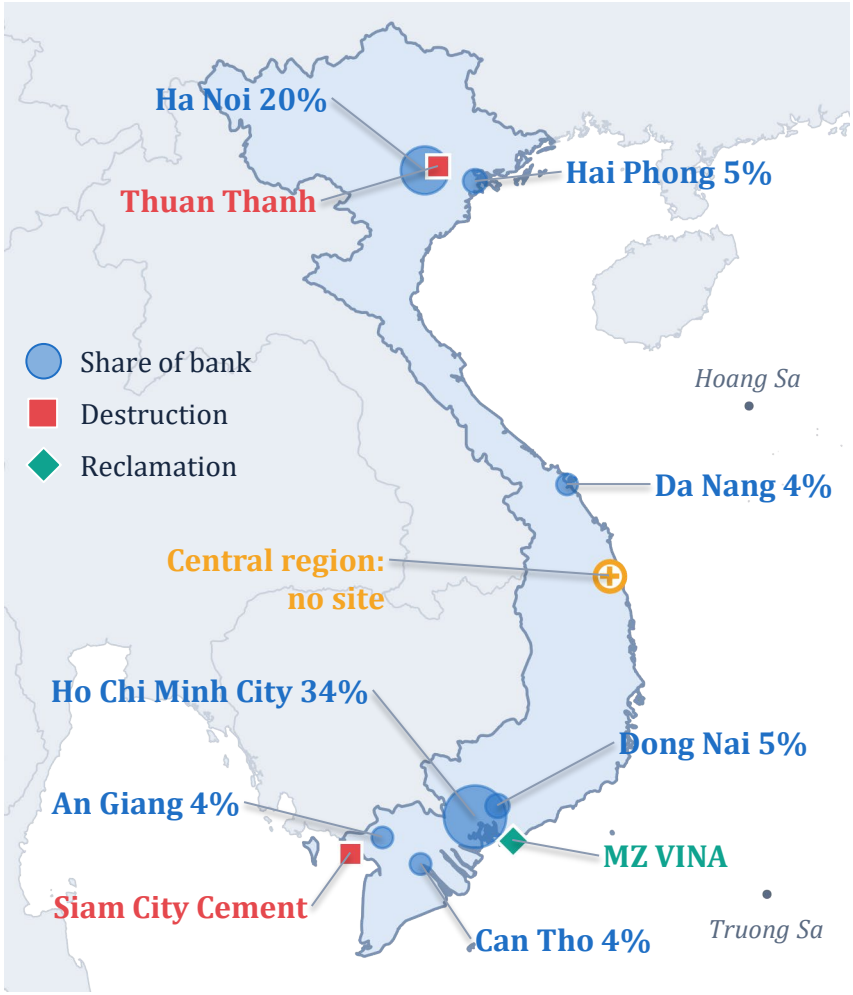
- Nine **refrigeration and air-conditioning sub-sectors** are covered by the inventory.
- **Residential AC** is the largest: 50.8% of the bank (24,936 t), with R32 becoming its dominant refrigerant.
- **Mobile AC** (7,715 t) and **industrial refrigeration** (7,825 t) each hold about 16% of the bank; industrial refrigeration carries about 24% of the climate impact.
- The bank peaks at **82,909 t around 2039**; its climate impact peaks earlier, in 2030.
- **64%** of the bank sits in Ho Chi Minh City, Ha Noi, Hai Phong and Dong Nai (see next slide).

(*) Unpublished report

What the Inventory Tells Us - Opportunities and Challenges

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Where the bank and treatment sites are



(*) Unpublished report

Opportunities

- Daikin's authorized service network (DAV-SSS, 100+ service centers) already sends recovered gas to MZ VINA (reclamation) and Thuan Thanh (destruction).
- Recoverable R22 peaks at 828 t in 2032, a source of reclaimed gas as HCFC import quotas fall to 100 t a year from 2030.
- Avoided emissions from formal treatment rose from 698 tCO_2e (2021) to 3,229 tCO_2e (2024), and over 3,200 technicians have been trained since 2021.

Challenges

- Of 560 t of end-of-life refrigerant in 2024, only 1.92 t (less than 0.4%) was reclaimed or destroyed; the rest was vented to the atmosphere.
- Many informal technicians (200,000+) lack recovery equipment, training and certification.
- Sites are concentrated, none in the Central region; contamination and quality testing constrain treatment.
- Collection, transport and treatment can cost more than the gas is worth, with no EPR recovery requirement yet; low-GWP alternatives also reshape demand.

Building an Operational LRM System

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1 Chain and timeline

ANNUAL REPORTING Report use of controlled substances by 15 January

Equipment owner → Technician → Collection → Recycling / reuse or Treatment

From 01/01/2024 Equipment owners: AC > 26.5 kW (90,000 BTU/h); industrial refrigeration > 40 kW electrical input

From 01/01/2028 Manufacturers and importers of smaller equipment and products (AC ≤ 26.5 kW; refrigeration ≤ 40 kW electrical)

2 Handling process

RETURN TO USE

1 RECOVERY




- Calibrated recovery equipment
- Segregate gases; fill cylinders ≤ 80%
- Keep cylinders upright and labeled

WHO Equipment owners, technicians, garages
NEEDS Technical capacity: trained staff, tools

Transport

2 STORAGE



- Keep recovery cylinders upright
- Ventilation, fire protection, segregated bays
- Leak detectors in enclosed areas

WHO OEM centers and hubs
NEEDS Traceability: cylinder IDs, weights, handovers

Transport per QCVN 76:2023/BTNMT; not as hazardous waste

3 RECYCLING



- Sample and identify gas
- Use specialized equipment
- If compliant: label cylinder "recycled"

WHO Treatment operators; MZ VINA reclaims
NEEDS Quality standards: identify, segregate, test

Quality passed

4 REUSE



Field quality test

- Equipment owner determines reuse
- Mechanical cleaning / filtration
- Keep operating records

WHO Equipment owners
NEEDS Market & finance: demand for reclaimed gas

Transport subject to hazardous-waste rules

Failed

5 TREATMENT / DESTRUCTION

Comply with hazardous-waste regulations; use authorized technologies and safeguards

WHO Thuan Thanh, Siam City Cement
NEEDS Funding for compliant disposal

RefNEXT - Digital Tools for Refrigerant Lifecycle Management

Pilot electronic logbook supported by CCAC and OECC, for traceability and reporting.

14 organizations voluntarily registered for pilot testing

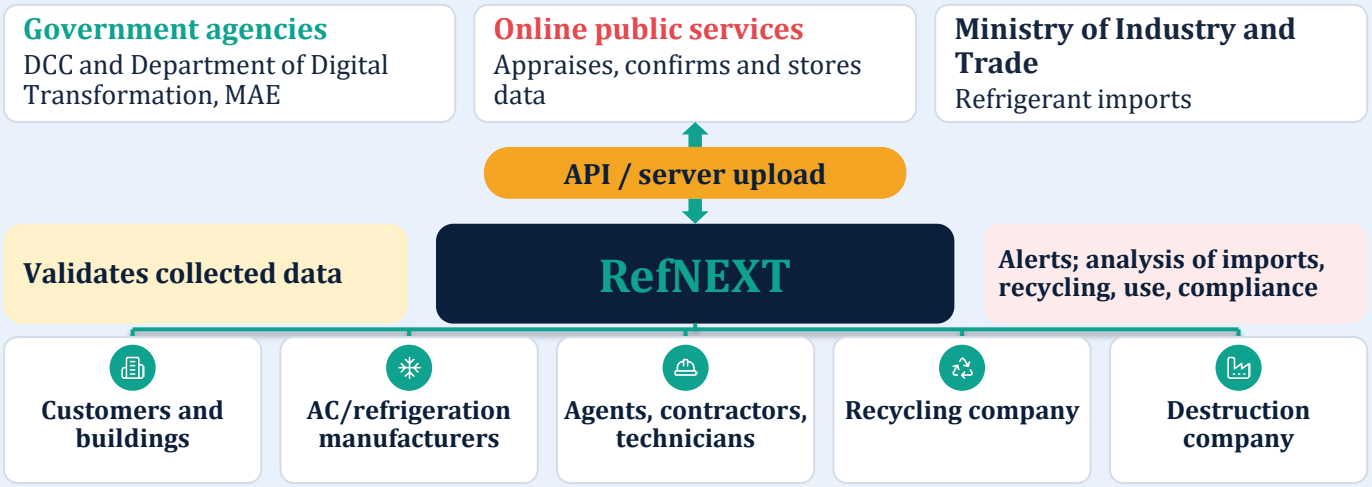
Track Equipment, gas type, quantities and service transactions

Connect Transfers among owners, service providers and treatment facilities

How RefNEXT works in practice

- **Weighing:** weight before and after each job gives the quantity recovered or charged.
- **Purity:** five parameters are tracked, including moisture and acidity.
- **Reports:** track jobs and cylinders in real time, with monthly and yearly totals of gas charged, recovered and treated.
- **Flexible use:** QR codes and the collection step are optional.

Data flow



Objectives of RefNEXT

Field recording

Record equipment, refrigerant type, cylinder code, charged and recovered quantities, time, operator and evidence to keep a history of every action.

Tracking the chain

Link recovery, collection, handover, reclamation or destruction, and reuse. Trace where the gas came from, who received it and its final status.

Support for aggregation and MRV

Standardize input data and store electronic photos and documents for aggregation, checking and reconciliation, and to support MRV at facility level.

Sustainable Financing and Carbon Market Opportunities

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Two business models make the system financially sustainable. Neither needs indefinite government subsidy; both need a defined policy enabling environment.



Mobile air conditioning ≈ 3.4 years

Payback at design throughput

- Recovers R134a at automotive garages.
- Earns revenue by reusing the recovered gas instead of buying virgin gas.
- Needs one-time equipment financing: small garages may lack access to capital.



Other stationary equipment ≈ 2.6 years

Payback with Multilateral Fund support and carbon credits

- Reclaims about half of the recovered gas and destroys the rest.
- Without carbon credits, loses about USD 310,000 a year: reclaimed gas sells at USD 9.00/kg, handling costs about USD 16.3/kg.
- Needs about USD 0.80 million of bridge financing until the first credits are issued.

Carbon credits and monitoring

- Destruction and HFC-reclamation credits: about USD 0.6 million a year at USD 15/tCO_2e.
- Verra VM0016 v2.0 credits destruction, not reclamation; Viet Nam has no crediting pathway for HFC reclamation yet.
- RefNEXT is the proposed backbone for monitoring, reporting and verification (MRV).

Where the money comes from

- State budget allocations.
- EPR contributions to the Viet Nam Environment Protection Fund (VEPF).
- An environmental levy on imported bulk HFCs and new refrigeration and air-conditioning equipment.
- Multilateral Fund, Global Environment Facility and carbon-credit revenues.

(*) Unpublished report

Thank you

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