



Assessing the carbon footprint of reclaimed refrigerant for reuse and virgin refrigerant production.

Why assess the carbon footprint of refrigerant treatment methods?

As a leading provider of heating, cooling, ventilation, air purification, service and refrigeration solutions, we are committed to reduce our greenhouse gas emissions to net zero by 2050. To achieve this, we assess the whole life cycle of our equipment, including materials, factory, use, end of life etc.



Part of this is evaluating and comparing the impact of two refrigerant treatment methods after recovery: refrigerant reclamation for reuse versus refrigerant destruction and virgin production.

Therefore, a third party, TCO2 Co. Ltd, has assessed the environmental impact of these two treatment methods. TCO2 Co. Ltd is an independent Japanese consulting firm focusing on sustainability insights and providing

environmental impact and cost calculation tools. The assessment was conducted in 2022 and validated by Prof. Norihiro Itsubo from Tokyo City University..

The study shows that the carbon footprint of reclaimed refrigerant reuse lies between 72% and 90% lower compared to that of virgin refrigerant production, depending on the refrigerant.

More about TCO2 Co. Ltd:

<http://tco2.com>

More about Prof. Norihiro Itsubo:

<http://www.comm.tcu.ac.jp/itsubo-lab/about/teacher/index.html>

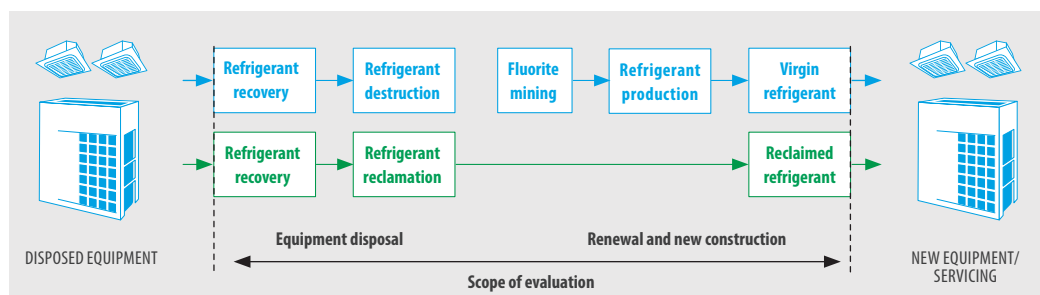
Refrigerant treatment methods carbon footprint.

Assessed treatment methods

To contribute towards the mitigation of global warming and realize a zero-waste society we must recover and reuse refrigerants alongside a rapid transition to lower GWP refrigerants. Today however, only 30% of recovered refrigerants is reclaimed for reuse, while reclamation has a positive effect in terms of global warming mitigation and resource circulation.

Daikin evaluated and compared 2 treatment methods after refrigerant recovery to understand the environmental impact.

1. Treating refrigerant as waste: Destruction of used refrigerant and virgin production of new refrigerant.
2. Treating refrigerant as a resource: Reclaimed refrigerant for reuse.



Graphic: Flow diagram showing the assessed treatment methods

More background info on the study can be found in the assessment report:
<https://doi.org/10.3390/su15010473>

The study assessed the impact of the production and end-of-life treatment of different refrigerants (R-410A, R-134a, R-32).

Results

When comparing method 1 (destruction + virgin refrigerant production) with method 2 (reclaimed refrigerant for reuse), the study shows that the carbon footprint of reclaimed refrigerant reuse lies between 72% and 90% lower compared to that of virgin refrigerant production, depending on the refrigerant.

Expressed in kgCO₂eq/kg of refrigerant, the study shows a reduction of 72% for R-410A, and 90% for R-134a and R-32.

The assessment is based on averaged primary data from 7 locations in Japan and Europe for R-410A and R-134a. For R-32 it is based on the average of primary data + estimated data based on R-410A.

RECLAMATION VS. RECYCLING

Reclamation is not the same as recycling. When a refrigerant is reclaimed, it is regenerated in a high quality way that equals virgin quality according to the AHRI700 standard. Recycled refrigerant is cleaned from impurities but is not rebalanced or brought to virgin quality.

The study took into account the impact of the production, destruction and reclamation process, but also the impact of collection, transport etc. related to this activity.

	Scenario	Region	Treatment detail	Total (kgCO ₂ eq/kg of refrigerant)	Destruction	Avoid HF production	Refrigerant production
R-410A	Destruction + virgin production	Europe	Gaseous/fume oxidation	11.35	1,70	-0,70	10.35
	Reclamation	Europe	Batch rectification	3.2 72% REDUCTION			
R-134a	Destruction	Europe	Gaseous/fume oxidation	11.47	1.68	-0,68	10.48
	Reclamation	Europe	Batch rectification	1.12 90% REDUCTION			
R-32	Destruction	Japan	Superheated steam incineration	11.54	3.77	0	7.77
	Reclamation	Japan	Batch distillation/Simple distillation	1,20 90% REDUCTION			

Graphic: Comparison of results of the impact of reclaimed refrigerant production vs. virgin refrigerant production for R-410A, R-134a, R-32, expressed in kgCO₂eq/kg of refrigerant

The study shows that the carbon footprint of reclaimed refrigerant reuse can be up to 90% lower compared to that of virgin production.

Based on the actual amounts of reclaimed refrigerant use in our VRV and chiller systems, the L∞P by Daikin program yearly saves 3,590 tonnes CO₂.

yearly

3,590¹
tonnes CO₂ saved
is equivalent to:

CO₂ emissions from

385,925²
kilometers driven
by a passenger car.

CO₂ emissions from

438³
persons for
one year.

¹ Yearly savings achieved by the L∞P by Daikin program that uses reclaimed R-410A, R-134a and R-32 in VRV and chillers, this does not include savings achieved by recycling machine or the L∞P by Daikin Partner program.

² Source: <https://www.eea.europa.eu/ims/co2-performance-of-new-passenger> (Average CO₂ impact of newly registered cars in 2020 (diesel, petrol, EV)).

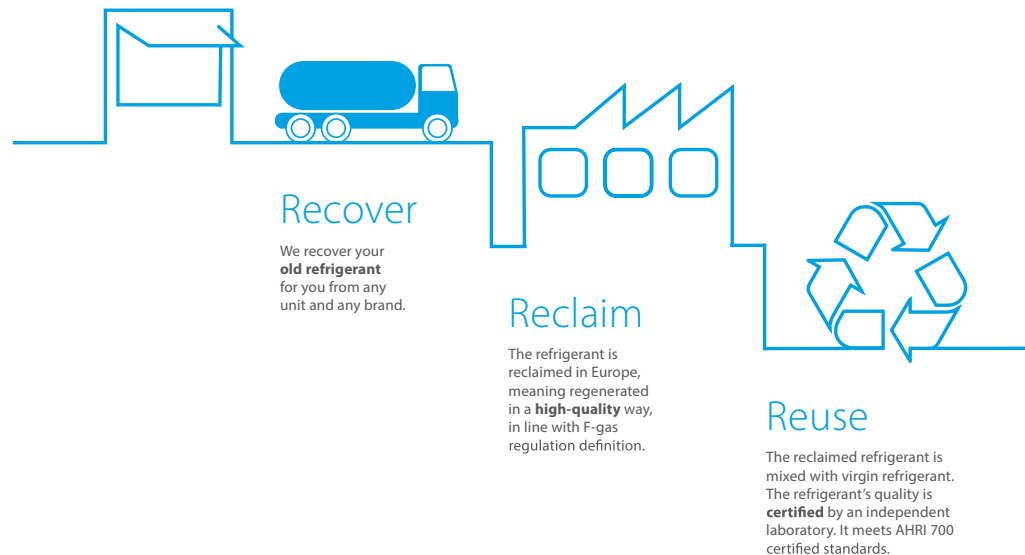
³ Source: <https://www.cambridge.org/core/journals/global-sustainability/article/unequal-distribution-of-household-carbon-footprints-in-europe-and-its-link-to-sustainability/F1ED4F705AF1C6C1FCAD477398353DC2> (Based on average CO₂ footprint/capita for Europe)

At Daikin, we attach great importance to how a refrigerant is handled throughout its life cycle. To reduce its impact at the end of life we want to increase collection and reuse.

Since 2019, we have been working towards a circular economy of refrigerants, in cooperation with other industry partners, including suppliers, installers and customers. By establishing a circular economy of refrigerants, where refrigerants are recovered, reclaimed and reused, it is possible to drastically reduce the carbon footprint of refrigerant production and reduce the use of natural resources.

Baptised L∞P by Daikin, we are conducting multiple initiatives to support the circular economy of refrigerants.

We call on our stakeholders to make a positive choice to contribute to greenhouse gas emissions reductions and support the EU economy by choosing a reclaimed refrigerant. With the L∞P by Daikin products and program, we are ready to face this challenge with you and reduce greenhouse gas emissions to net zero by 2050.



Products reusing reclaimed refrigerant

Since 2019 Daikin is offering products under the L∞P by Daikin circular economy initiative – a line of products using reclaimed refrigerant. By choosing such a product you actively support the reuse of refrigerant.



Re-using
R-410A,
R-134a &
R-32



Recover-Reclaim-Reuse Refrigerant service

Our latest initiative, the refrigerant service, saves resources and costs. Our aim is to collect larger amounts of refrigerant and certify the projects where old refrigerant is recovered and reused for new projects. This service is available for key accounts and investors.



Make
a positive
choice for the
environment
now!

R-Cycle recovery unit

The mobile refrigerant recovery unit removes impurities such as oil, acid and moisture from gas. It can be used independently of other Daikin circular economy initiatives.



Partner of retradeables

As a consortium partner Daikin supports Retradeables, a digital trading marketplace that enables trading reclaimed refrigerants between service companies and refrigerant distributors.



For more Information about the L∞P by Daikin program visit:
www.daikin.eu/loop-by-daikin

If you want to discover more about other Daikin initiatives on refrigerants, we invite you to read our policy paper.
www.daikin.com/csr/information/influence

Case Study:

L∞P by Daikin assists Perial AM in reaching their sustainability goals.

The challenge

Perial Asset Management (Perial AM) manages a diverse real estate portfolio mainly located in France and increasingly in Europe. The company is committed to reducing energy and water consumption as part of a continuous improvement process.

The arrival of new tenants at an office building in Boulogne-Billancourt spurred Perial Asset Management's decision to carry out renovation work to meet Perial AM's CSR objectives.

Constructed in the 1990s, the refurbished building extends over a surface area of 4,200 m² comprising the ground floor and seven stories, including offices and creating a 1,800 m² ERP area.

Daikin's solution

Working with Perial AM, Daikin installed new VRV units with reclaimed refrigerant at their office building, while recycling the R-410A refrigerant from the old units to use it as a field charge for the new system.

Daikin is the only manufacturer in the market able to offer customers a holistic approach to reusing their reducing refrigerant in new projects via its L∞P by Daikin program.

Aiming to become the new industry benchmark, L∞P by Daikin is assisting clients in reaching their sustainability goals.

“L∞P by Daikin has minimised both direct and indirect impact of the building, not only through appearance and system efficiency but also resource reuse.”

Do you want to know more?
[Find the full case study here.](#)



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