Environmental Product Declarations

Understanding EPDs for the built environment

All you need to know to get started with EPDs

Recently, there has been a significant focus on reducing the environmental impact of the built environment to address the climate crisis. Greenhouse gas emissions, measured in carbon dioxide equivalent, are the main contributors to global warming requiring urgent and substantial reduction.

The main priority for real estate owners and developers, both in the short and long term, is to create carbon-neutral buildings. By adopting a holistic approach to reducing carbon emissions associated with HVAC systems, solutions can be future-proofed for the decades to come, with Environmental Product Declarations (EPDs) playing a crucial role.

As part of our dedication to achieving net zero emissions by 2050, we aim to provide comprehensive information about the whole life carbon impact of our products and to identify carbon emissions sources through our EPDs. Our goal is to be a reliable partner to help you make well-informed decisions for your building, from the initial design stages to completion and beyond.

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Terms used

EPD	Environmental Product Declaration	page 1
EU Green Deal	Package of policy initiatives to reach EU climate neutrality by 2050	page 4
CSRD	Corporate Sustainability Reporting Directive	page 5
Scope 1 emissions	Direct emissions from resources owned by company	
Scope 2 emissions	Indirect emissions from the consumption of purchased energy	
Scope 3 emissions	All other indirect emissions that happen upstream or downstream	
SMEs	Small and medium enterprises	
WLC	Whole Life Carbon	
LCA	Life Cycle Assessment	page 6
cradle-to-grave	Environmental footprint assessment of a product from raw material use and manufacture to disposal	
GHG	Greenhouse Gas	page 7
PCR	Product Category Rules	page 8
PSR	Product Specific Rules	
CIBSE	Chartered Institution of Building Services Engineers – UK association supporting professionals in the built environment	
PEP ECOPASSPORT association	International association developing the environmental declaration programme PEP ecopassport® for electrical, electronic and HVAC products	
Daikin Altherma	Daikin's leading heat pump range for residential applications	page 10
VRV	Variable Refrigerant Volume – Daikin's leading heat pump range for commercial applications	
BREEAM	UK-based international certification system for sustainable buildings	page 14
LEED	US-based international building certification system recognising sustainable buildings	
WELL	Building certification system recognising sustainable buildings that advance human health and well-being	
LOOP by Daikin	Daikin's circular economy programme for reclaiming and reusing refrigerants	

Why are EPDs relevant to you?

EU Green Deal and 2050 net zero goals

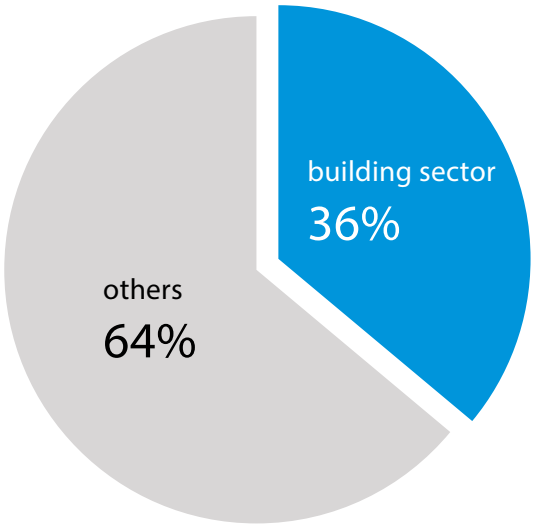
By 2050, the EU aims to be climate-neutral – an economy with net-zero greenhouse gas emissions. This objective is at the heart of the EU Green Deal and in line with the EU commitment to global climate action under the Paris Agreement.

A cornerstone of the EU Green Deal is to create more energy efficient buildings: **the building sector is responsible for 36% of the total greenhouse gas emissions** in the EU. Decarbonising the building stock is a priority.

With the EU Green Deal comes a €600 billion budget to stimulate investments that reduce CO_2 emissions from buildings. The instruments to measure these investments to reduce the CO_2 footprint of a building are EPDs. Therefore, **EPDs will play a crucial role in getting access to financial support when implementing low-carbon solutions**.

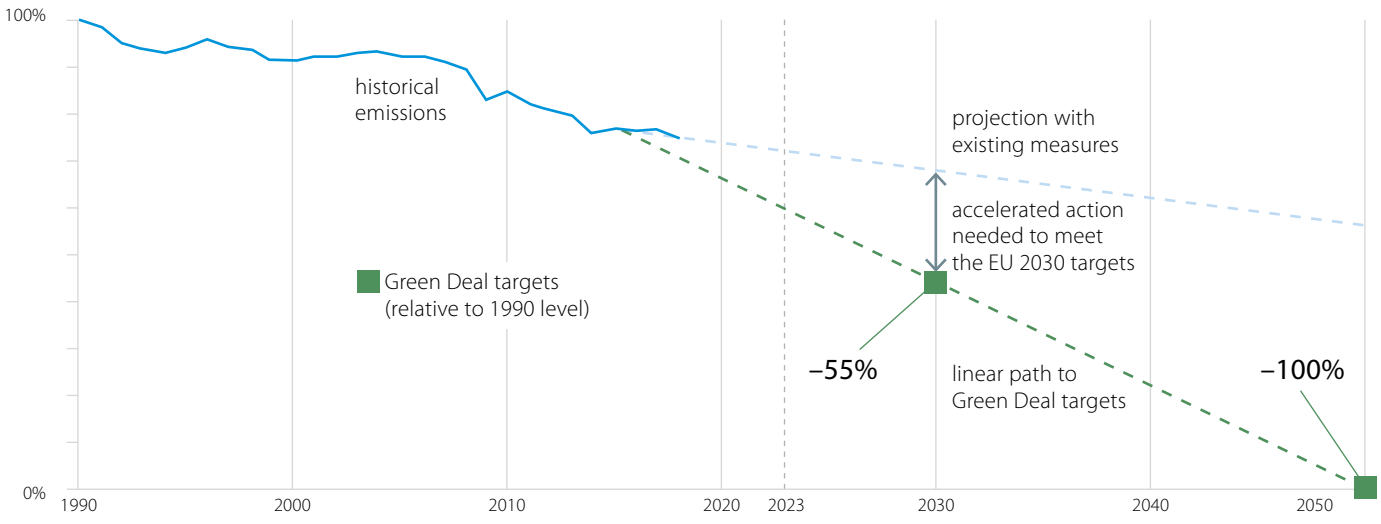
And the EU wants to go fast. By 2030, we will need to reduce net greenhouse gas emissions by at least 55%, compared to 1990 levels. To achieve this we need to **accelerate our actions** and know exactly where the main sources of building emissions are.

Greenhouse gas emissions in the EU



Source:
https://ec.europa.eu/commission/presscorner/detail/en/IP_21_6683

Development of CO_2 emissions (EU)



Sources: United Nations Framework Convention on Climate Change; European Environment Agency

Corporate sustainability reporting directive (CSRD)

Beginning in 2023, many companies will start reporting their sustainability data to show they are capable of aligning with the EU Green Deal. For many companies, this will mean issuing their first report in compliance with the **Corporate Sustainability Reporting Directive (CSRD)**. This report will provide information about strategy, targets, the role of the board members and the principal adverse impacts connected to its value chain.

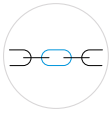
The CSRD will be first mandated for companies meeting two out of three criteria:

- Companies with over 250 employees
- Companies with turnover greater than €40 million
- Companies with assets over €20 million

It is estimated that 50,000 companies will need to issue a corporate sustainability report in the coming months.

How will an EPD be used for corporate sustainability reporting?

An EPD document will be an essential tool to calculate the emissions generated in the value chain of a company. Using the framework from the Greenhouse Gas Emissions Protocol, an EPD can provide supplier specific data in the following categories:

	Emission type	Examples	Relevance for heat pumps	EPD category
 Owned	**Scope 1 emissions** Direct emissions from resources owned by company	Emissions from fuel consumption from company-owned cars, gas consumption to operate boilers	CO_2eq emissions from potential refrigerant leakage	B1
 Energy	**Scope 2 emissions** Indirect emissions from the consumption of purchased energy	Emissions related to electricity used to power the lighting or office appliances, to charge electric vehicles	CO_2eq emissions related to the electricity use to operate the heat pump	B6
 Supply chain	**Scope 3 emissions** All other indirect emissions that happen upstream or downstream	Purchased goods, business travel, use of sold products, transportation	CO_2eq emissions related to get the heat pump to the company (manufacturing, transport, installation, …)	A, B and C

Relevance of EPDs for SMEs

Also for small and medium enterprises (SMEs) across Europe, more and more local regulations require EPDs.

In France RE2020 sets limits on the total carbon footprint that newly constructed houses, offices or schools can have, requiring them to calculate the footprint of the project through the use of EPDs.

In the UK, the Greater London Authority has set out a requirement to calculate the Whole Life Carbon (WLC) emissions of the project and demonstrate actions to reduce it, with other regions following the example.

Whole life carbon

explained

Life Cycle Assessment (LCA)

In order to interpret the values of an EPD, it is important to understand the process of the Life Cycle Assessment it is based on.

Daikin is **assessing the impact of its products using the cradle-to-grave model**, covering the entire impact of the product from extraction of raw materials to disposal or demolition. When looking specifically at the carbon emissions impact this is also referred to as Whole Life Carbon (WLC) assessment.

Sources of building emissions

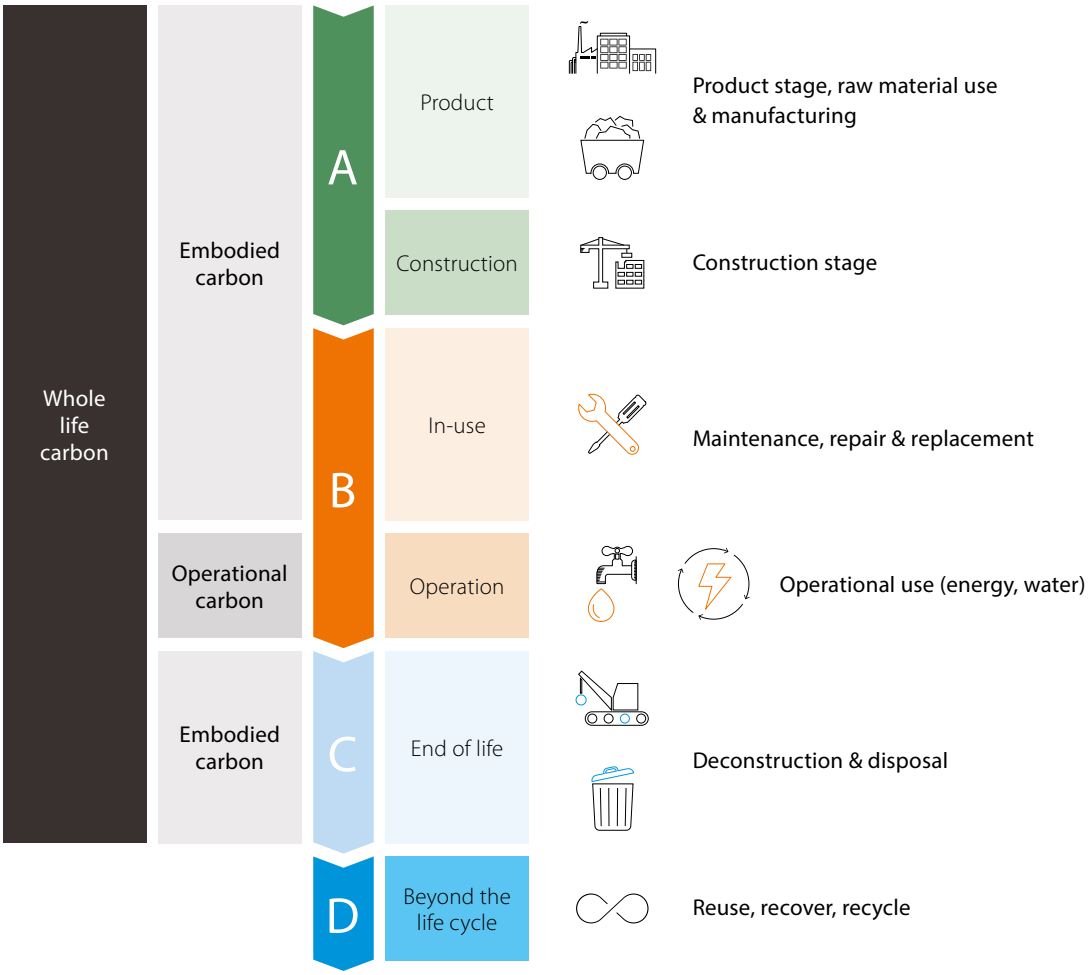
The focus is currently on reducing building emissions coming from its use (= operational carbon). Switching to heat pumps, better insulation etc. supports a clean and efficient energy transition.

Although these emissions represent the largest part of the total emissions today, a significant amount of emissions occurs when the building is constructed (= embodied carbon).

Understanding and reducing whole life carbon, which includes both operational and embodied carbon, is a crucial aspect of sustainable building design and construction aimed at significantly reducing a building's environmental impact.

Life cycle assessment model

linked to carbon emissions and EPD categories



Operational carbon emissions

Operational carbon emissions refer to the carbon or Greenhouse Gas (GHG) **emissions generated during the use and operation of a product or building**. These include the emissions produced by heating and cooling systems, lighting, and appliances to operate them.

The emissions can be produced directly (SCOPE 1) or indirectly (SCOPE 2).

These emissions vary from country to country as the electricity production is different. Therefore, the carbon impact of the same heat pump will be different depending on the country.

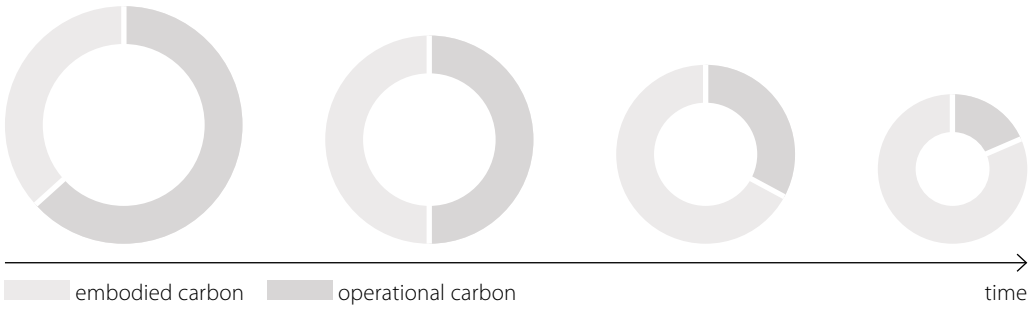
Embodied carbon emissions

Embodied carbon emissions refer to the carbon **emissions (GHG) generated from the production, construction, transportation, maintenance, repair, deconstruction and disposal of a product or building**. These emissions are called "embodied carbon" or "embedded carbon" because they are embodied within the materials and products that we use every day.

Embodied GHG emissions are important to consider because they represent a significant portion of a product or building's total carbon footprint. By understanding the embodied carbon, we can identify opportunities to reduce GHG emissions across the entire life cycle, from construction to disposal.

A new focus on emissions

As the energy mix gradually shifts towards greener sources, operational carbon emissions are expected to decrease while the significance of embodied carbon is likely to increase.



Beyond the life cycle (reuse, recovery, recycling)

These elements lie beyond the life cycle of a product or building. By reusing, repurposing or recycling product or building components we can significantly reduce the carbon footprint associated with the production of new materials.

To minimise the embodied carbon footprint of buildings, it's advisable to explore the possibility of repurposing an existing building through renovation or improvement while retaining the core structure. Reusing existing buildings or components also offers the additional environmental benefits of reducing waste.

Therefore, incorporating reuse strategies in building design and construction can be an effective way to reduce the overall carbon footprint of the built environment.

EPDs

Communicating the environmental performance

What is an EPD?

An **Environmental Product Declaration** (EPD) is a document that outlines the environmental performance or impact of a product or material over its lifetime in terms of its CO_2 emissions, water use, etc.

Within the construction industry, EPDs support carbon emission reduction by making it possible to quantify the impacts of different materials and products and to calculate a total carbon footprint for a building.

Different types of EPDs

Product-specific vs. industry-wide EPDs
An industry-wide, or generic EPD covers a broad product type (e.g. cement, VRF heat pump, etc.) and applies to a group of similar products from one or more manufacturers. It is based on a valid **Product Category Rule (PCR)**.

A product-specific EPD however, applies to a single product – or very similar products – from a single manufacturer. This is **the most transparent** approach, third-party verified, and the one that Daikin is using.

The framework for EPDs

Creating EPDs involves the application of ISO standards, the PCR and **Product Specific Rules (PSR)**. These PSRs are maintained by an EPD operator. Verification, publication and product requirements **differ from country to country**.

Daikin currently supports two programme operators: TM65 (CIBSE) and PEP ecopassport.

Programme comparison

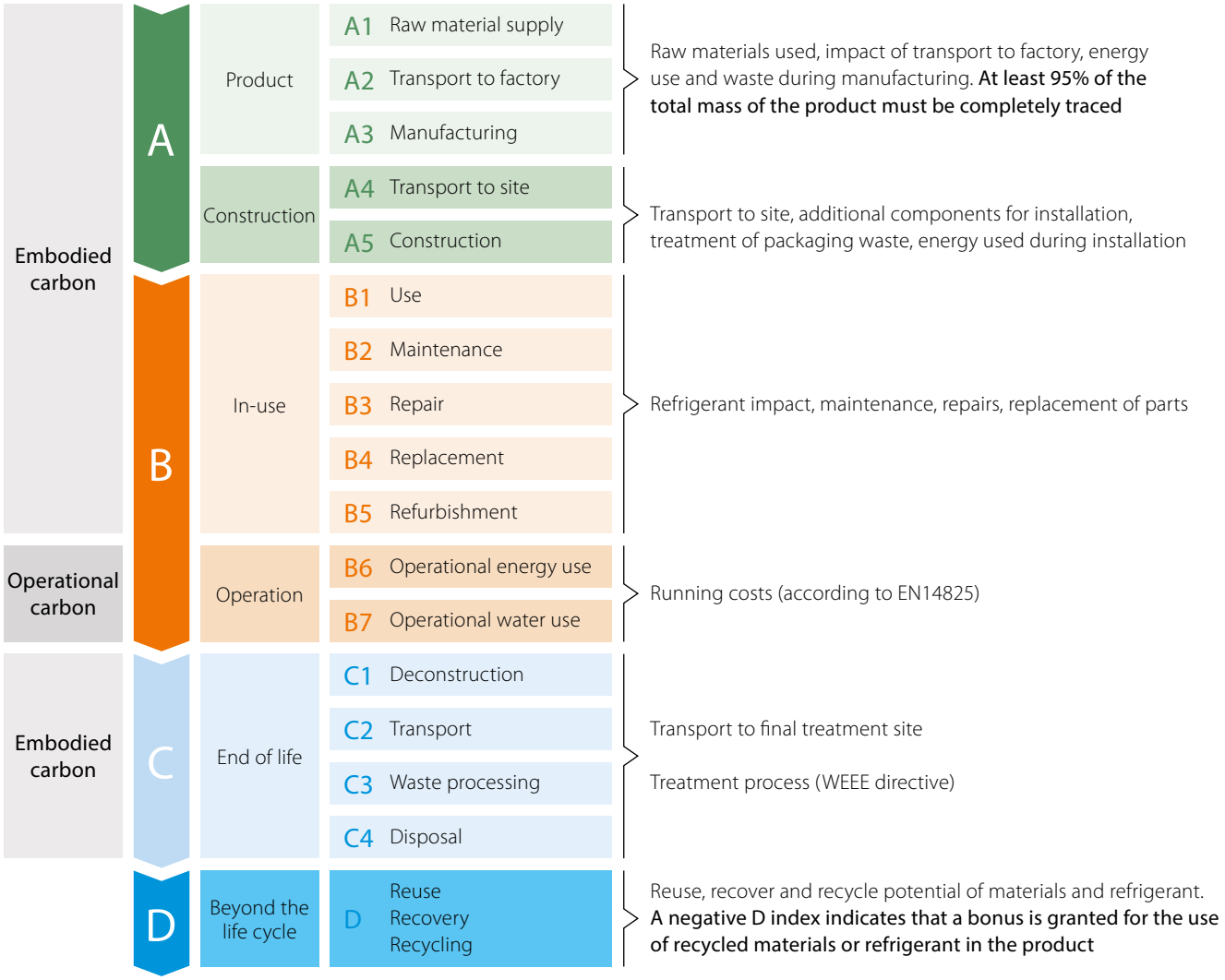
Operator	Programme	Country	Whole Life Carbon scope	Impact indicators	Type of verification
CIBSE	TM65 mid-level calculation	United Kingdom	Only embodied carbon	Global warming potential (CO_2eq) only	Self-declared by manufacturer (Type II non-verified EPD)
PEP ECOPASSPORT association	PEP ecopassport	France	Embodied carbon + Operational carbon + Beyond the life cycle	Different environmental input indicators: global warming potential, ozone depletion potential, acidification potential, smog, water use, etc.	Third-party verified (Type III third-party verified EPD)

We used the PEP ecopassport PSR for the remaining examples in this brochure.

What does an EPD consist of?

Based on specific EPD programme rules, an EPD declares the product impact according to the LCA life cycle stages (four modules from A to D).

Together these modules report for a specific product the embodied carbon plus the operational carbon (= whole life carbon) and the circular economy benefits.

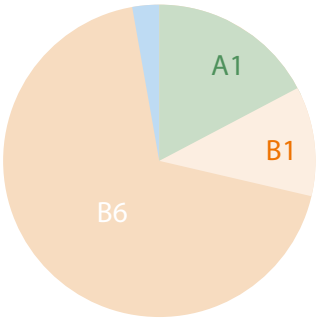


Using EPDs

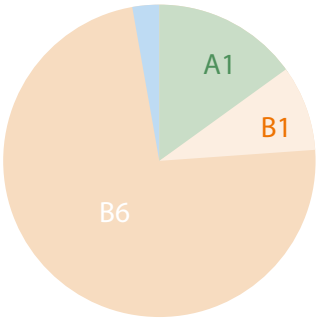
for HVAC systems

EPDs declare the environmental impact in detailed categories. This makes it possible to precisely trace exactly where the major impact comes from for a certain product.

CO_2eq breakdown 1for **Daikin Altherma** residential air-to-water heat pump system (outdoor + indoor)
(ERGA04EV / EHVH04S18E)



CO_2eq breakdown for **VRV 5** commercial air-to-air heat pump outdoor unit
(RXYSA4AY1)



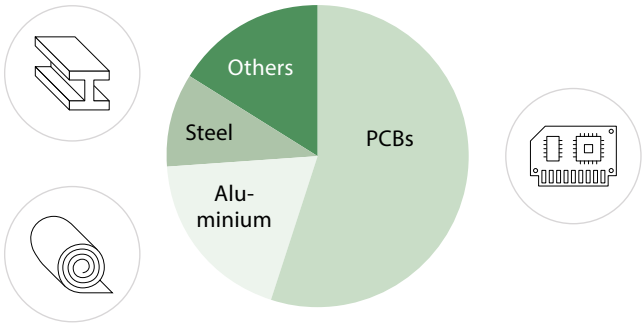
Embodied carbon	A	Product	A1	Raw material supply	15.8%	14.2%
			A2	Transport to factory	0.2%	0.1%
			A3	Manufacturing	0.1%	0.2%
		Construction	A4	Transport to site	0.1%	0.3%
			A5	Construction	1.0%	0.3%
	B	In-use	B1	Use	5.3%	8.6%
			B2	Maintenance	6.0%	0.3%
			B3	Repair	–	–
			B4	Replacement	–	–
			B5	Refurbishment	–	–
Operational carbon		Operation	B6	Operational energy use	69.2%	73.3%
			B7	Operational water use	< 0.1%	< 0.1%
Embodied carbon	C	End of life	C1	Deconstruction	–	–
			C2	Transport	< 0.1%	0.1%
			C3	Waste processing	0.1%	0.4%
			C4	Disposal	2.0%	2.0%
	D	Beyond the life cycle	D	Reuse Recovery Recycling		

The three major impacts

Three categories account for over 97% of all emissions:

A1 – raw material use
All materials should be studied for this category, including those that could represent a low mass weight but high carbon footprint, such as electronic printed circuit boards. The energy intensive PCB production process is a key factor in the large carbon footprint of these materials.

Raw material impact breakdown for VRV 5 (RXYSA4AY1)



B1 – use of the product
This impact comes from refrigerant refills required during the life of the equipment, taking into account a 2% leak rate based on the factory charge of the unit.*

* Although DX systems are regularly checked for leaks as required by the European F-gas regulation, the PEP methodology takes into account a leak rate of 2% per year. If your installation and maintenance are done properly, the actual value of module B can be less than that indicated in the PEP document.

B6 – operational energy use
This is currently the biggest system impact. It reflects the estimated energy consumption based on the product's SEER and SCOP (EN14825). **Daikin's goal is to have EPDs that are as realistic as possible. Therefore, we calculate our seasonal performance values with our top-selling units.**

Always verify that the products used to publish efficiency data are representative for your project.

Using EDPs to compare system impact

When comparing systems, it is important to **include all components used in the system**. This is especially the case with VRV and other large systems.

In a VRV system, the EPD for the outdoor unit only reflects the factory refrigerant charge. However, these systems require an additional field charge, which may differ drastically between type of system, pipe lengths and manufacturers. Therefore, it is important to calculate the impact for the specific installation.

In this example we compare two highly efficient VRV systems providing 12.3 kW of cooling capacity, with four indoor units and 35 m of field piping:

VRV IV R-410A

VRV 5 R-32

	Product	Whole life carbon ($kgCO_2eq$)	Product	Whole life carbon ($kgCO_2eq$)
Outdoor unit (incl. factory refrigerant charge and energy consumption for 22 years in France)	1 x RXYSCQ4TV1 (3.7 kg factory charge)	17,700	1 x RXYSA4AV1 (3.4 kg factory charge)	12,300
Most sold indoor unit	4 x FXFQ32B	3,473	4 x FXFA32A	4,360
Additional refrigerant field charge	1.33 kg	2,583	1.20 kg	753
Field piping	15.9 kg	59	14.5 kg	54
Total whole life carbon		**23,815**		**17,467**
Total whole life carbon reduction				**27%**

Significant reductions in **whole life carbon** can be achieved through the use of high efficiency, lower GWP systems, such as VRV 5.

We strive to publish credible, real-life data published on all our products, enabling you to choose a future-proof HVAC system for your building.

EPDs are a very good first step towards more awareness to lower the impact of the building industry, but the different assumptions make it impossible to use as a benchmark today. Therefore it is advisable to only compare EPDs within a manufacturer's range.

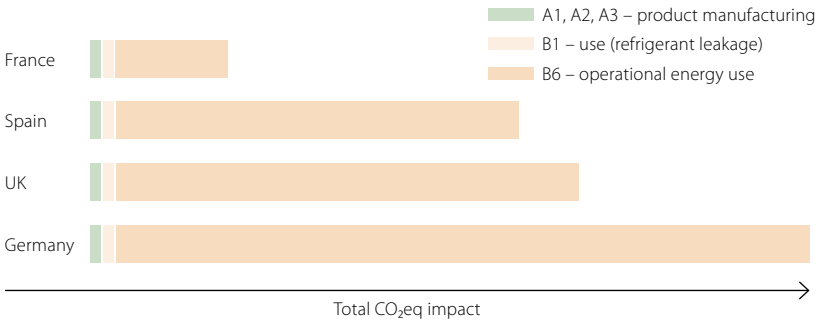
Validity of an EPD

Typically an EPD is valid for five years and a specific country.
An EPD is **country specific** because to calculate it, the specific country parameters are used, such as:

- Carbon intensity of the local energy grid
- Different PSR rules (e.g. different refrigerant leakage assumption)
- Transportation distance from the factory

The graph on the right simulates the theoretical impact per country for the same heat pump.

Simulation of the CO_2eq impact for the same heat pump in different countries



The examples in this brochure are based on the PEP ecopassport methodology for France and are therefore valid for France only. When assessing EPD documents, **always check for which country the values are valid**, as shown in this life cycle stages overview:

Life cycle stages overview indicates for which region values are applicable

Product stage			Assembly stage		Use stage							End of life stage				Beyond the system boundaries		
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	D	D
×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Geography, by two-letter ISO country code or regions.																		
EU	EU	BE	EU	FR	FR	FR	FR	FR	FR	FR	FR	FR	FR	FR	FR	EU		
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruct./demol.	Transport	Waste processing	Disposal	Reuse	Recovery	Recycling

Download our EPDs

Daikin aims to issue EPDs for its entire portfolio of solutions and for different countries. As a start, we're issuing EPDs for our residential and commercial air-to-water and air-to-air heat pumps, mainly for France.


Daikin Altherma
residential heat pumps


Split
air-to-air residential air conditioners and heat pumps


Sky Air
air-to-air commercial air conditioners and heat pumps


VRV
air-to-air commercial air conditioners and heat pumps

EPDs download:
https://register.pep-ecopassport.org/pep/consult

You can use these EPDs to evaluate the carbon footprint of products and compile a total carbon impact report for your building. These documents allow you to help select the most sustainable solution within the Daikin range for your project and ensure it is future proof.

Daikin, your partner

in decarbonising your building

We're there for you!

Let's act now to decarbonise buildings, creating a healthy environment for generations to come. Contact us here: **https://www.daikin.eu/en_us/about/environmental-responsibility/epd.html**

Every building requires a different solution to match its unique properties. That's why it is important to have an HVAC-R partner with expert knowledge and a product portfolio designed to achieve your objectives while staying within budget.

How will Daikin enable you to lower your carbon footprint?

- We continuously develop products with lower CO_2 footprints by using **lower GWP refrigerants** such as R-32
- We reuse materials where possible, even refrigerants through the **LOOP by Daikin programme** aimed at reusing available resources and fully supporting the EU circular economy
- We maximise **real life seasonal efficiencies**, delivered in a transparent and trustworthy way
- Our **team of experts goes beyond product support** to reach your green objectives by providing in-depth knowledge in the use of EPDs, EPDB legislation and green building schemes such as BREEAM, LEED, WELL, etc.
- We provide **support** to continuously monitor our systems, ensuring they operate as intended, keeping running costs low and maximising uptime **throughout the entire building life cycle**
- We **help customers make the right choice** by offering easy to use tools to select the best solutions for their residential, commercial or industrial building

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