



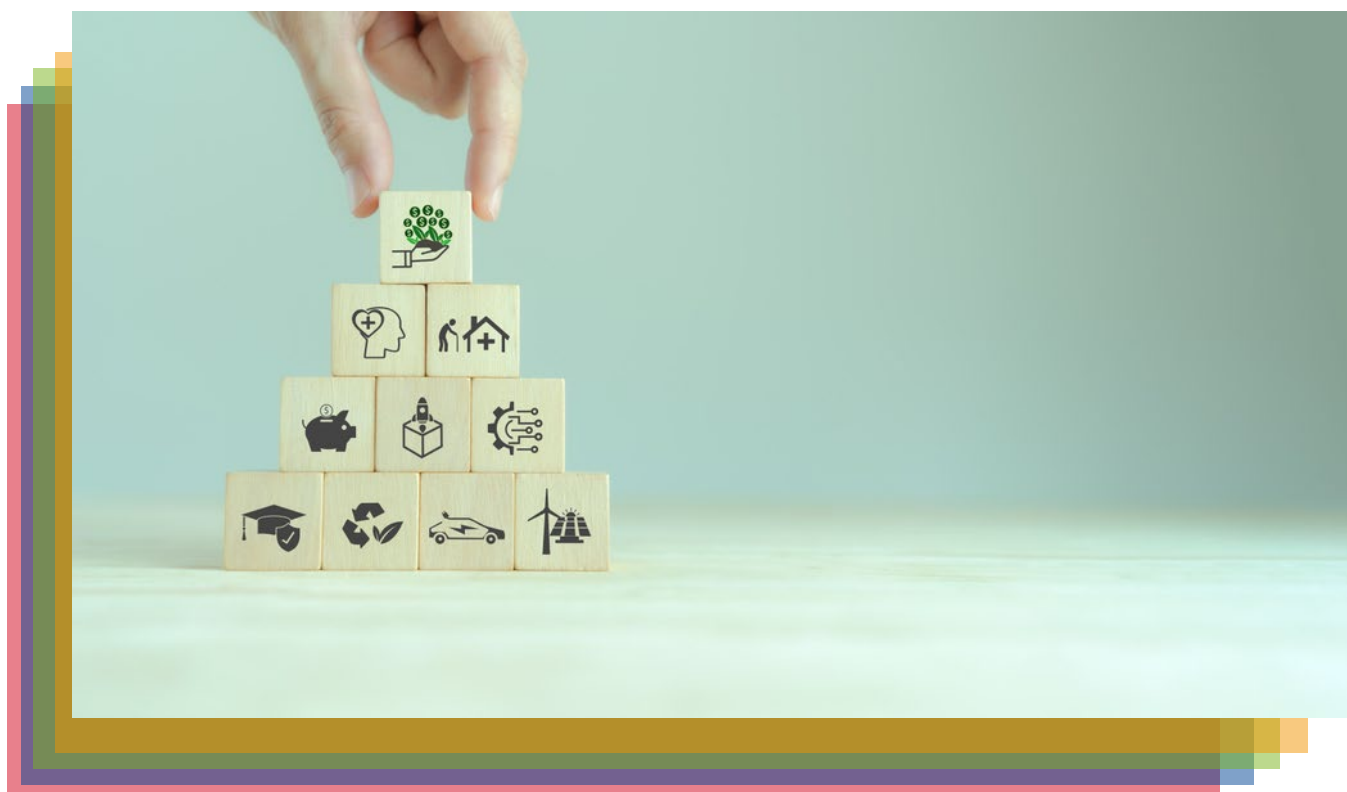
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HEALTH SYSTEM PERFORMANCE ASSESSMENT (HSPA): A FIRST STEP IN THE ASSESSMENT OF ENVIRONMENTAL SUSTAINABILITY



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■ APPENDICES

1 OVERALL ENVIRONMENTAL FOOTPRINT OF THE HEALTH SYSTEM

1.1 Methodological note on calculating the environmental footprint of the Belgian health system

1.1.1 Documentation sheet

Description	Methodological description of the calculation of the environmental footprint of the Belgian health system. Relevant for indicators: ENV-1 GHG environmental footprint of the healthcare sector ENV-2 Material environmental footprint of the healthcare sector ENV-3 Land environmental footprint of the healthcare sector
Rationale	Sustainable Development Goal (SDG) 12 aims to ensure sustainable consumption and production patterns, including environmental sustainability. Environmental impact is inherently multi-dimensional. The Planetary Boundaries framework formalises this multi-dimensionality by defining a safe operating space and assessing rising risks from human pressures on nine critical Earth-system processes.^{1, 2} Life Cycle Assessment (LCA) – and the EU Environmental Footprint (EF) method derived from LCA – operationalises this systems view by quantifying potential impacts across multiple categories along full value chains, thereby capturing both direct and upstream burdens.³⁻⁵ In this approach, environmental pressures and impacts span not only greenhouse gas emissions, but also particulate matter and photochemical ozone formation, acidification, land occupation and transformation, resource use, blue water consumption, waste generation, and chemical pollution and ecotoxicity (e.g. pharmaceutical residues in surface waters). The EF approach allows the calculation of environmental impacts for products and services, sectors, or countries while explicitly accounting for trade-offs and potential burden shifting across impact categories or geographies. Several of these dimensions are reflected in the broader SDG framework (e.g. SDG 6 Clean Water and Sanitation; SDG 7 Affordable and Clean Energy; SDG 13 Climate Action; SDG 14 Life Below Water; SDG 15 Life on Land). The SDG agenda, while structured as individual goals, is designed with interlinkages and spillovers, implying that environmental sustainability can only be addressed by balancing environmental, social and economic objectives.⁶ Evidence indicates that humanity has already exceeded safe limits for multiple planetary boundaries, not only climate.^{1, 7} In an assessment linking life-cycle impact indicators to planetary boundaries, Sala et al. (2020) found that environmental impacts of EU consumption were close to, or transgressing, boundaries for climate change, particulate matter, land use and mineral resources.⁴ Research also shows that the environmental footprint of the healthcare sector is substantial. Because healthcare represents a sizeable share of economic activity and final demand, its environmental footprint can be large even when impact intensities per euro of expenditure are moderate compared with more impact-intensive economic activities.³ International studies estimate that healthcare contributes a meaningful share of national and global environmental burdens across multiple indicators, representing around 2-7% of the GHG footprint in OECD countries;⁸⁻¹⁰ 7% of global non-metallic minerals footprint and 4% of global metal ores footprint;¹¹ 2-7% of SO₂, 1-6% of blue water and 2-8% of PM-footprint in a subset of countries.¹⁰ Estimates vary by country and method, and national studies can yield higher values when using detailed national expenditure and emissions data.^{7, 12} Healthcare impacts arise directly from operations and indirectly through upstream supply chains through the goods and services supplied to health systems. The indirect impact is often the largest component, representing around 60-80% of healthcare-related



	GHG emissions.^{8, 13, 14} This supports an environmental footprint approach using environmentally extended input-output (EE-IO/MRIO) methods, which link health expenditures to the multiple environmental impacts embodied in the goods and services the sector consumes and produces and enable identification of supply-chain hotspots.¹² A multi-category environmental footprint is not only diagnostic; it is also actionable. The health-care sector can make a contribution towards reducing environmental harm.¹⁴ It can inform on the potential of strategies such as reducing fossil energy dependence, improving resource efficiency, and advancing circularity in procurement and service delivery, while enabling monitoring over time and safeguarding against unintended trade-offs across impact categories.¹³
Calculation	The environmental footprints for the Belgian healthcare system are estimated using a top-down Environmentally Extended Multi-Regional Input-Output (EE-MRIO) approach. The method consists of three main steps (See technical definitions below for more details). 1. Constructing the healthcare final demand vector. Detailed health expenditure data by provider type and function from the System of Health Accounts (SHA), together with sectoral investment data from the national accounts, are combined to represent total monetary demand for healthcare goods, services and capital formation in Belgium. 2. Mapping the full supply chain using input-output analysis. Input-output analysis links this final demand to all domestic and international industries involved to produce the necessary goods and services required for the health system to function. Using input-output tables, it traces both direct healthcare activity and indirect activity embodied in intermediate goods across global supply chains. 3. Linking monetary flows to environmental extensions. Monetary flows are then matched to environmental extension tables, which contain sector-specific environmental impact intensities. This allows calculation of the direct and indirect environmental impacts associated with healthcare consumption, and distinguishes between domestic and imported contributions. This approach follows established methodologies used in previous healthcare footprint studies.^{8-12, 15} However, results may differ due to, amongst others, differences in input data, assumptions regarding the composition of healthcare final demand, sectoral resolution, and the environmental extensions used. The analysis uses the FIGARO EE-MRIO database (2025 edition, developed by Eurostat/JRC), covering 64 industries (NACE Rev.2) across the EU-27 and 18 non-EU countries plus a “rest of world” region (country-resolution matched to earlier FIGARO editions). The IO tables are benchmarked to official macroeconomic aggregates and follow the same quality standards as other official EU statistics. Environmental extensions draw on Eurostat Air Emission Accounts and additional environmental impact intensities derived from EXIOBASE v3.8.2 by VITO.^{16, 17} Impact categories include climate change, particulate matter formation, photochemical ozone formation, acidification, ecotoxicity, blue water consumption, material extraction and land use. Gross value added is also assessed to show how economic value is distributed along global healthcare supply chains.
Data source	Current health expenditure and financing data from the System of Health Accounts (2010-2023).^{18, 19} Capital investment data from Eurostat [nama_10_a64_p5] (NACE Q86 and Q87-88).²⁰ FIGARO annual input-output tables 2010-2023²¹ Environmental extension tables based on environmental extension lines from EXIOBASE v3.8.2¹⁶ and supplemented by VITO with Eurostat Air Emission Accounts data [env_ac_ainah_r2]¹⁷ (CO₂, N₂O, HFC, PFC, CH₄, CO, NMVOC, NOX, NH₃, PM₁₀, PM_{2.5}). Extension data of 2022 were used as proxy for 2023.
Technical definitions	Input-output analysis

The environmental impact of the health sector has been calculated using an extended multiregional input-output model based on FIGARO (industry-by-industry tables). The calculation is based on the following formula:

$$E_{ind,health}^T + E_{dir,health}^T = \langle e^{int} \rangle \cdot x + E_{dir,health}^T = \langle e^{int} \rangle \cdot L \cdot y_{health} + E_{dir,health}^T$$

with:

- $E_{ind,health}^T$: environmental footprint – indirect environmental impacts embodied in upstream supply chains for healthcare final demand
- $E_{dir,health}^T$: environmental footprint – direct environmental impacts generated by the healthcare sector itself
- $\langle e^{int} \rangle$: environmental impact intensity vector, the impact directly caused per unit of sectoral monetary output
- x : vector of sectoral monetary output
- L Leontief inverse, representing the economic structure of global supply chains
- y_{health} : final demand vector for healthcare goods, services and investments

The scope includes both indirect and direct impacts. Indirect impacts represent all upstream environmental pressures occurring in the global production network, e.g. manufacturing of pharmaceuticals and medical devices, agricultural inputs, energy production, construction, and transport. Direct impacts represent environmental pressures generated by the healthcare sector itself, such as on-site fuel combustion for heating, or fuel use for ambulance fleets.

Applying the formula yields one result – one footprint value – for each environmental impact category included in the calculation (see below). This represents the total (direct + indirect) environmental impact associated with healthcare final demand. To obtain more detailed results, diagonalisation can be applied:

- Diagonalising the environmental intensity vector produces allows attribution of impacts to the origin sectors and regions/country in which they occur.
- Diagonalising the final demand vector produces a diagonal matrix that enables attribution of impacts to the trigger products and services, i.e. products and services consumed by the health system by region/country that trigger the environmental impact
- Diagonalising both the environmental intensity vector and the final demand vector yields a full origin × trigger matrix, detailing both where impacts occur and which healthcare-related consumption cause them.

For a detailed discussion of the theoretical background and mathematical properties of IO models, see the foundational work of Leontief and Miller & Blair.^{22, 23}

Environmental impact categories

The following environmental impact categories in the environmental footprint method are included (Table 1).

Table 1 – overview and description environmental impact categories

Climate Change	kg CO2-eq	Global impact due to changes induced to the climate, including increased average global temperatures and sudden regional climatic changes, as a consequence of the emissions to the atmosphere of the so-called greenhouse gases, such as CO ₂ , CH ₄ , and N ₂ O.
Particulate Matter (PM)	disease inc.	Impact on human health due to the increased ambient concentrations of particulate matter (PM) due to the emissions of primary and secondary particulates (i.e. precursors, NO _x , SO ₂).
PM10	kg	Emissions to air of particulate matter contains a mixture of solid particles and liquid droplets. Particles are defined by their diameter for air quality regulatory purposes. Those with a diameter of 10 microns or less (PM10) are inhalable into the lungs and can induce adverse health effects. Fine particulate matter is defined as particles that are 2.5 microns or less in diameter (PM2.5). Therefore, PM2.5 comprises a portion of PM10.
PM2.5	kg	

Photochemical Ozone Formation	kg NMVOC eq.	Local and regional impact to the environment and human health related to the formation of tropospheric ozone resulting from the oxidation of solvents and other volatile organic compounds (VOCs) released to the atmosphere that affects organic compounds in animals and plants and can increase the frequency of respiratory problems.
Acidification	mol H ⁺ eq. and SO ₂ -eq.	Regional impact to the environment regarding the modification of acidity of soils, as consequences of emission and deposition of acids (and compounds that can be converted to acids) into the environment. Includes SO ₂ , NH ₃ , NO ₂
Land Use	Pt and km ²	Impacts because of occupation and transformation of land in terms of reduction of soil qualities (e.g. modification in the organic matter content of soil, or loss of the soil itself (erosion)). The indicator includes cropland, forest area, permanent pastures, infrastructure land, and other land use.
Ecotoxicity freshwater	CTUe	Local and regional impact to freshwater ecosystem due to the release of toxic substances that can accumulate and affect individual species as well as the functioning of the entire ecosystem.
Water Use	m ³ depriv. and m ³	Impact related to the consumption of freshwater (lakes, rivers, or groundwater)
Resource Use, fossils	MJ	Global impact related to the decreased availability and the potential scarcity for future generations of the total reserve of fossil resources.
Resource Use, minerals and metals	kg Sb eq.	Global impact related to the decreased availability and the potential scarcity for future generations of the total reserve of mineral and metal resources.
FOSSIL, BIOMASS, METALS, MINERALS, Resource use or primary material footprint	kg	Resource use or primary material footprint, split into biomass, non-metallic minerals, metal ores, and fossil energy carriers.
Gross value added	Million euros	The gross value-added indicator shows the global distribution of value added generated across sectors. The indicator shows the economics of the upstream supply network of the Belgian health sector. This is mainly with a more illustrative purpose to understand the functioning of the model.

Construction of a healthcare final demand vector

To construct a healthcare final demand vector, we follow the methodology developed by the OECD and RIVM.^{7, 8, 12} This vector represents the final demand for healthcare goods and services and is the input for a next step to calculate the environmental impact of this sector. The following steps are followed:

1. **Data.** Belgian current health expenditure data (SHA, 2010–2023, million EUR, current prices) by function (HC) and provider (HP) are extracted from the OECD database.^{18, 19}
Investment expenditures are taken from Eurostat national accounts for sector Q86 - human health activities.²⁰
2. **Compilation of expenditure categories.** Except for pharmaceutical and medical devices, all current spending retain provider-level detail. This gives the following subcategories:
 - Pharmaceuticals/OTC medicines (HC.5.1.1+HC.5.1.2)
 - Medical non-durables and devices (HC.5.1.3+HC.5.2)
 - Other current healthcare expenditure (total per HF minus HC.5): general hospitals (HP.1.1), mental health hospitals (HP.1.2), specialised hospitals (HP.1.3), long-term nursing care facilities (HP.2.1), mental health and substance abuse facilities (HP.2.2), other residential long-term care facilities (HP.2.9), medical practices (HP.3.1), dental practices (HP.3.2), other health care practitioners (HP.3.3), ambulatory health care centres (HP.3.4), providers of home health care services (HP.3.5), providers of patient

transportation and emergency rescue (HP.4.1), medical and diagnostic laboratories (HP.4.2), other providers of ancillary services (HP.4.9), pharmaceuticals (HP.5.1), medical devices and therapeutical appliances (HP.5.2), all other miscellaneous sellers and other suppliers of pharmaceuticals and medical goods (HP.5.9), providers of preventive care (HP.6), government health administration agencies (HP.7.1), social health insurance agencies (HP.7.2), private health insurance administration agencies (HP.7.3), other administration agencies (HP.7.9), households as providers of home health care (HP.8.1), all other industries as secondary providers of health care (HP.8.2)

- Investments by asset type: infrastructure (N11KG), transport equipment (N1131G), ICT equipment (N1132G), other equipment (N11OG), computer software and databases (N1173G), intellectual property products not elsewhere classified (N117G)

3. **Mapping to FIGARO sectors.** Each expenditure category is mapped to the industry classification of FIGARO. This mapping determines how each euro of healthcare spending is disaggregated into the goods and services used in production. The input structure of this FIGARO sector (its purchases from other sectors) is then used to distribute healthcare spending across the domestic and international supply chain. Choosing an appropriate proxy sector is important, as this structure determines how spending is translated into upstream economic activity and, subsequently, environmental impacts.

- Pharmaceuticals/OTC medicines: sector C21 (pharmaceutical manufacturing)
- Medical non-durables and devices: sector C26 (optical/electronic products)
- Other expenditures: see correspondence Table 2. Because pharmaceuticals are allocated directly to C21, this sector is excluded from the input structure used to disaggregate the remaining ("other") healthcare expenditures to avoid double counting. The same adjustment is not applied to C26, as this sector covers a broader range of products beyond medical devices.

Table 2 – Correspondence current health expenditure HP subcategories and Figaro industry classification

Healthcare provider	Corresponding NACE-sector (FIGARO-classification)
HP.1.1 General hospitals	Q86 Human health activities
HP.1.2 Mental health hospitals	Q86 Human health activities
HP.1.3 Specialised hospitals (other than mental health hospitals)	Q86 Human health activities
HP.2.1 Long-term nursing care facilities	Q87_88 Residential care activities and social work activities without accommodation
HP.2.2 Mental health and substance abuse facilities	Q87_88 Residential care activities and social work activities without accommodation
HP.2.9 Other residential long-term care facilities	Q87_88 Residential care activities and social work activities without accommodation
HP.3.1 Medical practices	Q86 Human health activities
HP.3.2 Dental practices	Q86 Human health activities
HP.3.3 Other health care practitioners	Q86 Human health activities
HP.3.4 Ambulatory health care centres	Q86 Human health activities
HP.3.5 Providers of home health care services	Q86 Human health activities
HP.4.1 Providers of patient transportation and emergency rescue	Q86 Human health activities
HP.4.2 Medical and diagnostic laboratories	Q86 Human health activities
HP.4.9 Other providers of ancillary services	Q86 Human health activities

HP.5.1 Pharmaceuticals	Q86	Human health activities (for remaining values only)
HP.5.2 Medical devices and therapeutical appliances	Q86	Human health activities (for remaining values only)
HP.5.9 All other miscellaneous sellers and other suppliers of pharmaceuticals and medical goods	Q86	Human health activities (for remaining values only)
HP.6 Providers of preventive care	O84	Public administration and defence; compulsory social security
HP.7.1 Government health administration agencies	O84	Public administration and defence; compulsory social security
HP.7.2 Social health insurance agencies	O84	Public administration and defence; compulsory social security
HP.7.3 Private health insurance administration agencies	K65	Insurance, reinsurance and pension funding, except compulsory social security
HP.7.9 Other administration agencies	O84	Public administration and defence; compulsory social security
HP.8.1 Households as providers of home health care	Q86	Human health activities
HP.8.2 All other industries as secondary providers of health care	O84	Public administration and defence; compulsory social security

- Investments by asset type: see correspondence Table 3.

Table 3 – Correspondence investment subcategories and Figaro industry classification

Gross fixed capital formation by asset type		Corresponding NACE-sector (FIGARO-classification)	
N11KG	Total construction (gross)	F	Construction
N1131G	Transport equipment (gross)	C29	Manufacture of motor vehicles, trailers and semi-trailers
N1132G	ICT equipment (gross)	C26	Manufacture of computer, electronic and optical products
N110G	Other machinery and equipment (gross)	C28	Manufacture of machinery and equipment n.e.c.
N117G	Intellectual property products (gross)	M72	Scientific research and development
N1173G	Computer software and databases (gross)	J62_63	Computer programming, consultancy, and information service activities

4. **Conversion to basic prices.** Health expenditure data reported in **purchaser prices** are converted into basic prices, trade & transport margins, and taxes/subsidies using data on the Belgian sector human health activities (Q86) from Eurostat use tables at purchaser prices [nama_10_cp16], the use table at basic prices [nama_10_cp1610], the table of trade and transport margins [naio_10_cp1620], and the table of taxes less subsidies on products [naio_10_cp1630]. For each product a conversion factor is calculated as the share of the basic price/trade and transport margins in the purchaser price over the whole period (only using years 2010-2023 for which the database is complete). These factors are provided in Table 4.
- Only basic prices and trade & transport margins are retained for further analysis. The trade and transport margins are directly allocated to wholesale trade (sector G46).

Table 4 – Correspondence expenditure subcategories and factors for basic prices, trade and transport margins, and taxes less subsidies

Expenditure category	Basic price	Trade & transport	Taxes less subsidies
Service sectors (K65, O84, Q86, Q87-88)	1.000	0.000	0.000

Pharmaceuticals & OTC (HC.5.1.1 + HC.5.1.2)	0.764	0.163	0.073
Medical non-durables & devices (HC.5.1.3 + HC.5.2)	0.450	0.376	0.174
Investment in construction, computer software and databases, intellectual property products	1.000	0.000	0.000
Investment in transport equipment	0.713	0.108	0.179
Investment in ICT equipment	0.450	0.376	0.174
Investment in other equipment	0.428	0.398	0.174

5. **Geographic allocation.** Spending on each product is allocated across countries using FIGARO's regional production shares, distinguishing domestic from foreign production.

Model output structure

The analysis produces two complementary outputs: a **longitudinal series** covering 2010-2023 and a **cross-sectional decomposition** providing a higher level of detail for 2022. Environmental impact data for 2023 were not yet available; therefore, preliminary results for that year were estimated by combining 2022 environmental intensities with 2023 monetary data. As no adjustment for inflation was applied, these preliminary estimates for 2023 are likely to overstate environmental impacts. For this reason, 2022 was selected as the reference year for the cross-sectional decomposition.

The **longitudinal results** provide, for each year and each environmental impact category, the total footprint of Belgian healthcare sector, further subdivided by type of spending (the subcategories of the healthcare final demand vector described above), by trigger product or service, representing the product or service directly consumed by the healthcare sector (see Table 5 for an overview of the triggers), and by region in which the impacts occur (aggregated into Belgium, the rest of the EU-27 and the rest of the world). These results illustrate how the environmental footprint evolves over time and how different components of the health system contribute to it. In the longitudinal series, the origin of impacts is not further disaggregated.

The **cross-sectional results** for 2022 contain the same subdivisions but add an additional level of structural detail by identifying the sector group in which impacts originate. This enables a trigger–origin analysis, showing which healthcare consumption categories drive environmental pressures and which sectors and regions in the global production network generate those impacts. Table 5 below provides an overview of the structure of origin sector groups.

Table 5 – Allocation of sectors in FIGARO to trigger product and services and origin sector groups

Industries (NACE Rev.2)		Trigger categories	Origin sector categories
Code	Label		
A01	Crop and animal production, hunting and related service activities	Food and catering	Agriculture and forestry
A02	Forestry and logging	Infrastructure	Agriculture and forestry
A03	Fishing and aquaculture	Food and catering	Agriculture and forestry
B	Mining and quarrying	Infrastructure	Mining
C10T12	Manufacture of food products; beverages and tobacco products	Food and catering	Other industry
C13T15	Manufacture of textiles, wearing apparel, leather and related products	Goods	Other industry
C16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	Infrastructure	Other industry
C17	Manufacture of paper and paper products	Goods	Other industry



C18	Printing and reproduction of recorded media	Goods	Other industry
C19	Manufacture of coke and refined petroleum products	Energy	Energy production
C20	Manufacture of chemicals and chemical products	Chemicals	Chemistry and pharmacy
C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	Pharmaceuticals	Chemistry and pharmacy
C22	Manufacture of rubber and plastic products	Goods	Other industry
C23	Manufacture of other non-metallic mineral products	Goods	Other industry
C24	Manufacture of basic metals	Goods	Other industry
C25	Manufacture of fabricated metal products, except machinery and equipment	Machinery and equipment	Other industry
C26	Manufacture of computer, electronic and optical products	Machinery and equipment	Other industry
C27	Manufacture of electrical equipment	Machinery and equipment	Other industry
C28	Manufacture of machinery and equipment n.e.c.	Machinery and equipment	Other industry
C29	Manufacture of motor vehicles, trailers and semi-trailers	Transport and trade services	Other industry
C30	Manufacture of other transport equipment	Transport and trade services	Other industry
C31_32	Manufacture of furniture; other manufacturing	Goods	Other industry
C33	Repair and installation of machinery and equipment	Machinery and equipment	Other industry
D35	Electricity, gas, steam and air conditioning supply	Energy	Energy production
E36	Water collection, treatment and supply	Water and waste management	Other industry
E37T39	Sewerage, waste management, remediation activities	Water and waste management	Other industry
F	Construction	Infrastructure	Other industry
G45	Wholesale and retail trade and repair of motor vehicles and motorcycles	Transport and trade services	Services
G46	Wholesale trade, except of motor vehicles and motorcycles	Transport and trade services	Services
G47	Retail trade, except of motor vehicles and motorcycles	Transport and trade services	Services
H49	Land transport and transport via pipelines	Transport and trade services	Services
H50	Water transport	Transport and trade services	Services
H51	Air transport	Transport and trade services	Services
H52	Warehousing and support activities for transportation	Transport and trade services	Services
H53	Postal and courier activities	Transport and trade services	Services
I	Accommodation and food service activities	Food and catering	Services
J58	Publishing activities	Services	Services
J59_60	Motion picture, video, television programme production; programming and broadcasting activities	Services	Services

J61	Telecommunications	Services	Services
J62_63	Computer programming, consultancy, and information service activities	Services	Services
K64	Financial service activities, except insurance and pension funding	Services	Services
K65	Insurance, reinsurance and pension funding, except compulsory social security	Services	Services
K66	Activities auxiliary to financial services and insurance activities	Services	Services
L	Real estate activities	Infrastructure	Services
M69_70	Legal and accounting activities; activities of head offices; management consultancy activities	Services	Services
M71	Architectural and engineering activities; technical testing and analysis	Services	Services
M72	Scientific research and development	Services	Services
M73	Advertising and market research	Services	Services
M74_75	Other professional, scientific and technical activities; veterinary activities	Services	Services
N77	Rental and leasing activities	Services	Services
N78	Employment activities	Services	Services
N79	Travel agency, tour operator and other reservation service and related activities	Transport and trade services	Services
N80T82	Security and investigation, service and landscape, office administrative and support activities	Services	Services
O84	Public administration and defence; compulsory social security	Services	Services
P85	Education	Services	Services
Q86	Human health activities	Medical products and services	Direct impacts
Q87_88	Residential care activities and social work activities without accommodation	Long term care	Direct impacts
R90T92	Creative, arts and entertainment activities; libraries, archives, museums and other cultural activities; gambling and betting activities	Services	Services
R93	Sports activities and amusement and recreation activities	Services	Services
S94	Activities of membership organisations	Services	Services
S95	Repair of computers and personal and household goods	Services	Services
S96	Other personal service activities	Services	Services
T	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	Services	Services
U	Activities of extraterritorial organisations and bodies	Services	Services

International comparability

The model produces results only for Belgium. While several countries have developed healthcare environmental footprints, differences in EE-MRIO models, sector classifications, health expenditure definitions, environmental extensions, and methodological assumptions mean that results are not directly comparable across model frameworks.

Limitations

Model- and assumption-dependence. Results depend on the specific EE-MRIO system used, the environmental extensions applied, the mapping of expenditures to sectors, and other underlying modelling assumptions. Different EE-MRIO frameworks can therefore yield different footprint estimates.



	Sectoral aggregation. FIGARO provides 64 sector categories. Sectoral aggregation limits the ability to capture fine-grained variations in upstream impacts. Nevertheless, FIGARO includes a dedicated pharmaceutical sector (C21), which improves the accuracy of pharmaceutical-related impacts in comparison to other MRIO systems, such as EXIOBASE, where pharmaceuticals are grouped with a broader “chemicals n.e.c.” category that yields less precise estimates for healthcare-relevant supply chains. Uniform environmental impact intensities across provider types. While the healthcare final demand vector is detailed, several current spending categories are ultimately mapped to the same FIGARO healthcare sector (Q86). As a result, the model applies identical supply-chain structures and environmental impact intensities to hospitals and outpatient providers. Hence, the model cannot distinguish environmental impact generated by one euro of spending in hospitals or outpatient providers. Limited representation of healthcare-specific sources. The IO analysis is a top-down, expenditure-driven approach and is not complemented with detailed bottom-up healthcare data. Consequently, emissions from sources such as anaesthetic gases, staff travel, on-site energy choices, or renewable energy procurement are not necessarily fully captured. Household consumption impacts not fully represented. The analysis captures environmental impact from industries, not from households. Therefore, household-level impacts related to healthcare, such as patient travel are not included. Direct impact of certain impact categories. Some impact categories are not fully aligned with the specifics of the healthcare sector. For example, the environmental-footprint (EF) land-use indicator is dominated by agricultural land occupation, while infrastructure land associated with hospital buildings and other healthcare infrastructure is not captured directly and cannot be isolated explicitly. Potential overestimation of environmental impacts in 2023. Environmental impact data for 2023 were not yet available. As a result, preliminary 2023 estimates were derived by applying 2022 environmental intensities to 2023 monetary data without inflation adjustment. These estimates are therefore likely to overstate environmental impacts, and 2022 was retained as the reference year for detailed structural analysis.
Dimension	Environmental sustainability
Related indicators	ENV-1 GHG environmental footprint of the healthcare sector ENV-2 Material environmental footprint of the healthcare sector ENV-3 Land environmental footprint of the healthcare sector ENV-5 Particulate matter environmental footprint of the healthcare sector (PM 2.5; PM10) ENV-6 acidifying gas environmental footprint of the healthcare sector ENV-7 Ozone precursor environmental footprint of the healthcare sector
Supervisor	Nicolas Bouckaert
Co-authors Reviewers	/ Maarten Christis (VITO), Pieter Fonteyn (VITO)

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1.2 GHG environmental footprint of the healthcare sector (direct and indirect emissions - Scope 1, 2 and 3) (ENV-1)

1.2.1 Documentation sheet

Description	Primary indicator: - Direct and indirect GHG emissions in the healthcare sector (in kg CO₂ eq per capita) (Scope 1, 2, 3) Secondary indicators: - Direct and indirect GHG emissions in the healthcare sector (% of total Belgian GHG emissions) (Scope 1, 2, 3) - Direct and indirect GHG emissions in the healthcare sector (in kt CO₂ eq) (Scope 1, 2, 3) - GHG emissions (in kt CO₂ eq) related to building and energy - GHG emissions (in kt CO₂ eq) related to transport and mobility - GHG emissions (in kt CO₂ eq) related to medical products - GHG emissions (in kt CO₂ eq) related to sustainable food - GHG emissions (in kt CO₂ eq) related to waste management and water use
Rationale	Greenhouse gases (GHG) like carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) trap heat, leading to global warming and climate change. Belgium formally committed to deliver a baseline assessment of greenhouse gas emissions of the health system, with the final objective of developing a climate resilient and low carbon, sustainable health system by 2050.¹
Calculation	Primary indicator (A): - Numerator: GHG emissions footprint of the health system in kt CO₂ eq (2022) - Denominator: Population of the corresponding year (calculated as mean of population at beginning and end of year) Indicator B: - Numerator: GHG emissions footprint of the health system in kt CO₂ eq (2022 in NEHAP, 2018 in OECD) - Denominator: Total GHG emissions in Belgium (2021 in NEHAP, 2018 in OECD) Indicator C: - Numerator: GHG emissions footprint of the health system in kt CO₂ eq (2022) - Denominator: - Indicators D-G: - Numerator: GHG emissions for "XXX" in kt CO₂ eq (2022) (XXX = construction and maintenance services / fossil fuels, etc.) - Denominator: GHG emissions footprint of the health system in kt CO₂ eq (2022)
Data source	Three different models were used: NEHAP 2025², VITO 2025 (see methodological note on VITO model), and OECD 2025³
Technical definitions	All direct (scope 1) and indirect (i.e. scope 2 and 3) emissions were considered based on greenhouse gas (GHG) emission inventory of the Belgian healthcare sector using a footprint (consumption-based) methodology. Scope 1 emissions are direct emissions associated with on-site fuel combustion (e.g. in boilers, heating systems, combined heat and power, backup power generation etc.) in healthcare facilities, emissions from the operation of fleet vehicles and other on-site emissions (from refrigerants, anaesthetics or on-site waste treatment). Scope 2 emissions are indirect emissions associated with the generation of purchased electricity, heat or steam.



	Scope 3 emissions are indirect emissions from upstream (e.g. material extraction, production of pharmaceuticals) and downstream (e.g. waste and sanitation) organizational activities. Scope 3 emissions include those related to pharmaceuticals, business services, medical equipment/instruments, food/catering, manufactured fuels, chemicals, and gases, other manufactured products, construction and maintenance services, other procurement, information and communication technologies and services, fossil fuels (coal, oil, etc.), transport, waste, water, and sanitation, electricity and steam.² The NEHAP model used the Health Care Without Harm's "Net Zero Roadmap" methodology. Emissions baseline was derived using a "hybrid" approach, combining both top-down expenditure where detailed and consistent activity-level data is lacking and more granular, precise bottom-up data where available. For top-down expenditure, an Environmentally-Extended Input-Output (EEIO) analysis was done. Emissions factors tied to product-based expenditure for Belgium were derived using the EXIOBASE 3 (version 3.8.2) environmentally extended multi-regional input-output (EE MRIO) tables. In EXIOBASE 3, the detailed supply–use structure is benchmarked to 2011; subsequent years are updated using macroeconomic and trade-based now-casting rather than newly compiled national supply–use tables. This methodological choice may explain some of the observed differences relative to other Multi-Regional (MR)-EEIO models. For bottom-up data, the following sources were used: Electricity and natural gas consumption across health facilities, and Metered Dose Inhalers (MDI) usage. Adjustments were made to top-down derived emissions figures reflecting energy consumption and pharmaceutical procurement to help improve the precision of the associated emissions derivation methods and incorporate scope 1 emissions that are not captured in emissions factors (EFs) from EXIOBASE. Health care activities included (based on classifications from the system of health accounts produced by OECD/Eurostat/WHO) were hospitals, residential long-term care facilities, providers of ambulatory health care, providers of ancillary services, retailers and other providers of medical goods, providers of preventative care, providers of health care system administration and financing (for more details, see table 1 in NEHAP 2025²). The OECD model used a "top-down" approach combining OECD's Inter-Country Input Output (ICIO) table, its environmental extension, and the JHAQ data collection on health expenditure (See Doucet et al. 2025 for more details)³ The VITO model used a "top-down" Environmentally Extended Multi-Regional Input-Output (EE-MRIO) approach. Environmental extensions tables were based on EXIOBASE v3.8.2 and supplemented by VITO with Eurostat Air Emission Accounts data (2023 update). Monetary tables used were FIGARO (25 edition) tables published by Eurostat, in which the region-level granularity was adjusted to cover the 46 regions of earlier FIGARO releases (see methodological note on VITO model for more details). As FIGARO is closely aligned with OECD's ICIO, OECD and VITO results are more similar than NEHAP. Moreover, NEHAP uses some bottom-up data, which is not the case in other models. It should also be noted that in the VITO model, Environmental impact data for 2023 were not yet available; therefore, preliminary estimates for that year were derived by combining 2022 environmental intensities with 2023 monetary data. As no adjustment for inflation was applied, these preliminary 2023 estimates are likely to overstate environmental impacts. Consequently, 2022 is considered the last year with fully reliable data and is used as the reference year in the interpretation and discussion of results.
International comparability	Given substantial differences in methodologies, data sources and underlying assumptions, international comparisons should be interpreted with caution and preferably limited to results derived from the same modelling framework. The International comparison is therefore based on results from the OECD model.³ Among the model components, the GHG emission vector for all industries and all countries is likely less robust and more assumption driven than other components. There seems to be greater cross-country variation in how emissions are allocated to industries. However, discussions to improve comparability are ongoing.
Limitations	Results differ by model. Differences in the sources used and assumptions done impacted results. Details on the limitations of each model can be found in their respective reports (NEHAP 2025², Doucet 2025³ and methodological note on VITO model).

Dimension	Environmental sustainability
Related indicators	ENV-4 Direct GHG emissions in human health activities ENV-2 Material environmental footprint of the healthcare sector ENV-3 Land use environmental footprint of the healthcare sector
Supervisor	Sophie Gerkens
Reviewers	Pieter Fonteyn (VITO), Ben Ashby (ARUP), Michael Mueller (OECD)

1.2.2 Results

BELGIUM

Based on the NEHAP report, direct and indirect GHG emissions in the healthcare system reached 9 901 kt CO₂ eq in 2022, representing 5% of total Belgian emissions and 850.5 kg CO₂ eq per capita. Scope 3 indirect emissions represented the most important part (86.4%) while direct emissions scope 1 represented 10.9% of total GHG emissions of the healthcare sector. A similar distribution is observed in the OECD model (based on 2018 data), where Scope 3 emissions represented 81.8% and Scope 1 emissions 12.1% of total emissions.

The model used by VITO provides longitudinal data on the evolution of GHG emissions. Based on this model, emissions were slightly lower than in the NEHAP report (7 321 kt CO₂ eq in 2022) and the evolution seems quite stable (see Figure 1). When accounting for the increase in population, we observe a small decline in the GHG emissions per capita, with the lower value observed in 2022 (2023 incomplete). The share of the health system in the Belgian GHG footprint remains relatively stable over time, fluctuating within a range of 4.9% and 5.5% (excluding 2020 and 2021). A temporary increase is observed during 2020-2021 (5.8%), reflecting the comparatively stronger rise in healthcare-related GHG emissions during the pandemic (see Table 6).

Finally, in the OECD model, emissions were slightly higher than in the VITO model (see Table 7).

Table 6 – Annual direct and indirect GHG emissions in the healthcare sector, 2012-2023

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	(2023*)
<i>In kg CO₂ eq per capita</i>	694.9	684.6	663.8	710.8	648.3	634.6	693.0	665.9	666.2	694.0	628.9	607.7
<i>In kt CO₂ eq</i>	7 691	7 617	7 422	7 988	7 323	7 202	7 903	7 633	7 666	8 018	7 321	7 129
<i>As a share of total Belgian GHG emissions (%)</i>	5.0%	4.9%	4.9%	5.5%	5.0%	4.9%	5.1%	5.2%	5.8%	5.8%	5.1%	5.5%

*2023 results are preliminary and likely overestimated, as they are based on 2022 environmental intensities combined with 2023 monetary data without inflation adjustment. Source: VITO 2025

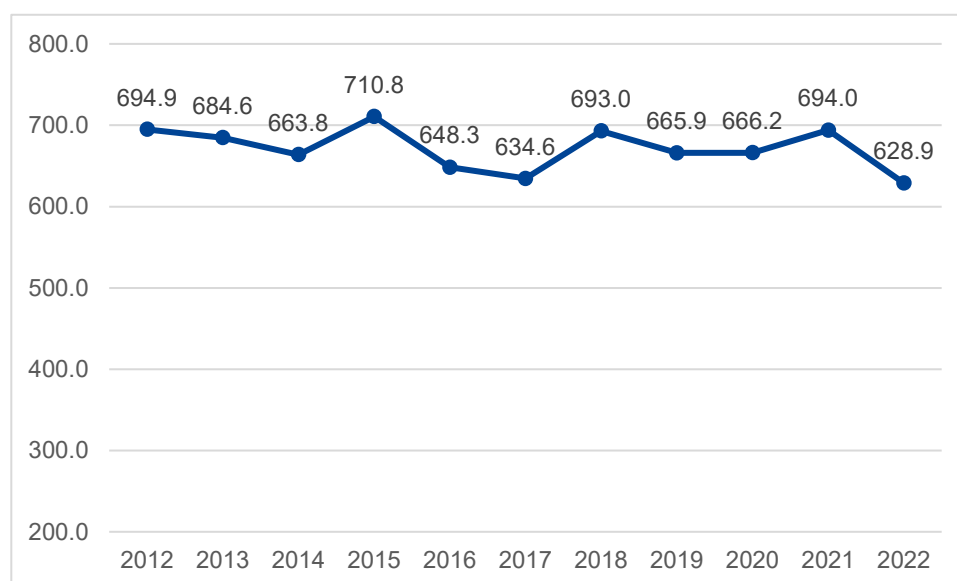
Table 7 – Direct and indirect GHG emissions in the healthcare sector, by source (NEHAP, VITO, OECD)

<i>Unit (year)</i>	NEHAP	VITO	OECD
<i>in kt CO₂ eq (2022)</i>	9 901	7 321	
<i>in kg CO₂ eq per capita (2022)</i>	851	629	
<i>As a share of total Belgian GHG emissions (%) (2022)</i>	5%	5.1%	
<i>in kt CO₂ eq (2018)</i>		7 903	8 336
<i>in kg CO₂ eq per capita (2018)</i>		693	731
<i>As a share of total Belgian GHG emissions (%) (2018)</i>		5.1%	5.5%

Sources: NEHAP, VITO, OECD



Figure 1 – Annual direct and indirect GHG emissions in the healthcare sector, in kg CO₂ eq per capita, 2012-2022



Source: VITO 2025

ANALYSIS BY TRIGGER PRODUCT OR SERVICE

Based on the NEHAP report, Medical products (pharmaceuticals, medical equipment and instruments – scope 3) accounted for the largest share of emissions in the health system, i.e. 44.3%¹ (see Table 8 and Figure 2). Within this category, pharmaceuticals alone represent 30.8%, making them the single most important trigger of healthcare-related GHG emissions. Emissions from Metered Dose Inhalers (MDIs) represented 0.4% of the GHG footprint (44 kt CO₂ eq).

Building and energy use is responsible for 15.0% of emissions. These emissions arise from a combination of direct on-site fuel combustion (scope 1), purchased electricity and heat (scope 2), and upstream energy supply (scope 3), reflecting the energy-intensive nature of healthcare facilities. The category “Other” represents a substantial 28.6% of total emissions, driven mainly by business services (16.4%) and manufactured fuels, chemicals, and gases (5.4%). Food and catering contribute 7.8% of emissions, while transport and mobility account for a smaller share (3.7%), largely driven by vehicle fuel use.

Table 8 – Details on GHG emissions by trigger product or service

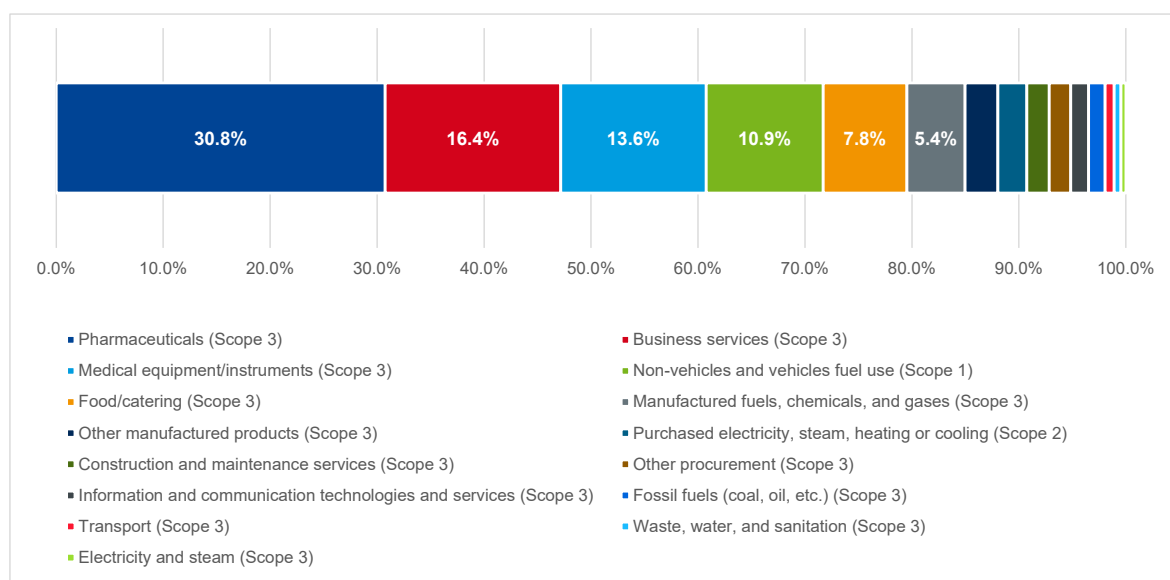
Topic	kt CO ₂ eq	%
Building and energy use	1480	14.95%
Non-vehicles fuel use (scope 1)	806	8.14%
Purchased electricity, steam, heating or cooling (scope 2)	269	2.72%
Fossil fuels (coal, oil, etc.) (scope 3)	152	1.54%
Electricity and steam (scope 3)	208	2.10%
Construction and maintenance services (scope 3)	45	0.45%
Transport and mobility	361	3.65%
Vehicles fuel use (scope 1)	277	2.80%

¹ The high contribution from pharmaceutical and chemical products may in part be related to the use of EXIOBASE as the EE-MRIO, which assigns relatively high emission intensities to these industries compared with ICIO or FIGARO.

Transport (scope 3)	84	0.85%
Medical products	4391	44.35%
Pharmaceuticals (scope 3)	3045	30.75%
Medical equipment/instruments (scope 3)	1346	13.59%
Sustainable food	775	7.83%
Food and catering (scope 3)	775	7.83%
Waste and water use	63	0.64%
Waste, water, and sanitation (scope 3)	63	0.64%
Other	2831	28.59%
Business services (scope 3)	1625	16.41%
Manufactured fuels, chemicals, and gases (scope 3)	539	5.44%
Information and communication technologies and services (scope 3)	166	1.68%
Other procurement (scope 3)	198	2.00%
Other manufactured products (scope 3)	303	3.06%

Source: NEHAP 2025

Figure 2 – Details on GHG emissions by trigger product or service (NEHAP)

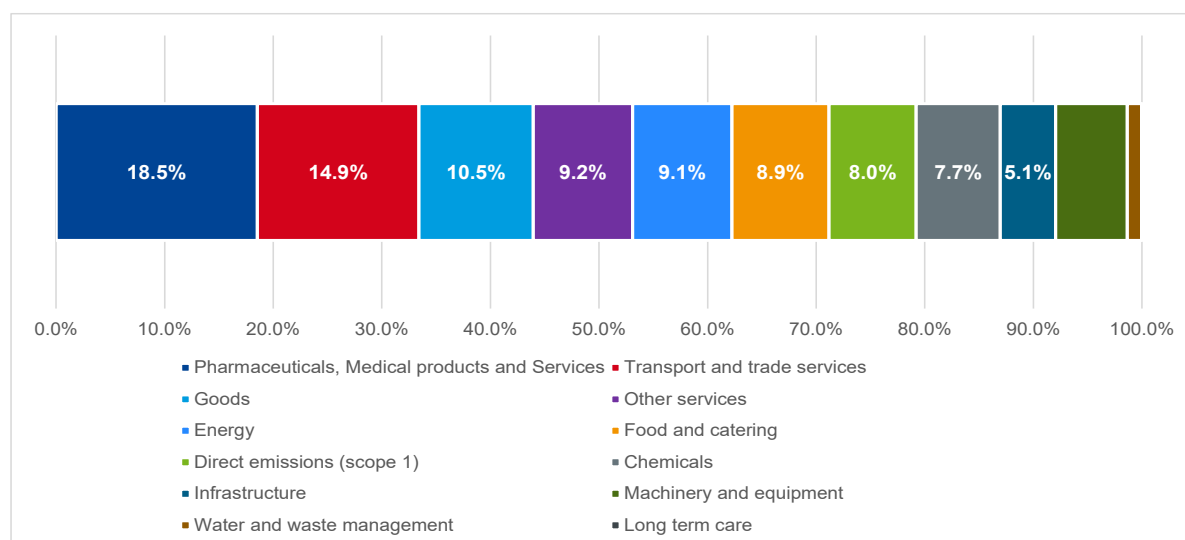


Sources: NEHAP 2025

Based on the VITO model, the repartition was slightly different but pharmaceuticals and medical products remain among the main drivers, but with a substantially lower share (see Figure 3). One reason for this is that the FIGARO model used by VITO has a dedicated pharmaceutical sector in the IO analysis, while EXIOBASE groups pharmaceuticals within a broader “chemicals not elsewhere classified” category, which may result in higher and less precise estimates.



Figure 3 – Details on GHG emissions by trigger product or service (VITO)



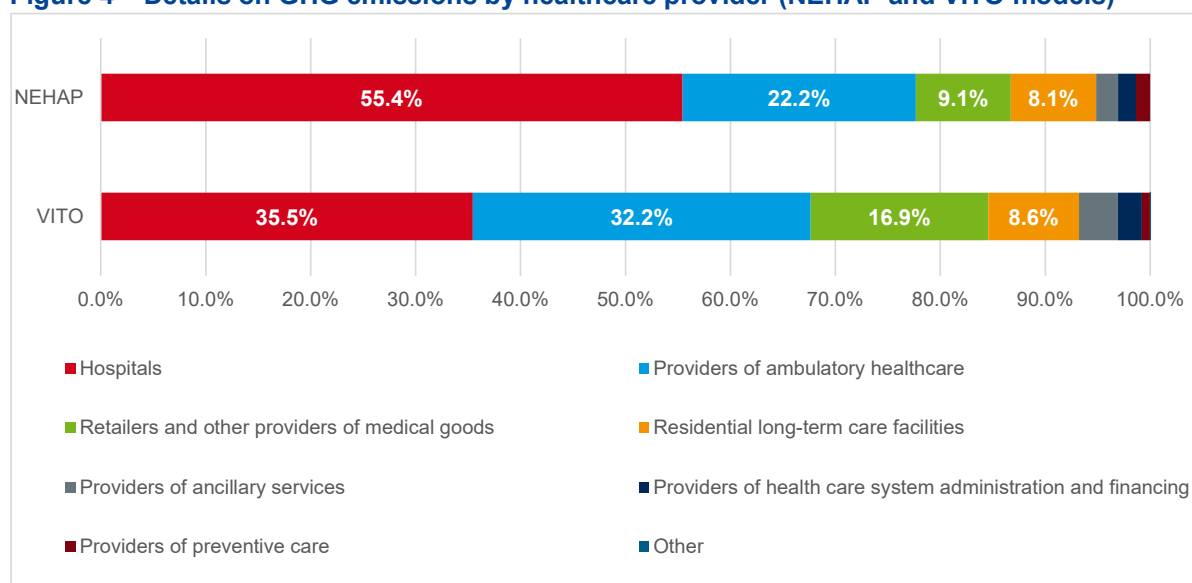
Sources: VITO 2025

ANALYSIS BY HEALTH CARE PROVIDERS

Based on the NEHAP model and spending categories, hospitals are the largest contributors to GHG emissions (55.4%), followed by providers of ambulatory healthcare (22.2%), retailers and other suppliers of medical goods (9.1%), and residential long-term care facilities (8.1%). Other providers account for less than 2.2%. The link between the high share of pharmaceutical products as triggers products and the high share of hospitals as providers can be partly explained by the fact that, in Belgium, pharmaceutical expenditures are largely attributed to hospitals (53.2% in 2022).⁴

The same hierarchical pattern is observed in the VITO model, with hospitals remaining the main contributors but at a lower share (see Figure 4). This difference can partially be explained by the exclusion of direct emissions and emissions related to investments (not allocated to healthcare providers in the VITO model). It should also be noted that the OECD model produces results comparable to those obtained by VITO (see the appendix of the OECD report).³ These results are not included in the figure, as the OECD model is based on a different reference year (2018).

Figure 4 – Details on GHG emissions by healthcare provider (NEHAP and VITO models)

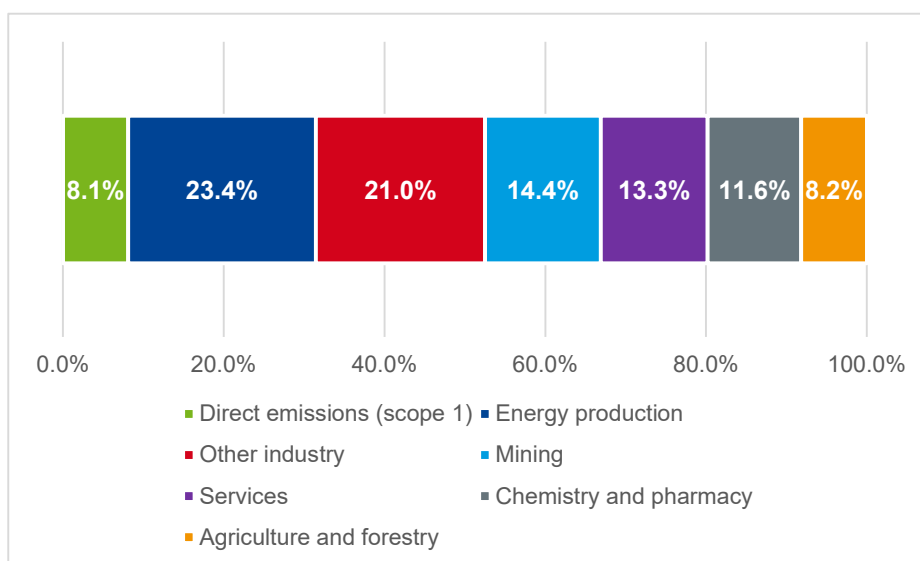


Sources: NEHAP 2025 and VITO 2025 (For VITO, direct emissions and emissions related to investments were not taken into account)

ANALYSIS BY SECTORAL ORIGIN

Based on the VITO model, Figure 5 illustrates the sectoral sources of GHG emissions associated with healthcare consumption in 2022. Beyond direct emissions from the healthcare sectors (8.1%), energy production stands out as the main contributor of GHG emissions (23.4%), followed by other industrial sectors (21.0%), mining (14.4%), services (13.3%), chemistry and pharmacy (11.6%), and agriculture and forestry (8.2%). Contrary to the material use and land-use footprints, which are dominated by 1 or 2 sectors, multiple sectors contribute a substantial share to the GHG footprint. A similar analysis can also be found in the appendix of the OECD report, but based on 2018 data).

Figure 5 – Details on GHG emissions by sectoral origin (VITO)



Sources: VITO 2025

REGIONAL COMPARISON

Even if the NEHAP report published data per region, these data were not reliable as the national level results were disaggregate by region based on the population².

Due to this methodological choice, no difference in GHG emissions per capita between regions could be highlighted. Regional data are therefore not reported to avoid inappropriate comparisons.

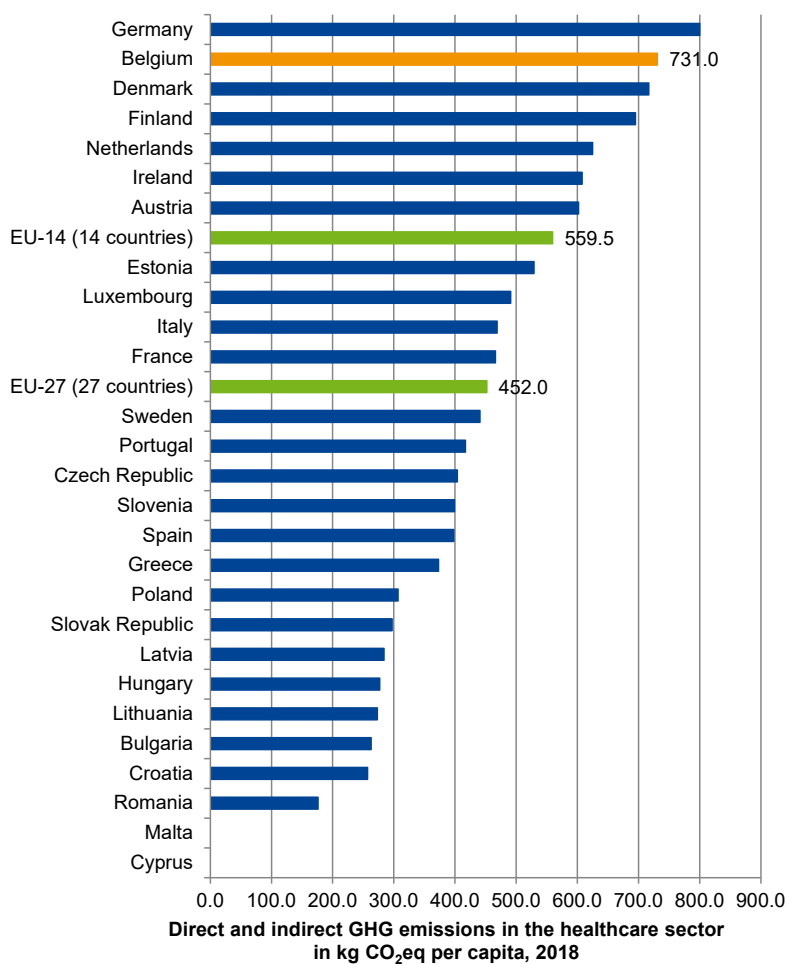
INTERNATIONAL COMPARISON

As methodological assumptions, data sources and choices made in each model can have a substantial impact on results, it is important to use the same model for country comparisons. Based on the OECD model, GHG emissions per capita in Belgium were above the EU-averages and Belgium was the second highest country in 2018, just after Germany (see Figure 6). GHG emissions in the healthcare sector in Belgium, expressed as a share of total GHG emissions for all sectors are also higher in Belgium than the EU-averages and Belgium was the fourth highest country in 2018 (see Figure 7).

² The only regional differences captured concerned bottom-up electricity and natural gas consumption data

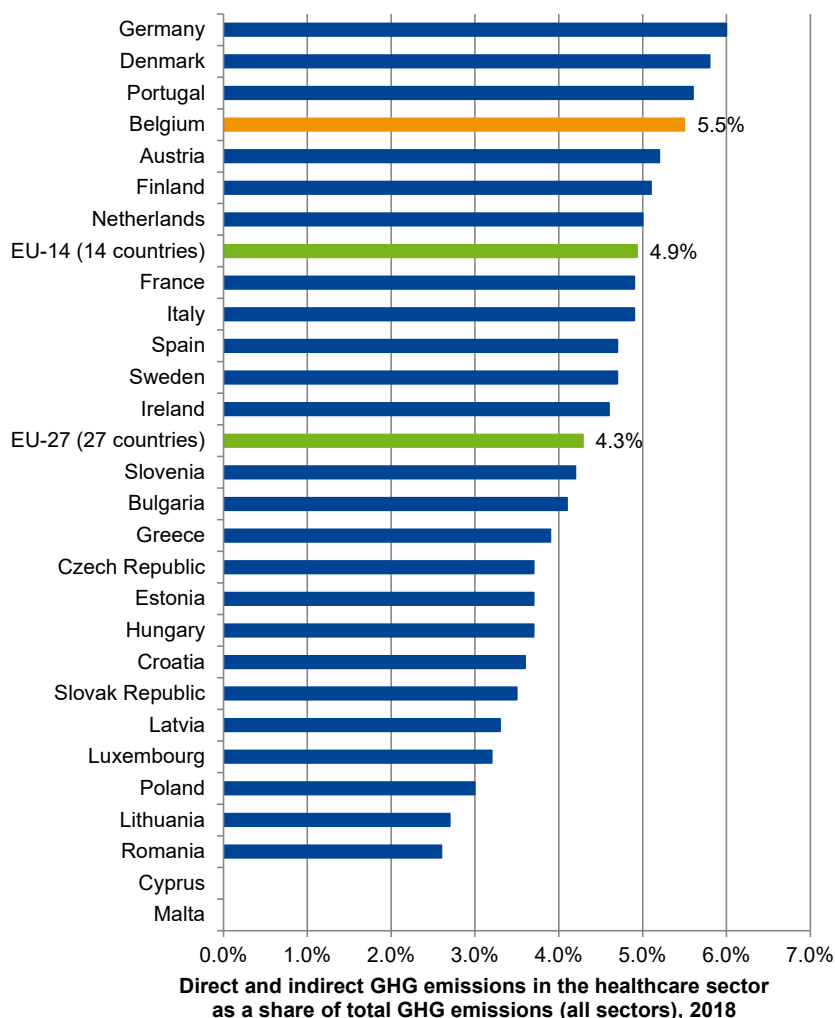


Figure 6 – Direct and indirect GHG emissions in the healthcare sector, in kg CO₂ per capita, international comparison, 2018



Source: OECD 2025

Figure 7 – Direct and indirect GHG emissions in the healthcare sector, as a share of total GHG emissions (all sectors), international comparison, 2018



Source: OECD 2025

KEY POINTS

- Assessing direct and indirect GHG emissions in the healthcare sector is complex, and results vary depending on the model and assumptions applied. While these estimates should be interpreted with caution, understanding the magnitude and trends of these emissions remains essential to achieve a climate-resilient, low-carbon, and sustainable health system by 2050.
- To estimate these emissions, this report used data from three different models: NEHAP², VITO, and OECD³ (see the technical sheet for details).
- Estimated direct and indirect GHG emissions in the healthcare sector in 2022 ranged between 7 321 and 9 901 kt CO₂ eq, depending on the model. On a per capita basis, this corresponds to 629–851 kg CO₂ eq.
- When accounting for the increase in population, a small decline in the GHG emissions per capita is observed, with the lowest value observed in 2022 (629 kg CO₂ eq per capita) and the highest value in 2015 (711 kg CO₂ eq per capita). The share of the health system in the Belgian GHG footprint remains relatively stable over time, fluctuating within a range of 4.9% and 5.5% but a temporary



increase to 5.8% was observed during the COVID-19 pandemic (based on the VITO model, no evolution available for other models).

- Scope 3 emissions dominated, accounting for 86.4% of total healthcare-related GHG emissions in 2022, while Scope 1 direct emissions represented 10.9%. Medical products (pharmaceuticals, medical equipment, and instruments – scope 3) were the largest contributors at 44.3%. Among healthcare providers, hospitals accounted for 55.4% of emissions (based on the NEHAP model). The link between the high impact of pharmaceutical products and the high impact of hospitals can be partly explained by the fact that, in Belgium, pharmaceutical expenditures are largely attributed to hospitals (53.2% in 2022).⁴ The high contribution from pharmaceutical products may also be related to the use of EXIOBASE as the EE-MRIO, which assigns relatively high emission intensities to this industry compared with ICIO or FIGARO.
- Compared to other countries, direct and indirect GHG emissions per capita in Belgium (731 kg CO₂ per capita in 2018) were above EU averages (with 560 and 452 kg CO₂ eq for the EU-14 and EU-27, respectively – Based on the OECD model). Belgium ranked the second highest country in the EU in 2018, just after Germany. Expressed as a share of total GHG emissions for all sectors, results are also higher in Belgium (5.5%) than the EU-averages (4.9% for the EU-14 and 4.3% for the EU-27) and Belgium was the fourth highest country in 2018 (after Germany, Denmark and Portugal).
- In conclusion, even if these data should be interpreted with caution, the performance of the Belgian health system concerning its GHG footprint seems moderate and the modest decline observed in 2022 must be significantly accelerated.

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1.3 Material environmental footprint of the healthcare sector (ENV-2)

1.3.1 Documentation sheet

Description	Primary indicator: A. Annual material environmental footprint of the healthcare sector, in kg per capita Secondary indicator(s): B. Annual material environmental footprint of the healthcare sector, in kilo tonnes C. Annual material environmental footprint of the healthcare sector, as a share of total material environmental footprint
Rationale	Demand for healthcare is expected to continue increasing due to population ageing, expanding medical treatment options and rising expectations regarding access and quality of care.¹⁻³ This growth leads to higher demand for healthcare infrastructure, medical devices, pharmaceuticals and consumables, all of which rely at least partly on primary material extraction. At the same time, healthcare delivery has become increasingly material-intensive, with a marked shift towards single-use products over the past decade, driven by infection prevention requirements, regulatory standards, cost considerations and ease of use.^{1, 4, 5} Material extraction and processing are major drivers of resource depletion, land-use pressures, biodiversity loss and water stress, making material use a key dimension of environmental sustainability.^{6, 7} The material environmental footprint captures all raw materials extracted – domestically and abroad – and used directly and indirectly to satisfy healthcare demand. This perspective is particularly relevant for healthcare, as a large share of its environmental impacts occur upstream in international supply chains.⁷⁻¹⁰ Resource extraction includes biomass (e.g. cotton, wood, starch crops), fossil energy carriers (e.g. crude oil, natural gas, coal), metal ores (e.g. iron ore, copper ore, aluminium ore, lithium) and non-metallic minerals (e.g. sand, limestone, gypsum, mineral salts). Healthcare systems account for substantial shares of material extraction, notably biomass for medical textiles, paper and food provision; fossil resources for plastics and synthetic polymers, energy-intensive production processes, heating and transport; metal ores for infrastructure, machinery, batteries and medical equipment; and non-metallic minerals for construction and renovation, medical devices and pharmaceutical ingredients.^{7, 10} Traditionally, medical devices and consumables follow a linear “make-use-dispose” model, with logistics and organisational practices focused primarily on waste management rather than reuse.^{1, 11} From an environmental sustainability perspective, this contributes to rising material footprints and increasing dependence on primary resources. Circular economy strategies offer opportunities to reduce material footprints by maintaining material value for longer, reducing new extraction and improving supply resilience. In healthcare, this involves rethinking product design, procurement and use in line with the hierarchy of R-strategies (Refuse, Rethink, Reduce, Reuse, Repair, Refurbish, Remanufacture, Repurpose, Recycle and Recover), while safeguarding patient safety, quality of care, performance and cost-effectiveness.^{11, 12} Because circular solutions may involve trade-offs, such as increased energy or water use for sterilisation, enhancing circularity and reducing the material footprint should be pursued using life-cycle assessments (LCA) of medical products to avoid shifting of environmental burdens to other impact categories.^{1, 4, 5, 10}
Calculation	Material footprint was calculated by VITO (see methodological note) Primary indicator (A): • Numerator: Annual material footprint of the healthcare sector, in kg • Denominator: Population of the corresponding year (calculated as mean of population at beginning and end of year) Indicator B:



	• Numerator: Annual material footprint of the healthcare sector, in kilotonne • Denominator: / Indicator C: • Numerator: Annual material footprint of the healthcare sector, in kg • Denominator: Annual material footprint over all sectors, in kg
Data source	Environmental footprints were calculated by VITO using an Environmentally Extended Multi-Regional Input-Output (EE-MRIO) approach (see methodological note). Longitudinal results are reported for the period 2010-2023, while the cross-sectional structural decomposition is presented for 2022. Environmental impact data for 2023 were not yet available; therefore, preliminary estimates for that year were derived by combining 2022 environmental intensities with 2023 monetary data. As no adjustment for inflation was applied, these preliminary 2023 estimates are likely to overstate environmental impacts. Consequently, 2022 is considered the last year with fully reliable data and is used as the reference year in the interpretation and discussion of results. Population data from Eurostat.¹³
Technical definitions	See methodological note for the material footprint calculated by VITO. Material use is measured in kilograms of materials extracted and used, classified into four material categories: biomass, non-metallic minerals, metallic ores, and fossil energy carriers. For the international comparison, results from Andrieu et al. (2023) for the latest available year (2015) are used.⁷ The study applies a top-down environmentally extended multi-regional input-output (EE-MRIO) approach to estimate the material footprints of the healthcare sector in 44 countries, including all EU Member States, as well as five aggregated regions representing the rest of the world. The analysis relies on EXIOBASE v3.8.2 to trace global supply chains and quantify the material footprint of the healthcare sector. Healthcare expenditure data are sourced from the WHO and OECD Health Expenditure Database. Capital formation is accounted for. Results derived from EXIOBASE are not directly comparable to those obtained using FIGARO, which is applied for the main analysis. For example, while FIGARO includes a dedicated pharmaceutical sector, EXIOBASE groups pharmaceuticals within a broader "chemicals not elsewhere classified" category, which may result in less precise estimates for healthcare-relevant supply chains (see methodological note).
International comparability	Given substantial differences in methodologies, data sources and underlying assumptions, international comparisons should be interpreted with caution and preferably limited to results derived from the same modelling framework. Andrieu et al. (2023) provide internationally comparable estimates of the material footprint of the healthcare sector for the year 2015 (see above in technical definitions).⁷ The methodology applied in this study differs from the approach used for the primary and secondary indicators presented here, and results are therefore not directly comparable.
Limitations	See methodological note
Dimension	Environmental sustainability
Related indicators	ENV-1 GHG environmental footprint of the healthcare sector ENV-3 Land use environmental footprint of the healthcare sector ENV-14 Total annual primary waste in the healthcare sector
Supervisor	Nicolas Bouckaert
Reviewer	Pieter Fonteyn (VITO)

1.3.2 Results

BELGIUM

Table 9, Figure 8 and Figure 9 present the annual material footprint of the health system over the period 2012-2023, expressed both per capita (Figure 8) and in absolute terms (Figure 9), and disaggregated by material type. The total material footprint ranged from 1 084 kg per capita (11 998 kilotonne) in 2012 to 1 042 kg per capita (12 131 kilotonne) in 2022. Thus, the total footprint in 2012 and 2022 is of a similar absolute magnitude despite growth in healthcare output over the period, which is reflected in a slightly lower per capita value in 2022. However, substantial variability is observed over time. Following an initial decrease between 2012 and 2016, reaching a low of 848 kg per capita (9 573 kilotonne), the footprint increased again due to higher current spending and investment levels. This was followed by a COVID-related peak reaching a maximum of 1 151 kg per capita (13 293 kilotonne) in 2021, and a subsequent decline.

In terms of material composition, non-metallic minerals clearly dominate the footprint, consistently accounting for more than half of total material use (a 53% share in 2022; see Figure 13). This reflects the material intensity of healthcare-related construction, renovation and infrastructure, as well as the use of mineral-based inputs in medical products and pharmaceuticals. Biomass and fossil materials constitute the second and third largest components (each representing 19% in 2022; see Figure 13), while metals account for a smaller but relatively stable share (9% in 2022; see Figure 13).

Figure 8 and Figure 9 further show that current spending, which represents the main component of healthcare spending, accounts for the majority of the material footprint in all years, particularly for biomass and fossil materials. This reflects the ongoing consumption of medical goods, pharmaceuticals, energy and consumables. Investments, while smaller in absolute terms, account for approximately one fifth to one sixth of the total material footprint, which is higher than their share in total healthcare spending (around one tenth to one twelfth). Investments therefore contribute disproportionately to the footprint of non-metallic minerals and metals, highlighting the role of construction, renovation and capital equipment in driving material extraction.



Table 9 – Annual material footprint of the health system by material type (in kg per capita and in kilotonne)

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	(2023*)
Results in kg per capita												
<i>All materials</i>	1 084	1 079	1 028	956	848	892	1 002	973	1 077	1 151	1 042	994
<i>Biomass</i>	200	195	207	206	192	194	211	208	200	210	194	197
<i>Fossils</i>	225	222	201	165	134	158	200	179	199	222	202	166
<i>Metals</i>	89	89	82	70	66	77	91	86	97	100	91	84
<i>Non-metallic minerals</i>	571	574	536	515	456	463	500	499	581	619	555	547
Results in kilotonne												
<i>All materials</i>	11 998	12 004	11 488	10 745	9 573	10 126	11 424	11 156	12 393	13 293	12 131	11 658
<i>Biomass</i>	2 210	2 171	2 318	2 316	2 167	2 198	2 404	2 390	2 300	2 424	2 262	2 307
<i>Fossils</i>	2 491	2 466	2 252	1 859	1 517	1 793	2 280	2 053	2 295	2 568	2 353	1 950
<i>Metals</i>	982	985	920	782	743	879	1 038	990	1 116	1 152	1 055	988
<i>Non-metallic minerals</i>	6 315	6 383	5 998	5 788	5 146	5 256	5 702	5 723	6 681	7 149	6 462	6 413

Source: VITO

* 2023 results are preliminary and likely overestimated, as they are based on 2022 environmental intensities combined with 2023 monetary data without inflation adjustment. (see methodological note).

Figure 8 – Annual material footprint of the health system by material type, subdivided by investment versus current spending (in kg per capita)



Source: VITO, Eurostat

Figure 9 – Annual material footprint of the health system by material type, subdivided by investment versus current spending (in kilotonne)

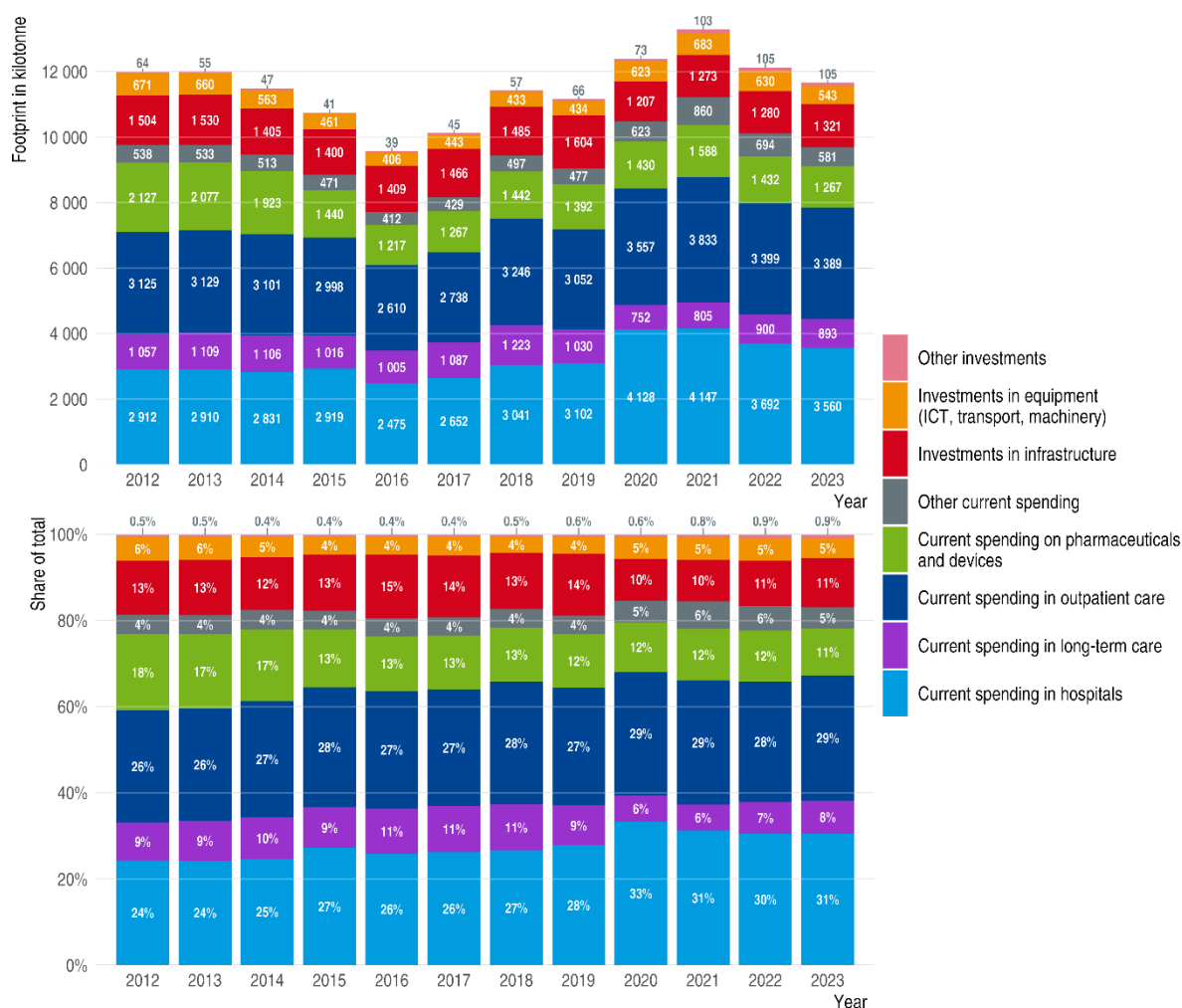


Source: VITO

ANALYSIS BY SPENDING CATEGORY

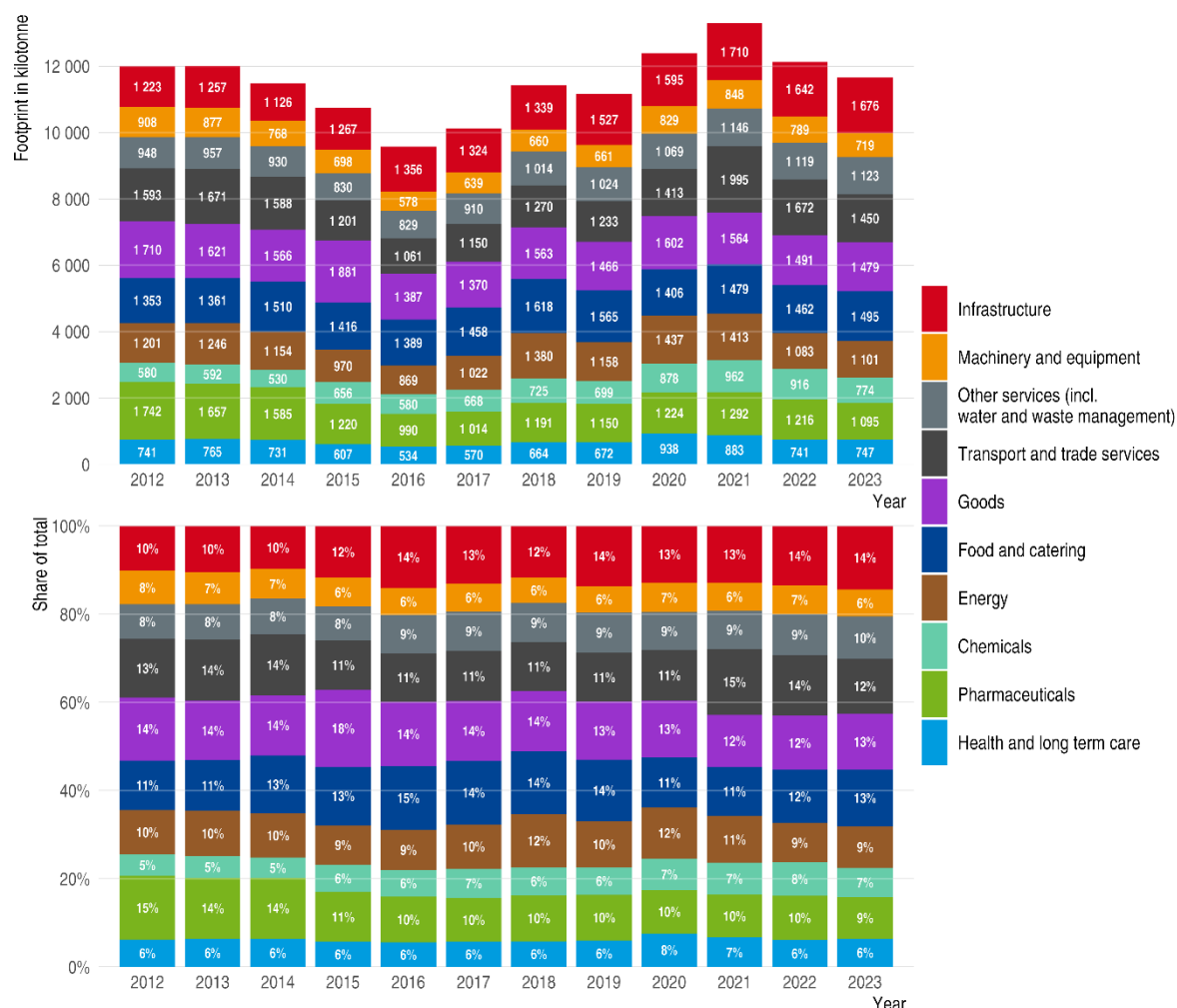
Figure 10 presents the material footprint of the health system over the period 2012-2023, disaggregated by current spending categories and investment types, and shown both in absolute terms (kilotonne) and as shares of the total footprint. The figure highlights where within the health system material use is generated. As indicated above, current spending dominates the material footprint in all years, accounting for approximately 80-85% of the total footprint. Hospital care and outpatient care together consistently represent around 50-60% of total material use. This primarily reflects their large share in overall healthcare spending and their central role in healthcare delivery. These spending categories are also closely associated with the COVID-related peak in material use. Pharmaceuticals and medical devices account for roughly 10-15% of the material footprint. Finally, investments generally represent around 15-20% of the total footprint. Within investments, infrastructure accounts for roughly two thirds of the impact, while equipment (including ICT, transport and machinery) accounts for about one third. This underlines the material intensity of construction and renovation in the health system.

Figure 10 – Annual material footprint of the health system by spending category (in kilotonne)



Source: VITO

Figure 11 – Annual material footprint of the health system by trigger product or service (in kilotonne)



Source: VITO

ANALYSIS BY TRIGGER PRODUCT OR SERVICE

Figure 11 and Figure 12 present the material footprint of the health system broken down by trigger product or service. Trigger products or services refer to the goods or services directly purchased by the healthcare sector that initiate upstream material extraction along supply chains in the input-output framework. This perspective complements the breakdown by spending category by identifying which types of goods and services directly initiate material use along global supply chains.

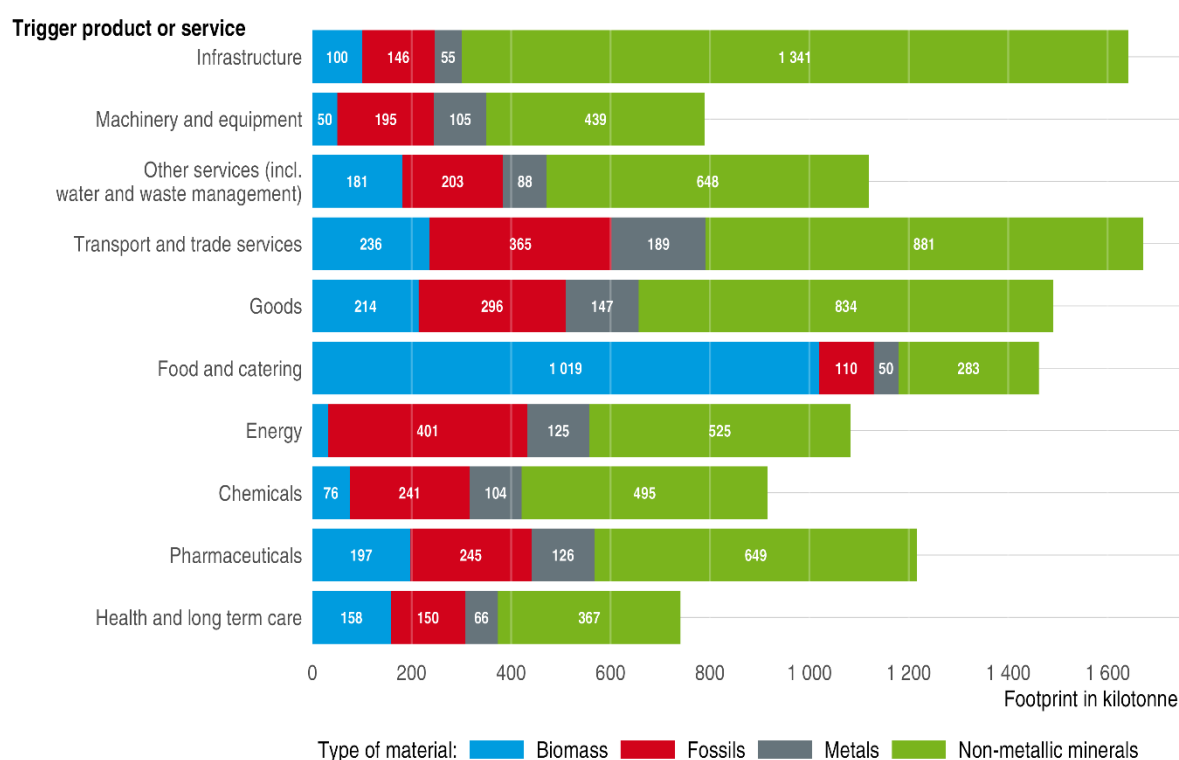
Figure 11 shows that the main contributors to the material footprint are infrastructure-related activities, goods, food and catering, transport and trade services, and pharmaceuticals, each accounting for shares consistently above 10% over the period 2012-2023. Over time, the most notable changes are a declining relative contribution of pharmaceuticals and an increasing contribution of infrastructure-related material use. The former appears to be linked to relatively limited growth in pharmaceutical spending between 2012 and 2020, resulting in a declining share within total healthcare expenditure. The latter is not explained solely by higher investment budgets (see Figure 10), but likely reflects current spending partly directed towards infrastructure-related goods and services.

These results highlight that a substantial share of the healthcare material footprint is driven not only by direct healthcare goods, such as pharmaceuticals and medical products, but also by enabling services,

including construction, transport, energy, food and supporting services, that underpin healthcare delivery.

Figure 12 provides a more detailed snapshot for 2022, illustrating how different trigger products and services are associated with distinct material profiles. Infrastructure and construction-related triggers are dominated by non-metallic minerals, reflecting the importance of construction materials such as concrete, or sand. Food and catering display high contributions from biomass. Fossil materials represent a large share of the material footprint for energy-related triggers, and to a lesser extent for transport and trade services, machinery and equipment, chemicals and pharmaceuticals. Other trigger categories show a more balanced mix of material types.

Figure 12 – Material footprint of the health system in 2022 broken down by trigger product or service and material type (in kilotonne)



Source: VITO

Note: No numeric labels are shown for material categories with values below 50 kilotonne.

STRUCTURE AND ORIGINS OF THE HEALTHCARE MATERIAL FOOTPRINT (2022)

Figure 13 presents the relative composition of the health system's material footprint in 2022, disaggregated by material type (A), spending category (B), trigger product or service (C), origin sector (D) and origin region (E).

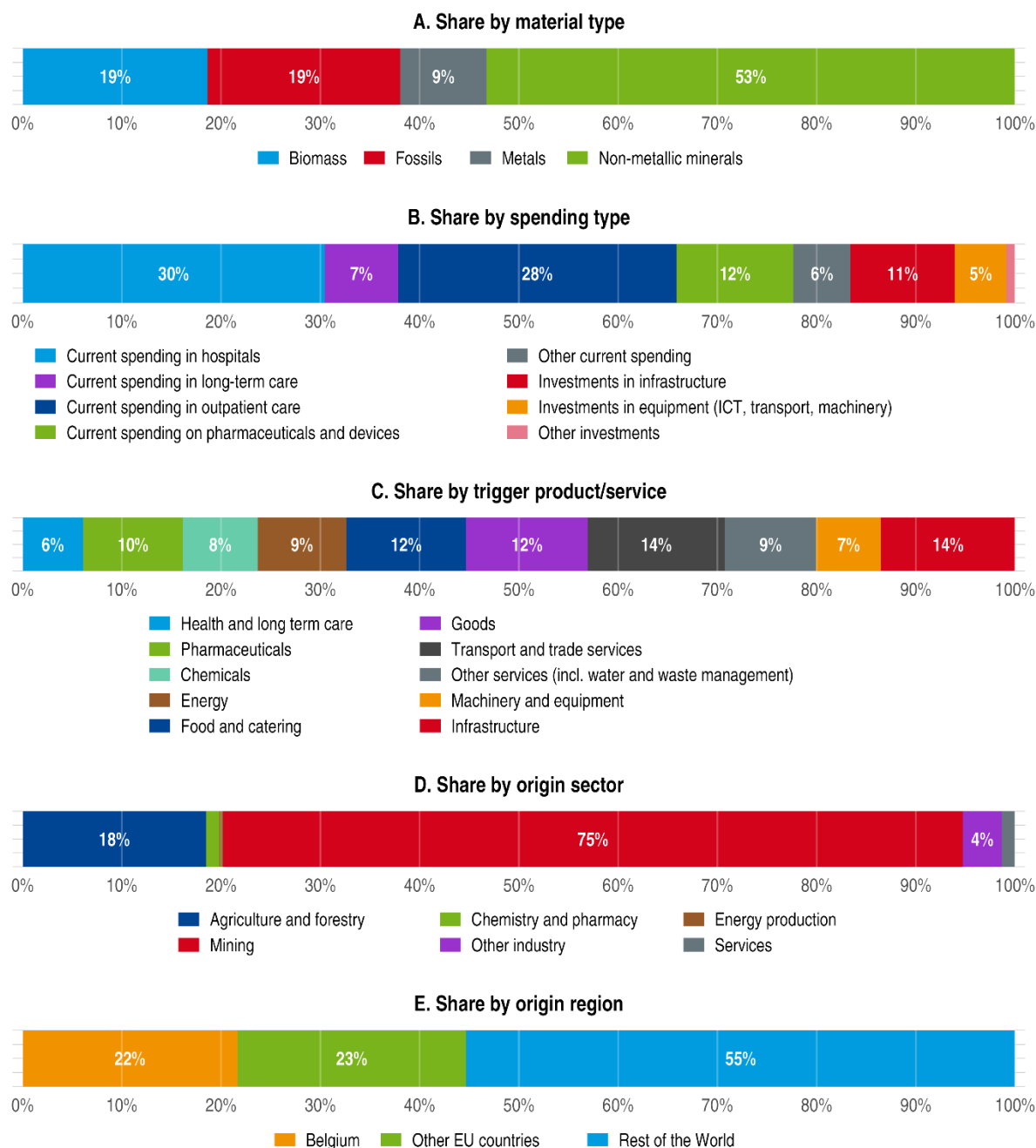
Panels A to C summarise patterns described in more detail above. In panel A, the material footprint is dominated by non-metallic minerals (53%), followed by biomass and fossil materials (each 19%), while metals account for a smaller share (9%). Panel B shows that current spending, in particular hospital and outpatient care, accounts for the majority of the footprint, with investments representing a smaller but relatively material-intensive share. Panel C confirms that the footprint is triggered not only by direct healthcare goods, such as pharmaceuticals and medical products, but also by enabling goods and services, including infrastructure, transport, energy, food and supporting services.

Panel D highlights the sectoral origin of material extraction underlying healthcare consumption. The footprint is overwhelmingly dominated by the mining sector, which accounts for approximately 75% of the total footprint in 2022, reflecting the importance of non-metallic minerals, metal ores and fossil

resources in healthcare supply chains. Agriculture and forestry contribute around 18%, mainly linked to biomass use, while other sectors play a minor role.

Panel E shows the geographical origin of material extraction. More than half of the healthcare material footprint (55% originates in the rest of the world, with other EU countries accounting for 23% and Belgium for 22%. This highlights the strong dependence of the health system on international supply chains for raw materials and intermediate goods, and illustrates that a substantial share of the environmental impact associated with Belgian healthcare consumption occurs outside national borders.

Figure 13 – Material footprint of the health system in 2022, relative shares by material type, spending category, trigger product or service, origin sector, and origin region



Source: VITO

Note: No numeric labels are shown for categories with shares below 2.5%.

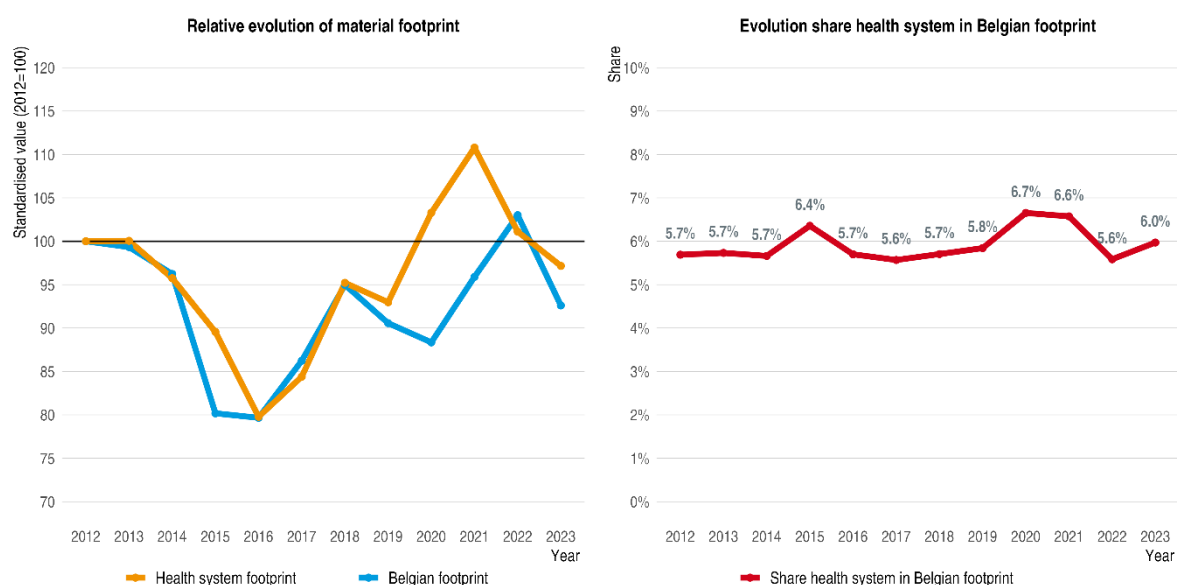
SHARE OF HEALTH SECTOR IN BELGIAN MATERIAL ENVIRONMENTAL FOOTPRINT

Figure 14 compares the relative evolution of the material footprint of the health system with that of the overall Belgian material footprint over the period 2012-2023 (left panel), with 2012 values standardised to 100, and shows the corresponding share of the health system in the Belgian material footprint (right panel).

The left panel indicates that both footprints follow a broadly similar trajectory, with a marked decline between 2012 and 2015 and even 2016 for the health system, followed by an increase between 2016 and 2018, which may partly reflect broader macroeconomic conditions including low interest rates that stimulated investment activity. During 2020-2021, a divergence emerges between the healthcare sector and the overall Belgian material footprint, associated with increased healthcare spending related to COVID-19, while other economic activities temporarily contracted. This was followed by a rebound in broader economic activity, with increased consumption and investment contributing to a peak in the Belgian material footprint in 2022. Subsequently, both footprints declined again, and by 2023 remained slightly below their 2012 levels, indicating that the reductions observed in the mid-2010s were not fully reversed.

The right panel shows that the share of the health system in the Belgian material footprint remains relatively stable over time, fluctuating within a narrow range of approximately 5.6% to 6.7%. A temporary increase is observed during 2020-2021, reflecting the comparatively stronger rise in healthcare-related material use during the pandemic.

Figure 14 – Relative evolution of the material footprint of the health system and Belgium since 2012 and evolution of the share of the health system in the Belgian material footprint



Source: VITO

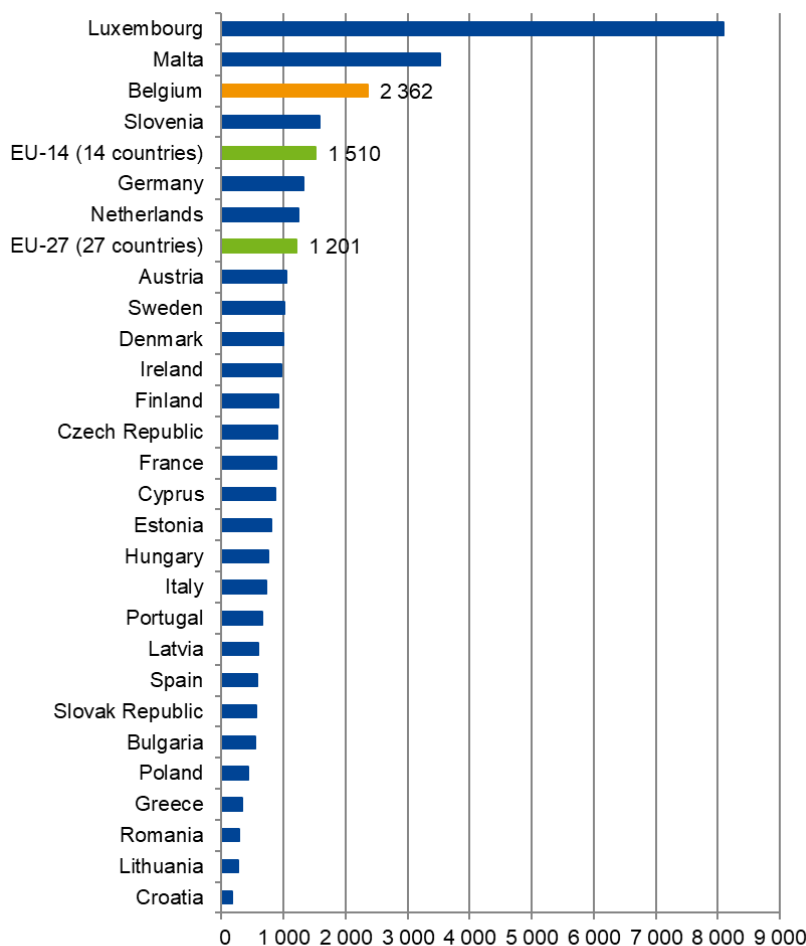
INTERNATIONAL COMPARISON

Figure 15 presents the material footprint of the healthcare sector across EU countries in 2015, expressed in kg per capita. The results are taken from Andrieu et al. (2023) and are based on the EXIOBASE EE-MRIO model (see technical definitions), which provides the most recent internationally comparable estimates available.⁷ The Belgian estimates are approximately 2.5 times higher than those obtained using FIGARO – particularly for metals and non-metallic minerals – and are therefore not directly comparable with the primary and secondary indicators reported above. These differences reflect variations in model structure, sectoral aggregation, data sources and underlying assumptions.

Substantial variation is observed between countries. Belgium records a material footprint of 2 362 kg per capita, which is above both the EU-27 average (1 201 kg) and the EU-14 average (1 510 kg²),

placing Belgium among the higher-impact countries. Higher per-capita values are observed in a limited number of countries, notably Luxembourg and Malta, while most other EU Member States show lower per capita material footprints for the healthcare sector.

Figure 15 – Material footprint of the healthcare sector in 2015, international comparison (in kg per capita)



Source: Andrieu et al (2023), data 2015

Material footprint in kg per capita

KEY POINTS

- **The material footprint of the Belgian health system is around 1 000 kg per capita.** It ranged from 1 084 kg per capita (11 998 kt) in 2012 to 1 042 kg per capita (12 131 kt) in 2022. Despite growth in healthcare output, the absolute footprint in 2012 and 2022 is of similar magnitude, resulting in a slightly lower per-capita footprint in 2022.
- **Short-term variability reflects investment cycles and the COVID-19 shock.** Substantial variability is observed over time, with a decline between 2012-2016 followed by an increase broadly mirroring trends in the wider economy and partly linked to favourable investment conditions. The material footprint peaked in 2021 due to COVID-related surges in activity, followed by a partial decline but the mid-2010s reductions were not fully reversed by 2023.
- **The healthcare sector accounts for a stable share of the Belgian material footprint.** Abstracting from the COVID-19 period, the material footprint of the health system evolves broadly in line with that of the wider economy. The health system accounted for approximately 5.6% to

6.7% of the Belgian material footprint. A temporary increase during 2020-2021 reflects the sharper rise in healthcare-related material use compared with other sectors during the pandemic.

- **Non-metallic minerals dominate the healthcare material footprint.** They account for more than half of total material use, they are particularly predominant in infrastructure. Biomass, mainly linked to food and catering, and fossil energy carriers, particularly linked to energy use, transport and pharmaceuticals, each account for around one fifth, while metals play a smaller but stable role.
- **Current spending accounts for the majority of material use, but investments are highly material-intensive.** Current spending accounts for around **80-85%** of the material footprint, with hospital and outpatient care together responsible for more than half. Investments represent only a minor share of total spending but contribute around **one fifth to one sixth** of the footprint, confirming their high material intensity.
- **Material use is driven not only by healthcare goods but also by enabling services.** Trigger analysis shows that infrastructure-related activities, goods, food and catering, transport and trade services, and pharmaceuticals are the main initiators of upstream material extraction. This highlights the importance of construction, logistics, energy, food and supporting services in healthcare's material footprint and underscores the need for material efficiency and circularity across the entire supply chain.
- **Healthcare material use is largely driven by global extraction outside Belgium.** Around three quarters of material extraction originates in mining and about one fifth in agriculture and forestry. Only 22% of the footprint occurs in Belgium, with more than half generated outside the EU, underscoring strong dependence on international supply chains.
- **Belgium shows a high healthcare material footprint in international comparison.** In 2015 (the latest available internationally comparable data), Belgium recorded 2 362kg per capita, well above the EU-averages (EU-27: 1 201 kg, EU-14: 1 510 kg). These results are based on a different EE-MRIO model (EXIOBASE) and are therefore not directly comparable with the main analysis ; they should be interpreted as indicative only, as no more recent comparable data were identified.

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1.4 Land use environmental footprint of the healthcare sector (ENV-3)

1.4.1 Documentation sheet

Description	Primary indicator: D. Annual land use environmental footprint of the healthcare sector, in m² per capita Secondary indicator(s): E. Annual land use environmental footprint of the healthcare sector, in million Pt per capita F. Annual land use environmental footprint of the healthcare sector, in km² G. Annual land use environmental footprint of the healthcare sector, as a share of total land use footprint
Rationale	Demand for healthcare is expected to continue increasing due to population ageing, expanding medical treatment options and rising expectations regarding access and quality of care.¹⁻³ This growth leads to higher demand for healthcare infrastructure, food provision in hospitals and care facilities, medical textiles, pharmaceuticals and other goods and services, all of which rely directly or indirectly on land resources at some stage. Land is a finite and scarce resource that serves multiple competing societal functions. Since the 1960s, growth in global population and consumption has substantially accelerated land use, pushing land systems further into a zone of increasing environmental risk.⁴ Today, around half of the world's ice- and desert-free land is used for agriculture, illustrating the scale of human pressure on terrestrial ecosystems.⁵ Land-use change and land occupation linked to biomass production are among the main drivers of biodiversity loss, soil degradation and ecosystem disruption.⁴⁻⁸ Converting natural ecosystems into cropland, pasture, forest plantations or built infrastructure alters soil properties (e.g. organic matter content and erosion rates), reduces habitat availability and degrades ecosystem services that are essential for environmental and human health.⁵⁻⁸ Recent assessments of planetary boundaries indicate that land-system change has exceeded the safe operating space, increasing risks to ecosystem stability and resilience.⁴ The healthcare sector contributes to land-use impacts through both direct and indirect pathways. Direct land occupation arises from healthcare infrastructure, including hospitals, care facilities and associated services. However, the dominant share of land-use impacts linked to healthcare occurs upstream, embedded in the production of goods and services consumed by the sector. In particular, food provision for patients, staff and visitors, as well as biomass-based inputs such as cotton for medical textiles, paper products, furniture, and packaging, rely on cropland, pasture and forest land.^{8, 9} The land-use environmental footprint captures the amount of land required – domestically and abroad – and used directly and indirectly to satisfy healthcare demand. This perspective is particularly relevant for healthcare, as a large share of its environmental impacts occurs along international supply chains rather than at the point of care delivery.¹⁰⁻¹² Land use is closely interconnected with other environmental impact categories. Agricultural land use contributes to nutrient losses, water abstraction and chemical pollution, while deforestation and land conversion affect carbon stocks and climate regulation.⁴⁻⁹ As a result, measures aimed at reducing environmental impacts in healthcare – such as replacing fossil-based materials with bio-based alternatives – may unintentionally increase land-use pressures if assessed in isolation. This underlines the importance of explicitly measuring land use as part of a multi-category environmental footprint. Circular economy strategies can help reduce land-use pressures by maintaining material value for longer, limiting demand for new biomass extraction and improving supply resilience (see also ENV-3).¹³ In addition, dietary shifts towards more plant-based food provision have been shown to substantially reduce land requirements, as plant-based



	foods generally require far less land per unit of nutrition than animal-based products. ^{14, 15}
Calculation	Land use footprint was calculated by VITO (see methodological note) Primary indicator (A): • Numerator: Annual land use footprint of the healthcare sector, in km² • Denominator: Population of the corresponding year (calculated as mean of population at beginning and end of year) Indicator B: • Numerator: Annual land use footprint of the healthcare sector, in km² • Denominator: / Indicator C: • Numerator: Annual land use footprint of the healthcare sector, in km² • Denominator: Annual land use footprint over all sectors, in km²
Data source	Environmental footprints were calculated by VITO using an Environmentally Extended Multi-Regional Input-Output (EE-MRIO) approach (see methodological note). Longitudinal results are reported for the period 2010-2023, while the cross-sectional structural decomposition is presented for 2022. Environmental impact data for 2023 were not yet available; therefore, preliminary estimates for that year were derived by combining 2022 environmental intensities with 2023 monetary data. As no adjustment for inflation was applied, these preliminary 2023 estimates are likely to overstate environmental impacts. Consequently, 2022 is considered the last year with fully reliable data and is used as the reference year in the interpretation and discussion of results. Population data from Eurostat.¹⁶
Technical definitions	See methodological note Land use can be expressed either in km², representing the physical surface area, or in points (Pt), a normalized and weighted indicator used in European Environmental Footprint models. In this approach, land-use impacts on ecosystems (e.g. biodiversity and ecosystem quality) are normalized against a reference such as the annual environmental impact of an average EU citizen, making the result dimensionless, and then weighted based on expert judgment and policy relevance.^{17, 18}
International comparability	Given substantial differences in methodologies, data sources and underlying assumptions, international comparisons should be interpreted with caution and preferably limited to results derived from the same modelling framework. Andrieu et al. (2023) provide internationally comparable estimates of the land use footprint of the healthcare sector for the year 2015 (see above in technical definitions).⁷ The methodology applied in this study differs from the approach used for the primary and secondary indicators presented here, and results are therefore not directly comparable.
Limitations	See methodological note
Dimension	Environmental sustainability
Related indicators	ENV-1 GHG environmental footprint of the healthcare sector ENV-2 Material environmental footprint of the healthcare sector ENV-13 Annual food waste in hospitals and residential care ENV-16 Annual water consumption in healthcare sector
Supervisor	Nicolas Bouckaert
Reviewer	Pieter Fonteyn (VITO)

1.4.2 Results

BELGIUM

Table 10 and Figure 16 present the annual land use footprint of the health system over the period 2012-2023, expressed using four complementary metrics: land occupation per capita (m^2 per capita), total land occupation (km^2), land-use impact weighted by soil quality (Pt per capita), and total land-use impact (billion Pt). Results are further disaggregated by current spending versus investments.

The total land-use footprint declined from 0.54 m^2 per capita in 2012 (6 007 km^2) to 0.48 m^2 per capita in 2022 (5 587 km^2). Over the period 2012-2018, land use showed considerable variability, with higher values in 2015 and 2018 and lower values in the intervening years, ranging between 0.47 and 0.56 m^2 per capita. From 2018 onwards, land use gradually declined, reaching its lowest level at the end of the period. Overall, the land-use footprint in 2022 is lower than in 2012, indicating a modest reduction in land occupation per capita. No COVID-related peak is observed, reflecting the specific scope of this indicator.

When accounting for land-use quality, expressed in points (Pt) reflecting impacts on soil quality due to land occupation and transformation, similar patterns emerge. The land-use impact ranged from 18.42 thousand Pt per capita (204 billion Pt) in 2012 to 16.74 thousand Pt per capita (195 billion Pt) in 2022, with higher levels observed in 2015 and 2018.

Across all metrics, current spending accounts for the majority of the land-use footprint, reflecting the structurally recurring demand for food provision and other biomass-based products and services embedded in healthcare delivery. Investments represent a smaller share and show a marked decline over time. Between 2012 and 2022, the absolute reduction in the land-use footprint of investments (-319 km^2) exceeds that of current spending (-101 km^2), while per capita land use associated with investments decreased by around 40%.



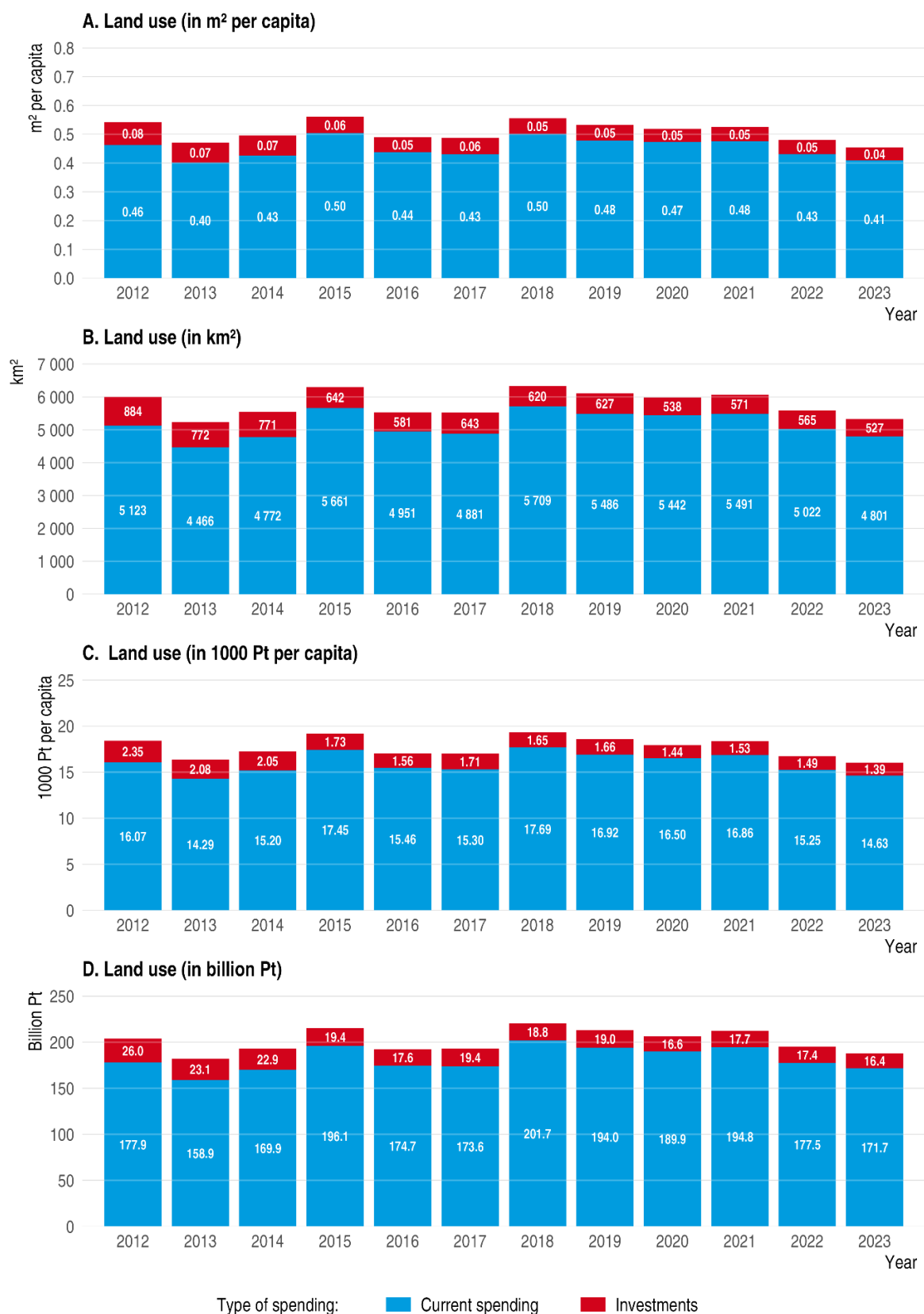
Table 10 – Annual land use footprint of the health system (in m² per capita, km², 1000 Pt per capita, billion Pt)

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	(2023*)
Results by surface												
in m ² per capita	0.54	0.47	0.50	0.56	0.49	0.49	0.55	0.53	0.52	0.52	0.48	0.45
in km ²	6 007	5 238	5 543	6 303	5 532	5 524	6 329	6 113	5 980	6 062	5 587	5 328
Results by surface quality												
in 1000 Pt per capita	18.42	16.36	17.25	19.17	17.02	17.01	19.33	18.58	17.94	18.39	16.74	16.03
In billion Pt	203.8	182.1	192.8	215.5	192.3	193.0	220.5	213.0	206.5	212.5	194.9	188.0

Source: VITO

* 2023 results are preliminary and likely overestimated, as they are based on 2022 environmental intensities combined with 2023 monetary data without inflation adjustment. (see methodological note).

Figure 16 – Annual land use footprint of the health system by investment versus current spending (in m² per capita, km², 1000 Pt per capita, billion Pt)



Source: VITO, Eurostat

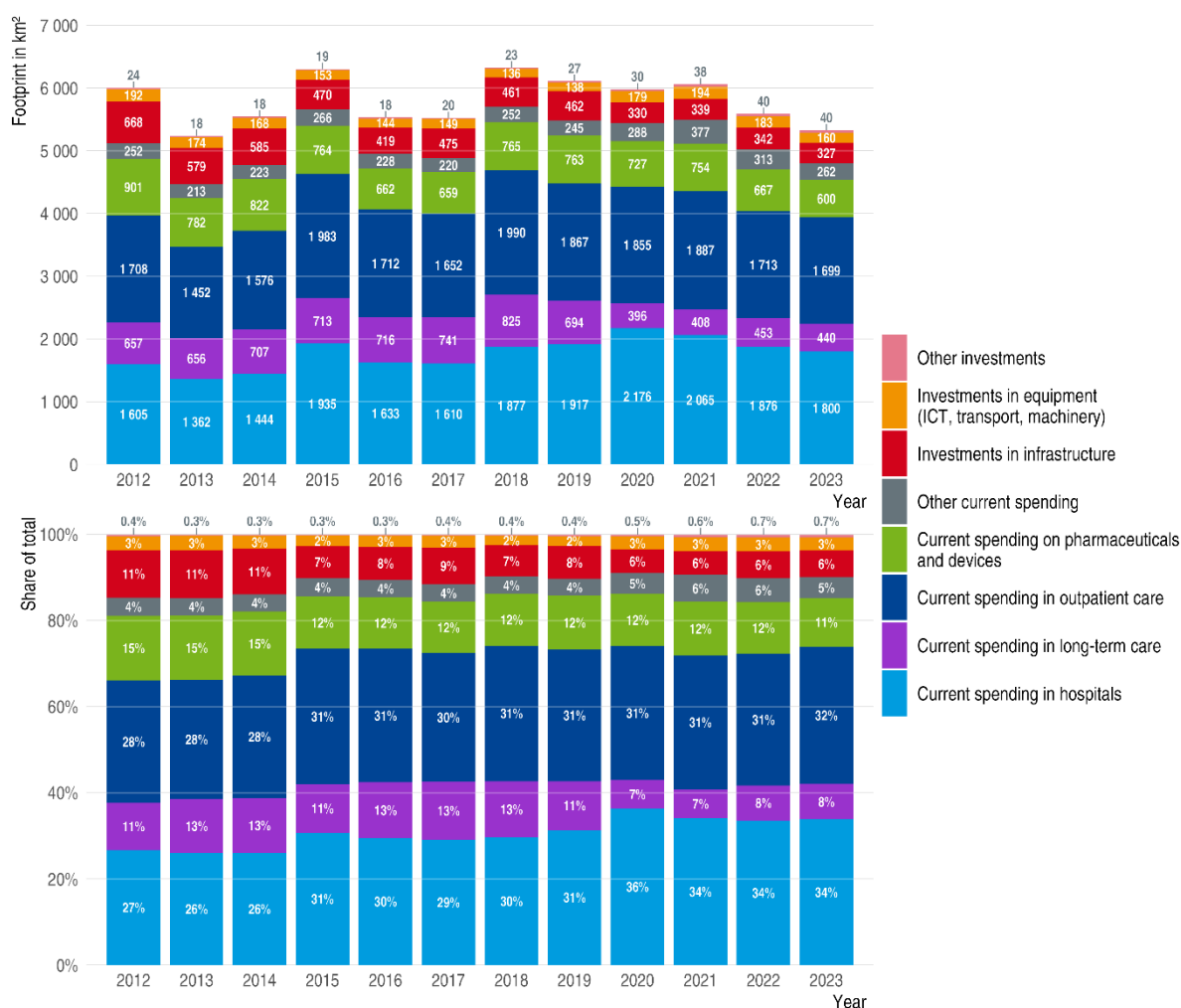


ANALYSIS BY SPENDING CATEGORY

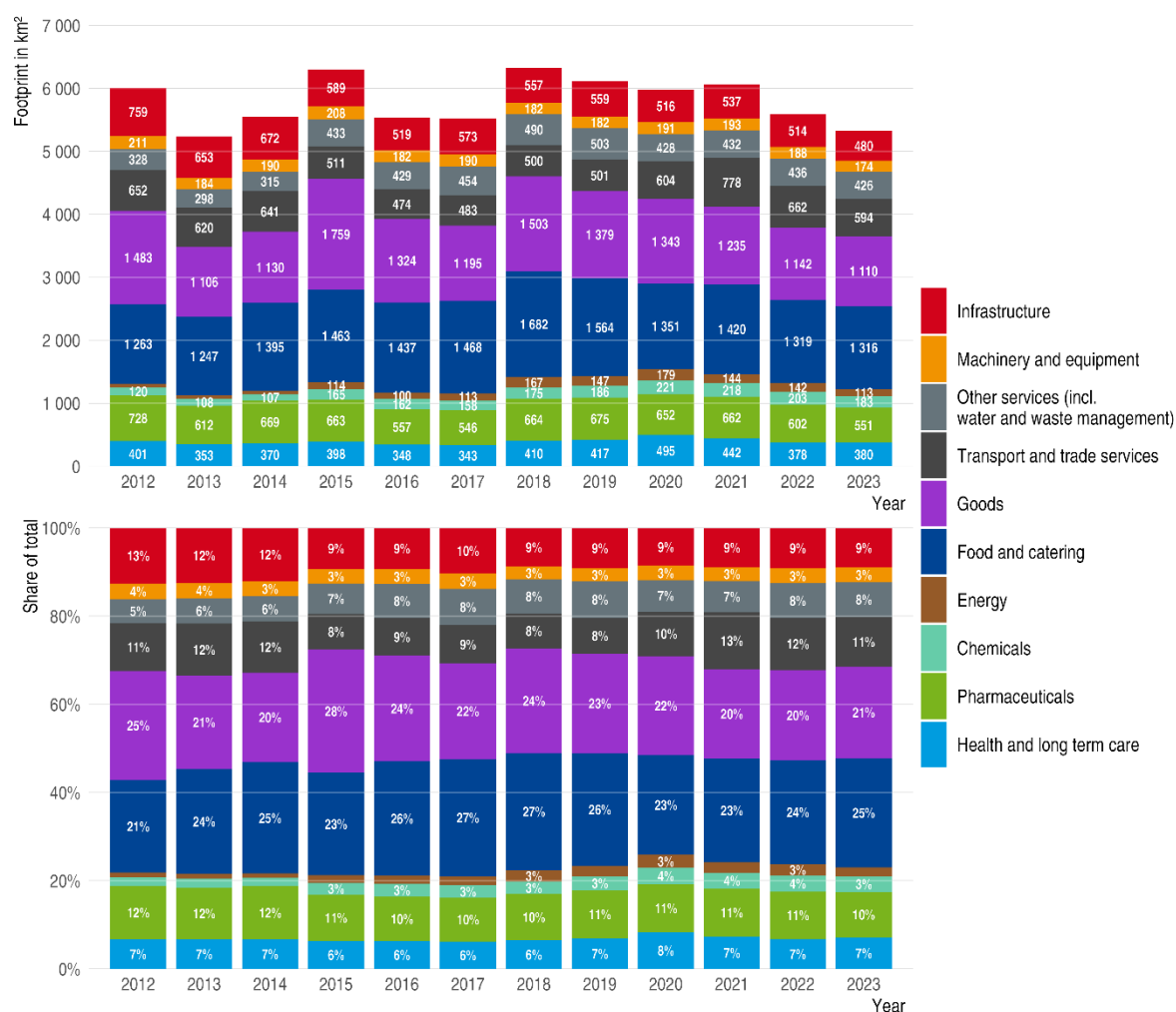
Figure 17 presents the annual land use footprint of the health system over the period 2012-2023, disaggregated by current spending categories and investment types, and shown both in absolute terms (km²) and as shares of the total footprint. The figure illustrates where land use demand is generated within the health system. As also shown in Figure 16, current spending dominates land use in all years, accounting for approximately 85-90% of the total footprint. Within current spending, hospital care and outpatient care are the largest contributors and together consistently represent around 55-65% of total land use, with their share increasing over time. Long-term care and pharmaceuticals and medical devices contribute smaller and declining shares, generally in the range of 7-13% and 11-15%, respectively, while other current spending remains marginal. Investments account for a smaller share of land use, typically 10-15%, with infrastructure responsible for roughly two thirds of the investment-related footprint and equipment (including ICT, transport and machinery) for about one third.

Higher total land use in 2015 and 2018 coincides with increased environmental impact in hospital and outpatient care. Although no COVID-related peak is observed in absolute land use, a shift in relative shares towards hospital and outpatient care is apparent, reflecting changes in budget allocation during the pandemic.

Figure 17 – Annual land use footprint of the health system by spending category (in km²)



Source: VITO

Figure 18 – Annual land use footprint of the health system by trigger product or service (in km²)

Source: VITO

Note: No numeric labels are shown for categories with values below 100 km² or 2.5%.

ANALYSIS BY TRIGGER PRODUCT OR SERVICE

Figure 18 presents the annual land use footprint of the health system by trigger product or service over the period 2012-2023, expressed in km² and relative shares. Trigger products or services refer to the goods or services directly purchased by the healthcare sector that initiate upstream land use along supply chains in the input-output framework. This perspective complements the breakdown by spending category by identifying which types of products and services directly initiate land use along global supply chains.

Land use is dominated by goods and food and catering, each accounting for approximately 20-25% of the total footprint. Food and catering is a major contributor due to the land-intensive nature of agricultural production embedded in healthcare-related food provision. Other relevant contributors include pharmaceuticals, transport and trade services, and infrastructure-related activities, each accounting for around 10% of the total footprint. By contrast, energy and chemicals represent only minor shares.

Overall, the figure shows that healthcare-related land use is driven largely by enabling goods and services, such as infrastructure, transport, food and other supporting goods and services that underpin healthcare delivery, rather than by direct healthcare products, such as pharmaceuticals and medical products.



STRUCTURE AND ORIGINS OF THE HEALTHCARE LAND USE FOOTPRINT (2022)

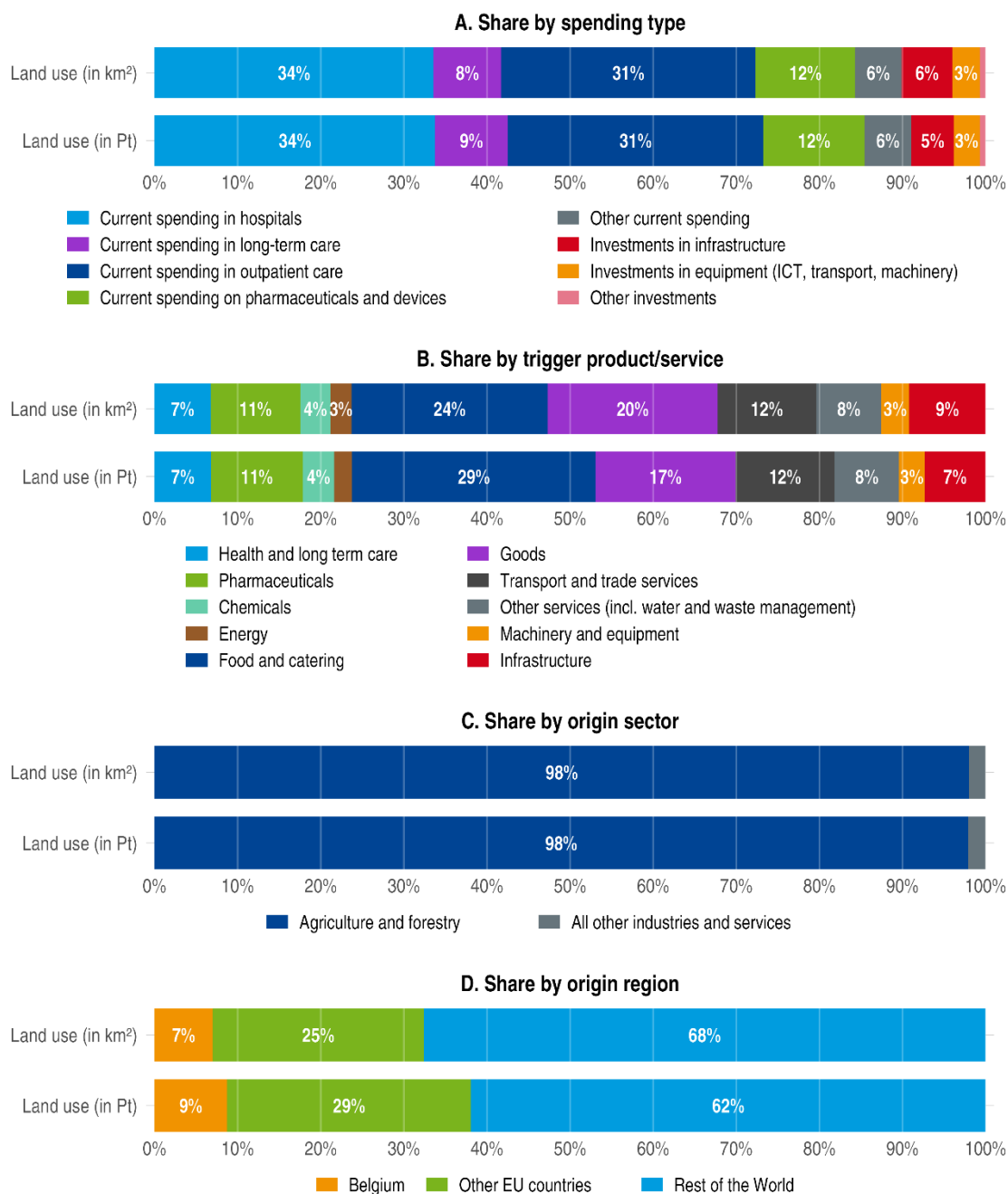
Figure 19 presents the relative composition of the land use footprint of the health system in 2022, expressed both in surface area (km²) and surface-quality-weighted impacts (Pt), and disaggregated by spending category (A), trigger product or service (B), origin sector (C) and origin region (D).

Panels A and B summarise patterns described in more detail above. Panel A shows that current spending, in particular hospital and outpatient care, accounts for the majority of the footprint, while investments represent a smaller share. Panel B indicates that, in terms of trigger products and services, land use is mainly driven by food and catering and goods, reflecting the land-intensive nature of agricultural production embedded in healthcare supply chains. Pharmaceuticals and transport and trade services also account for shares above 10%. Some notable differences emerge between results expressed in km² and in Pt, with quality-adjusted results assigning relatively more weight to food-related land use and less to goods and infrastructure.

Panel C shows that land use associated with healthcare consumption is almost entirely attributable to agriculture and forestry, which account for approximately 98% of total land occupation in both km² and Pt. This underscores that healthcare-related land use is overwhelmingly driven by biomass production.

Panel D highlights the geographical origin of land use. Land use is primarily driven by agricultural land occupation outside national borders. In terms of surface area, around two thirds (68%) of land use occurs in the rest of the world, with 25% in other EU countries and 7% in Belgium. When weighted by surface quality (Pt), the share of land use occurring in Belgium and the EU increases slightly, while the share attributed to the rest of the world decreases to around 62%. This indicates that land use within Europe is, on average, associated with higher impacts on soil quality per unit of area.

Figure 19 – Land use footprint of the health system in 2022, relative shares by spending category, trigger product or service, origin sector, and origin region (in surface area and weighted by surface quality)



Source: VITO

Note: No numeric labels are shown for categories with shares below 2.5%.

SHARE OF HEALTH SECTOR IN BELGIAN LAND USE ENVIRONMENTAL FOOTPRINT

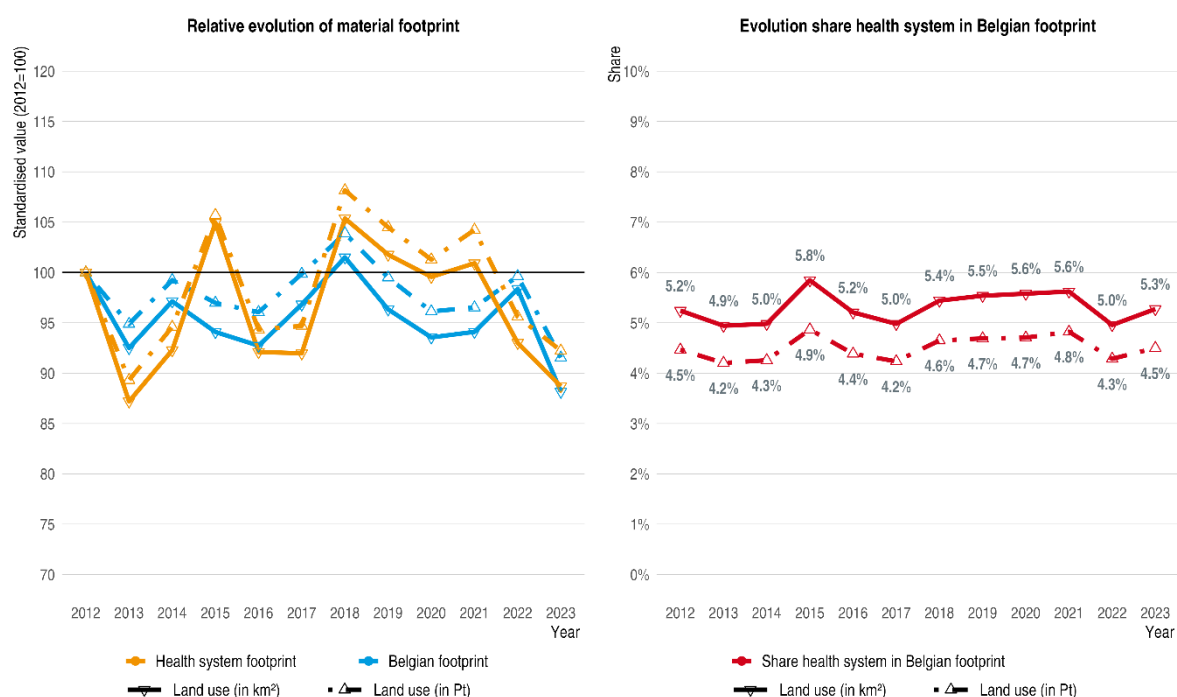
Figure 20 compares the relative evolution of the land use footprint of the health system with that of the overall Belgian land use footprint over the period 2012-2023 (left panel), with 2012 values standardised to 100, and shows the corresponding share of the health system in the Belgian land use footprint (right panel), expressed both in km² and surface-quality-weighted impacts (Pt).

The left panel shows that the land use footprint of the health system broadly follows the same trajectory as the overall Belgian footprint. After a period of fluctuation between 2012 and 2018, land use declined

gradually for both. Two notable divergences can be observed: a relative peak in healthcare-related land use in 2015, and a peak in overall Belgian land use in 2022, linked to the post-COVID rebound in consumption. No clear COVID-related surge is observed for healthcare land use, reflecting the limited impact of the pandemic on food provision and other biomass-intensive activities within the health system. Trends based on surface area and quality-weighted impacts are similar, although quality-weighted values are consistently higher, suggesting that reductions in land use over time occurred relatively more on land with lower soil-quality impacts.

The right panel shows that the share of the health system in the Belgian land use footprint remains relatively stable over time. Healthcare accounts for approximately 4.9-5.8% of total land use when expressed in km², while its share is substantially lower, around 4.2-4.9%, when weighted by surface quality. This suggests that healthcare-related land use is, on average, associated with somewhat lower soil-quality impacts than land use in the broader economy.

Figure 20 – Relative evolution of the land use footprint of the health system and Belgium since 2012 and evolution of the share of the health system in the Belgian land use footprint



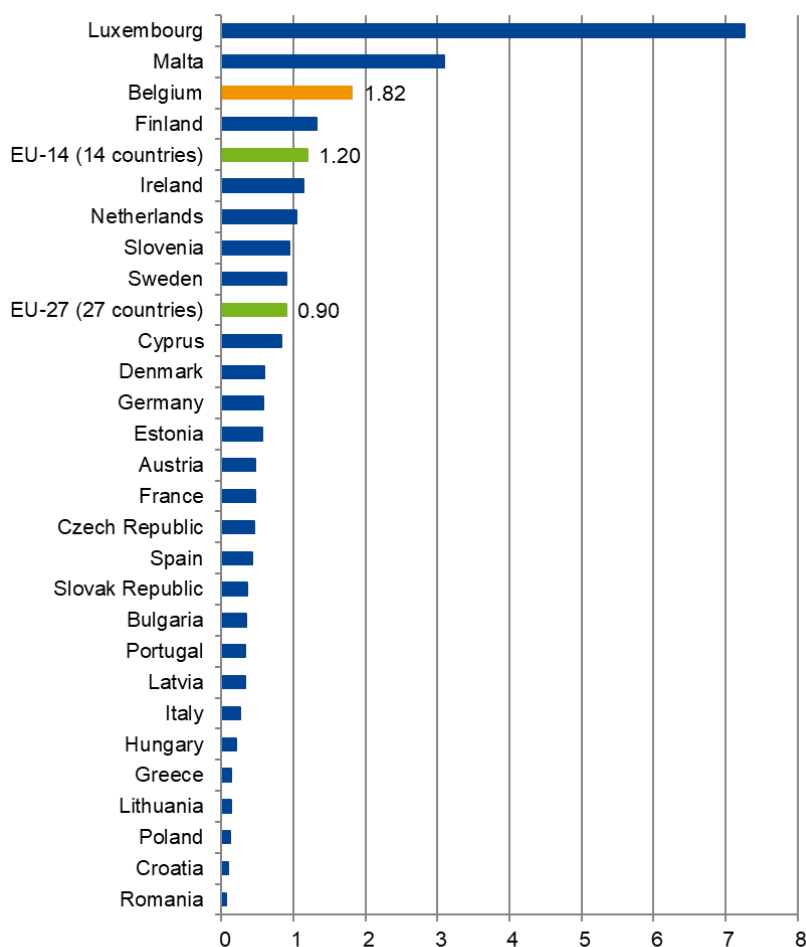
Source: VITO

INTERNATIONAL COMPARISON

Figure 21 presents an international comparison of the land-use footprint of the healthcare sector in 2015, expressed in m² per capita. The results are taken from Andrieu et al. (2023) and are based on the EXIOBASE EE-MRIO model (see technical definitions), which provides the most recent internationally comparable estimates available.¹⁹ The Belgian estimates are approximately 3 times higher than those obtained using FIGARO – particularly for metals and non-metallic minerals – and are therefore not directly comparable with the primary and secondary indicators reported above. These differences reflect variations in model structure, sectoral aggregation, data sources and underlying assumptions.

Substantial variation is observed across EU countries. Belgium records a land-use footprint of 1.82 m² per capita, which is above the EU-27 average (0.90 m²) and the EU-14 average (1.20 m²), placing Belgium among the higher-impact countries. Only a limited number of countries, notably Luxembourg and Malta, show higher per-capita values, while most EU Member States display considerably lower land-use footprints for the healthcare sector.

Figure 21 – Land use footprint of the healthcare sector in 2015, international comparison (in m² per capita)



Source: Andrieu et al (2023), data 2015

Land use footprint in m² per capita

KEY POINTS

- **The land use footprint of the health system declined modestly over time.** Between 2012 and 2022, land use decreased from 0.54 to 0.48 m² per capita (from 6 007 to 5 587 km²). Fluctuations occurred between 2012 and 2018, with peaks in 2015 and 2018, followed by a gradual decline. No COVID-related peak is observed, reflecting the structurally biomass-driven nature of this indicator.
- **Healthcare represents a stable share of Belgium's land use footprint.** The health system accounts for around 4.9-5.8% of total Belgian land use in surface area terms and drops to 4.2-4.9% when weighted by soil-quality impacts. This indicates that healthcare-related land use is, on average, associated with somewhat lower soil-quality impacts than land use in the broader economy.
- **Current spending dominates land use, while investment-related land use declined strongly.** Current spending consistently represents 85-90% of the land use footprint, driven by recurring demand for food and other biomass-based goods. Hospital and outpatient care together account for 55-65% of total healthcare-related land use and increased over time. Investments represent 10-15% but declined sharply, with per capita land use falling by around 40% between 2012 and 2022.
- **Land use is mainly driven by enabling goods and services that support healthcare delivery, rather than by direct healthcare products.** Food and catering and goods each account for 20-

25% of land use, while pharmaceuticals, transport and trade services, and infrastructure-related activities each contribute around 10%. Quality-weighted results assign relatively more weight to food-related land use and less to goods and infrastructure.

- **Land use is primarily driven by agricultural land occupation abroad.** Around 98% of land use originates in agriculture and forestry, highlighting the dominance of biomass production. Approximately two thirds of land use occurs outside the EU, while only 7% takes place in Belgium, underscoring reliance on global supply chains.
- **Belgium has a relatively high healthcare land-use footprint in international comparison.** Using the latest available internationally comparable data (2015), Belgium records a land-use footprint of 1.82 m² per capita, well above the EU-averages (EU-27: 0.90 m², EU-14: 1.20 m²), placing it among the higher-impact countries. These figures are based on the EXIOBASE EE-MRIO model and are therefore not directly comparable with the main analysis; they should be interpreted as indicative only, as no more recent comparable data were identified.

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2 AIR EMISSIONS

2.1 Annual direct GHG emissions (scope 1) in the healthcare sector (on-site fuel combustion and healthcare fleet) - production perspective (ENV-4)

2.1.1 Documentation sheet

Description	Primary indicator: A. Annual direct GHG emissions in the healthcare sector (human health activities Q-86), in kg per capita (production perspective) Secondary indicators: B. Annual direct GHG emissions in the healthcare sector, in tonnes C. Annual direct GHG emissions in the healthcare sector, as a share of total direct GHG emissions
Rationale	The aim of this indicator is to focus on direct GHG emissions (scope 1) in the healthcare sector, so GHG emissions from on-site combustion of fossil fuels (e.g. fuel used in hospital boilers) or from the operation of the healthcare fleet. Greenhouse gases have a strong ability to absorb thermal radiation, and an increase in their concentration in the atmosphere leads to a rise in temperature. A decrease in direct GHG emissions means a higher contribution to climate change mitigation. This can help identify area of improvements such as the need to switch to cleaner energy sources, to better isolate buildings or to promote the use of green vehicles. In concertation with experts, it was decided to focus on the production perspective rather than the consumer perspective because this perspective is more transparent, has longer time series, and is based on more recent data. The difference between both perspectives in terms of results is minimum.
Calculation	Calculation are done by the Federal Planning Bureau for Eurostat based on regional and national emission inventories, an activity model and emission factors (activity data * emission factor) using NACE classification. Primary indicator (A): - Numerator: Annual direct GHG emissions in healthcare sector (Q86 – human health activities), in kg - Denominator: Population of the corresponding year (calculated as mean of population at beginning and end of year) Indicator B: - Numerator: Annual direct GHG emissions in healthcare sector (Q86 – human health activities), in tonnes - Denominator: / Indicator C: - Numerator: Annual direct GHG emissions in healthcare sector (Q86 – human health activities), in tonnes - Denominator: Annual direct GHG emissions in total (all NACE activities)
Data source	Federal Planning Bureau (plan.be) and Eurostat: Air emissions accounts by NACE Rev. 2 activity [env_ac_ainah_r2_custom_19043223] ¹ (Last update of data: 28/11/2025 23:00). Comparison with data updated on 13/12/2024 was also done. Eurostat data were also compared with the following sources: NEHAP² (see indicator ENV-1 for a description of this model) and VITO (see the methodological note linked to indicators ENV-1, ENV-2 and ENV-3 for a description of this model). For VITO, it should be noted that Eurostat data released in 2023 were used.
Technical definitions	Air Emissions Accounts record the flows of residual gaseous and particulate materials emitted by resident units (=economic activities) and flowing into the atmosphere. Natural flows of residual gaseous and particulate materials are excluded e.g. volcanos, forest

	fires. Also excluded are air emissions arising from land use, land use changes and forestry as well as any indirect emissions. - To calculate GHG emissions, the following formula was applied: carbon dioxide (CO₂) + 265 x nitrous oxide (N₂O) + 28 x methane (CH₄)³ + fluorinated gases (i.e. hydrofluorocarbons (HFC), perfluorocarbons (PFC), sulphur hexafluoride (SF₆) and natrium trifluoride (NF₃)) expressed in CO₂ equivalents. CO₂ emissions related to biofuel consumption are not included in the total CO₂ emissions. Therefore, they are not accounted for in the calculation of GHG emissions. - The healthcare sector was identified via the statistical classification of economic activities in the European Community (NACE Rev. 2): Human health activities (Q86) (excluding residential care). - The indicator includes the emissions of greenhouse gases by production activities. It excludes emissions by households for transportation and other purposes. - For the calculation per capita, the average population of the reference year (calculated as the arithmetic mean of the population on 1st January of two consecutive years) is used as denominator. - More details on the methodology: https://ec.europa.eu/eurostat/web/environment/methodology³
International comparability	Statistical Classification of Economic Activities in the European Community (NACE) https://ec.europa.eu/eurostat/web/nace/overview allows European comparison. For a description of NACE-Bel, see: https://statbel.fgov.be/sites/default/files/Over_Statbel_FR/Nomenclaturen/NACE-BEL%202008_FR.pdf (pp. 465-474)⁴ However, comparability between country is not guaranteed. Differences in the allocation of road transport emissions to NACE activities across countries can for example have a noticeable effect and may affect cross-country comparability. A study performed by Eurostat has showed important variations between countries regarding the share of CO₂ emissions from road transport by economic activity, with coefficients of variance greater than 40% for each of the NACE activities, suggesting that the comparability across countries is most likely not given.⁵
Limitations	The data come from a model based on activity, not on measurements. Residential care activities and social work activities without accommodation (Q87–Q88) were aggregated, making it impossible to isolate data for Q87 alone. Consequently, only human health activities (Q86) are considered as a proxy for the health care system, while residential care activities were excluded. Differences with other EU countries and jumps observed in data (in 2015 and 2021) can partly be explain by methodological factors: - Since 2021, Wallonia has applied a new and more accurate method to estimate energy consumption (more especially natural gases), based on data directly obtained from distribution network operators (as already implemented in Brussels and Flanders before 2021). Nevertheless, previous years were not retroactively modified, which can partly explain a jump in data in 2021 in Wallonia. - Emissions from road transport data⁴ (total quantities emitted) are based on national/regional emissions inventories and the COPERT 5 model and allocation keys among NACE sectors vary between countries. In Belgium the allocation key is based on excise duties for Eurostat 2025 data, whereas previous estimates (e.g. 2024 data) relied

³ Global warming potential (GWP) values from the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (IPCC) were used (<https://ghgprotocol.org/sites/default/files/2024-08/Global-Warming-Potential-Values%20%28August%202024%29.pdf>)

⁴ Other emissions (non-vehicle fuel emissions) are based on the emission inventories of the regions and the federal level (CRF/CRT, LRTAP, fluorinated gas inventories, etc.). Some of these data can be directly attributed to sector Q86, while others are broader aggregates that are then allocated across NACE branches based on a distribution key derived from the energy consumption of the different branches.

	on vehicle registrations. Excise duties are considered more reliable; however, this new approach appears to have an important impact for Q86 emissions: GHG emissions in human health activities in Eurostat version released in 2024 are quite stable across the years while an important increase is observed in Eurostat version released in 2025 (see details in “data sources comparison”). Excise duties are calculated on a five-year basis (2010, 2015, 2020) using an “structural survey” of the National Bank of Belgium while intermediate years are based on less detailed surveys and extrapolations. As 2014 is based on an extrapolation of 2010 data, a jump in excise data is observed in 2015, which can partly explain the 2015 jump in GHG emissions.
Dimension	Environmental sustainability
Related indicators	ENV-1 GHG emission footprint in the healthcare sector, ENV-8 Annual fossil energy consumption in the healthcare sector
Supervisor	Sophie Gerkens
Reviewers	Jehan Charlier

2.1.2 Results

BELGIUM

In 2023, human health activities (Q86) generated direct greenhouse gas emissions (GHG) of 1 296 864.17 tonnes of CO₂ equivalents (see Table 11).

While direct GHG emissions from all economic activities decreased between 2012 and 2023, from 95.3 to 79.8 million tonnes of CO₂ eq, the trend for human health activities increased, and almost doubled (see Figure 22 and Table 11). Consequently, the share of direct GHG emissions from human health activities within total emissions from all economic activities increased (see Table 11).

However, it is important to note that Belgium changed its methodology (with retroactive adjustments) and based on the previous methodology, direct GHG emissions in human health activities were more stable (585 202 t CO₂ eq in 2012 and 586 578 t CO₂ eq in 2022, +0.2%).

ANALYSIS BY TYPE OF GAS

Regarding human health activities, CO₂ is the dominant greenhouse gas, representing 96.9% of total emissions in 2023. Furthermore, CO₂ emissions have risen sharply, increasing by 84% between 2012 and 2023. These emissions result from on-site combustion of fossil fuels (e.g., fuel used in hospital boilers) and the operation of the healthcare fleet⁵. However, it is currently challenging to determine which source has the greatest impact. Starting mid-2026, CO₂ emissions from road transport will be reported separately, enabling a more accurate assessment of the contribution of the healthcare fleet to the healthcare system's GHG emissions. It should also be noted that in the report of the NEHAP 2025² vehicles fuel use represented 25% of direct emissions (see ENV-1) but this seems to be based on the previous Eurostat method, in which road transports were estimated based on the number of vehicle registrations rather than excise duties (see also the analysis by sources and the limitations in the documentation sheet).

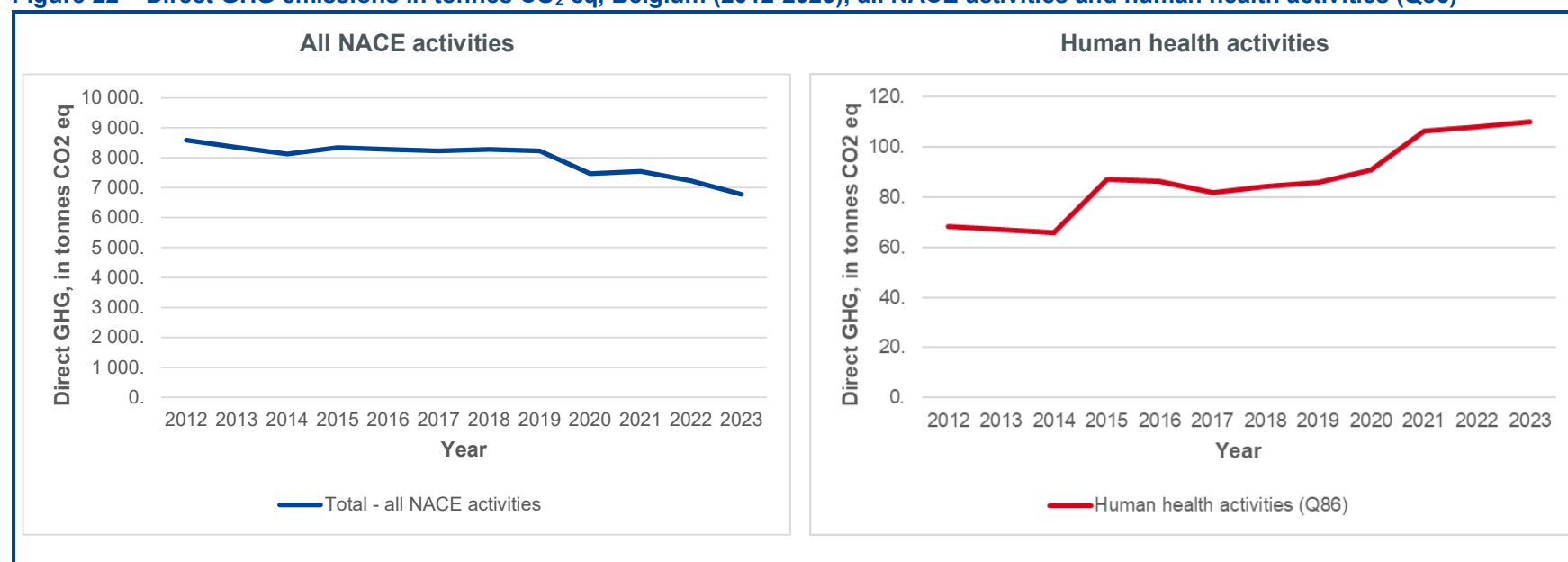
Nitrous oxide (N₂O) also plays a role in human health activities, but the impact was smaller (2.8% of GHG emissions in 2023) and emissions from this gas decreased between 2012 and 2023 (-50%). Other gases accounted for less than 0.3%.

⁵ Including ambulance, nursing home cars and other company cars

Table 11 – Annual direct GHG emissions in human health activities (Q86), Belgium (2012-2024)

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	(2024*)
<i>Annual direct GHG emissions in human health activities (Q86)</i>													
<i>In kg CO₂ eq per capita</i>	68.45	67.21	66.07	87.20	86.26	81.69	84.36	85.91	90.87	106.43	108.02	110.09	(111.18)
<i>In tonnes CO₂ eq</i>	760 311	749 968	740 541	983 159	977 493	929 259	963 936	987 027	1 048 481	1 233 168	1 261 652	1 296 864	(1 318 465)
<i>As a share of total direct GHG emissions (%)</i>	0.80%	0.81%	0.81%	1.05%	1.04%	0.99%	1.02%	1.04%	1.22%	1.41%	1.49%	1.62%	(1.63%)

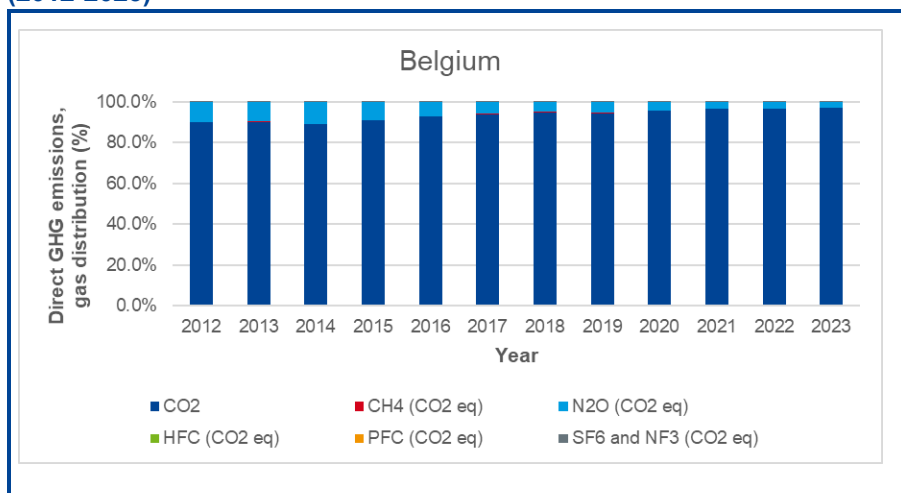
* First estimates. Source: Eurostat 2025 (Air Emissions Accounts)

Figure 22 – Direct GHG emissions in tonnes CO₂ eq, Belgium (2012-2023), all NACE activities and human health activities (Q86)

Eurostat 2025 (Air Emissions Accounts)



Figure 23 – Direct GHG emissions in human health activities (Q86), gas distribution, Belgium (2012-2023)



Eurostat 2025 (Air Emissions Accounts)

Table 12 – Direct GHG emissions in tonnes CO₂ eq by gas, percentage change between 2012 and 2023, Belgium

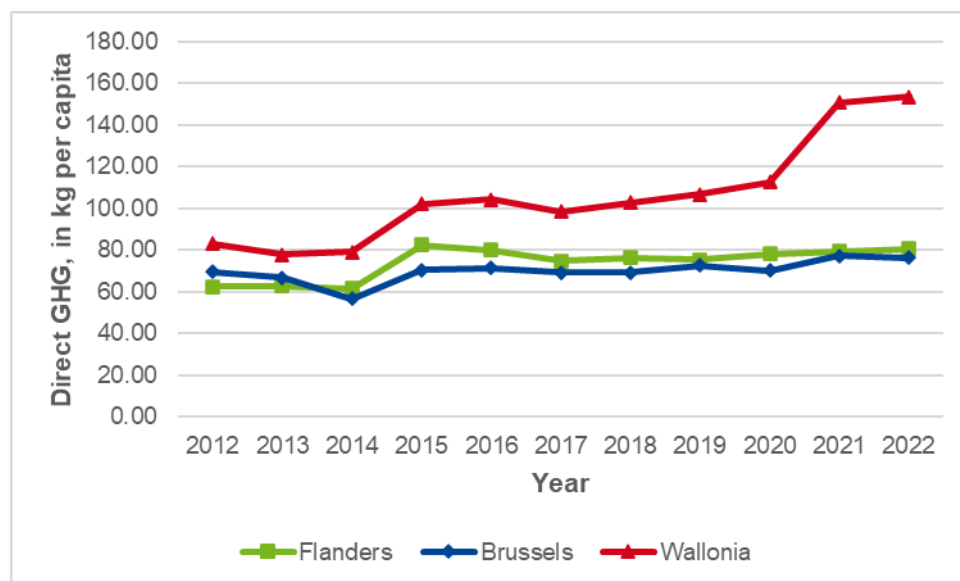
	Belgium		
	2012 (%)	2023 (%)	% change
CO₂	683 129.7 (89.8%)	1 257 037.8 (96.9%)	+84.0%
CH₄ (CO₂ eq)	1 035.2 (0.1%)	2 347.3 (0.2%)	+126.8%
N₂O (CO₂ eq)	74 268.4 (9.8%)	36 664.6 (2.8%)	-50.6%
HFC (CO₂ eq)	1 719.3 (0.2%)	759.6 (0.1%)	-55.8%
PFC (CO₂ eq)	0.04 (<0.1%)	0.0 (0%)	-100.0%
SF₆ and NF₃ (CO₂ eq)	158.9 (<0.1%)	54.8 (<0.1%)	-65.5%
Total	760 311.5	1 296 864.2	+70.6%

Eurostat data 2025 (Air Emissions Accounts)

REGIONAL COMPARISON

For human health activities, direct GHG emissions per capita increased across all regions, with the most pronounced rise observed in Wallonia in 2021 (see Figure 24 and Table 13). However, the sharp increases observed across all regions in 2015 and in Wallonia in 2021 can be partially attributed to methodological factors (see the limitations in the documentation sheet).

Figure 24 – Direct GHG emissions, in kg per capita, by region (2012-2022)



Sources: National planning bureau 2025. Wallonia: data gaps in 2021 due to a change in methodology, without retroactive adjustments.

Table 13 – Direct GHG emissions, in kg per capita, by region (2012-2022)

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Flanders	62.5	62.7	61.7	82.5	80.0	74.9	76.4	75.5	78.3	79.3	80.5
Brussels	69.5	66.7	56.7	70.5	71.4	69.3	69.4	72.7	70.1	77.2	76.2
Wallonia	82.9	78.0	79.0	102.1	104.2	98.5	102.9	106.8	112.4	150.6	153.5

Sources: National planning bureau 2025.

INTERNATIONAL COMPARISON

Expressed in kilograms per capita, direct GHG emissions from human health activities in Belgium were higher and showed an upward trend compared to the stable EU averages (see Figure 25). Across EU countries, emissions vary substantially in magnitude and in 2023, Belgium recorded the highest level of direct GHG emissions in human health activities among all EU member states (see Figure 26).

Concerning the evolution per type of gas, important variations can be observed between Belgium and EU-27 countries. The share of CO₂ in total emissions was slightly lower and more stable in the EU-27 than in Belgium, with 87.1% of direct GHG emissions in kg per capita in 2023 (96.9% in Belgium), showing an increase of +0.5% of CO₂ compared to 2012 (+73.5% in Belgium, see Table 14).

Although methane emissions per capita were low in Belgium, a substantial increase was observed, rising by 113.8% between 2012 and 2023, whereas the EU-27 average declined by 19.9% over the same period. As a result, by 2023, Belgium reached a level comparable to the EU-27.

However, comparison between countries should be used with cautions as methodological factors can partly explain differences (see the limitations in the documentation sheet).



Figure 25 – Direct GHG emissions in human health activities, in kg CO₂ eq per capita, European comparison (2012-2023)

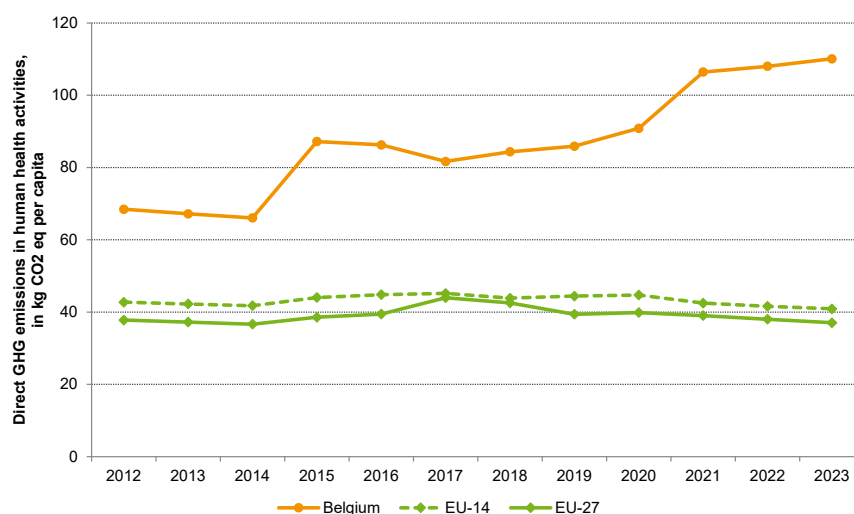
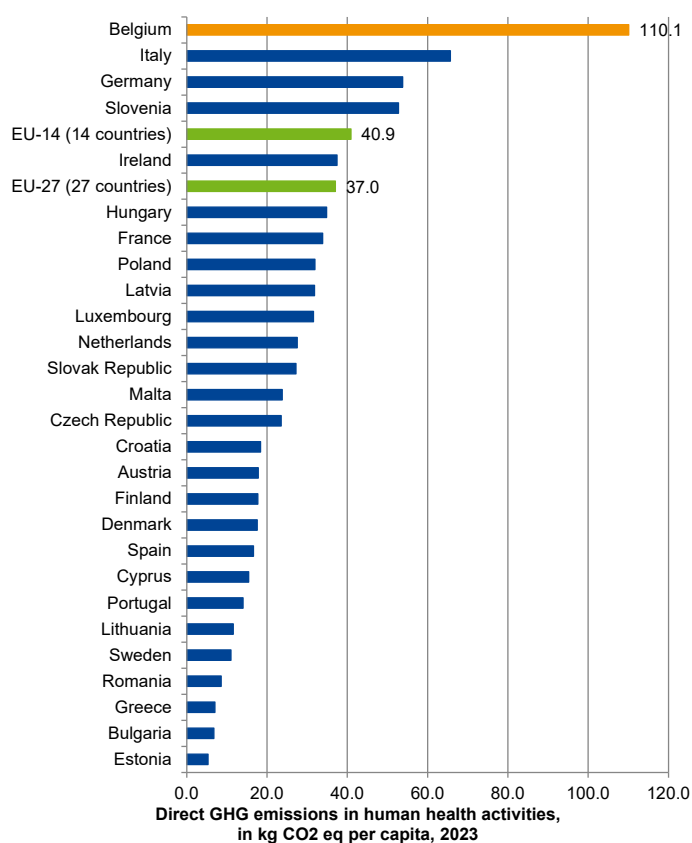


Figure 26 – Direct GHG emissions in human health activities, in kg CO₂ eq per capita, European comparison (2022)



Sources: Eurostat 2025 (Air Emissions Accounts)

Table 14 –Direct GHG emissions in kg CO₂ eq per capita, by gas, percentage change between 2012 and 2023, Belgium and EU-27

	Belgium			EU-27		
	2012	2023	% change	2012	2023	% change
CO₂	61.505	106.710	73.5%	32.100	32.268	0.5%
CH₄ (CO₂ eq)	0.093	0.199	113.8%	0.249	0.200	-19.9%
N₂O (CO₂ eq)	6.687	3.112	-53.5%	4.040	3.300	-18.3%
HFC (CO₂ eq)	0.155	0.064	-58.3%	1.280	1.219	-4.8%
PFC (CO₂ eq)	0.000	0.000	-	0.011	0.015	42.5%
SF₆ and NF₃ (CO₂ eq)	0.014	0.005	-67.5%	0.052	0.041	-22.2%
Total	68.5	110.1	60.8%	37.7	37.0	-1.8%

Sources: Eurostat 2025 (Air Emissions Accounts)

DATA SOURCES COMPARISON

While direct GHG emissions from the VITO model and Eurostat's 2024 data were quite similar, and slightly lower than those estimated by the NEHAP model (see ENV-1 for a description of VITO and NEHAP models), a significant increase is observed in Eurostat's 2025 data (see Table 15). Between 2024 and 2025, Belgium introduced a new method for estimating emissions from road transport (see the documentation sheet), which appears to have an important impact on results (see Figure 27). However, even if Belgium remained high compared to other countries (also based on data released in 2024), as mentioned in the documentation sheet, comparability per NACE activity between country is not guaranteed.

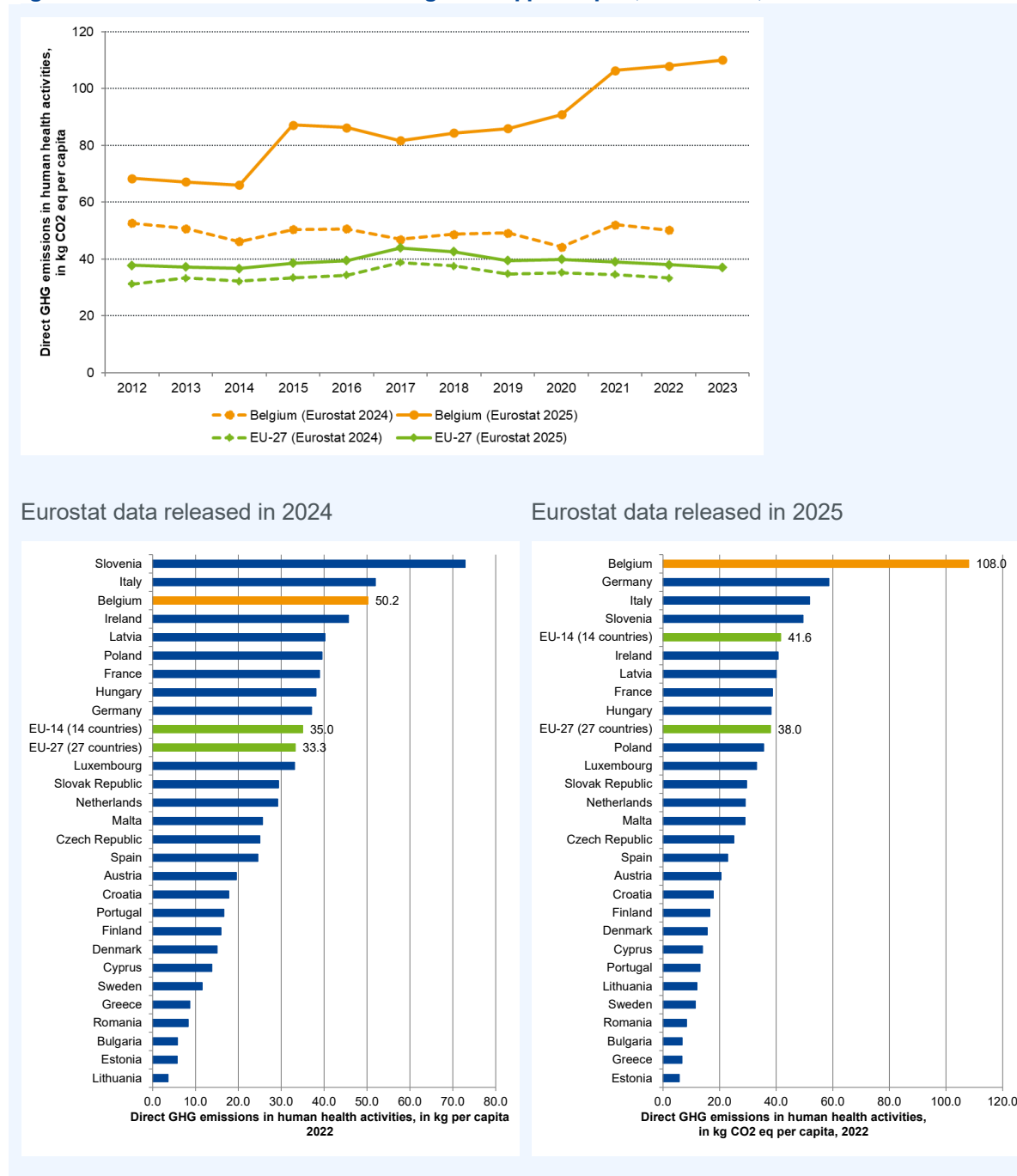
Table 15 – Direct GHG emissions in kt CO₂ eq, 2022, comparison by sources

	NEHAP	VITO	Eurostat (released on 12/2024)	Eurostat (released on 11/2025)
Human health activities (Q86)	-	588.11	586.58	1 296.86
Human health activities, residential care activities and social work activities (Q86-Q87-Q88)	1 083.00	909.83	908.22	1 675.95

Sources: NEHAP 2025, ², VITO 2025, Eurostat 2024 and Eurostat 2025.



Figure 27 – Direct GHG emissions in kg CO₂ eq per capita, 2012-2023, Eurostat 2024 and 2025



Source: Eurostat 2024 and 2025

DISCUSSION

The elevated level of direct GHG emissions is also related to the high fossil energy consumption in human health activities observed in indicator ENV-8. While potential causes could be a high energy intensity of healthcare facilities, the reliance on fossil fuels for heating and cooling, the relatively high density of hospitals per capita and a carbon-intensive healthcare fleet, methodological differences in data reporting between countries but also within Belgium may also have contributed to the wrong performance of Belgium for this indicator.

KEY POINTS

- Direct GHG emissions (Scope 1) in the healthcare sector include emissions from on-site combustion of fossil fuels (e.g. fuel used in hospital boilers) and from the operation of the healthcare fleet. The healthcare sector was identified using the statistical classification of economic activities in the European Community (NACE Rev. 2), specifically code Q86, which covers human health activities (excluding residential care).
- Annual direct GHG emissions in human health activities in Belgium increased from 760 311.5 t CO₂ eq in 2012 to 1 296 864.2 t CO₂ eq in 2023 (+70.6%). However, it is important to note that Belgium changed its methodology to better estimate emissions from road transports (with retroactive adjustments) and based on the previous methodology, direct GHG emissions were more stable (585 202 t CO₂ eq in 2012 and 586 578 t CO₂ eq in 2022, +0.2%).
- While CO₂ is the dominant greenhouse gas (96.9% in 2023), it is currently challenging to determine which CO₂ source has the greatest impact. Nitrous oxide (N₂O) also plays a role in human health activities but the impact was smaller (2.8% of GHG emissions in 2023) and emissions from this gas decreased between 2012 and 2023 (-50%). Other gases (methane (CH₄) and fluorinated gases) accounted for less than 0.3%.
- At the regional level, Wallonia reported higher per capita emissions in 2022 (153.5 kg CO₂ eq per capita), compared to Flanders (80.5 kg CO₂ eq per capita) and Brussels (76.2 kg CO₂ eq per capita). In this case, methodological factors were not the main explanation as the methodology was more aligned between regions since 2021. A more in-depth analysis of these disparities is therefore required to identify their underlying causes.
- At the European level, direct GHG emissions per capita were generally lower and more stable in other countries. In 2023, Belgium recorded 110.1 kg CO₂-eq per capita, representing a 60.8% increase compared to 2012, whereas the EU-27 average stood at 37.0 kg CO₂-eq per capita, a slight decrease of 1.8% over the same period. Notably, Belgium reported the highest level of direct GHG emissions from human health activities among all EU member states in 2023. However, it is also important to note that the new methodology introduced in Belgium to better estimate emissions from road transport strongly influenced this result. Under the previous methodology, Belgium's emissions were consistently higher than the EU average but remained closer and more stable (50.2 kg CO₂-eq per capita in Belgium in 2022, compared to 33.3 and 35.0 kg CO₂ eq per capita in the EU-27 and EU-14, respectively).
- While potential causes of high direct GHG emissions in Belgium could be a high energy intensity of healthcare facilities, the reliance on fossil fuels for heating and cooling, the relatively high density of hospitals per capita and a carbon-intensive healthcare fleet, methodological differences in data reporting between countries may also have contributed to the observed gap. Results should therefore be used with cautions and further investigations are needed. In one of their reports, Eurostat reported that comparability per NACE activity between country was not guaranteed.⁵
- In conclusion, even if methodological differences in data reporting between countries but also within Belgium may have contributed to the observed poor performance of Belgium regarding direct GHG emissions in human health activities, the expected decrease seems far from being achieved, and continued efforts remain essential.



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2.2 Particulate matter emissions in the healthcare sector (ENV-5)

2.2.1 Documentation sheet

Description	Primary indicator: A. Annual emissions of PM2.5 in human health activities (Q86), in grammes (g) per capita Secondary indicator: B. Annual emissions of PM2.5 in human health activities (Q86), in tonnes (t) C. Annual emissions of PM10 in human health activities (Q86), in g per capita D. Annual emissions of PM10 in human health activities (Q86), in t E. Annual emissions of PM2.5 in human health activities (Q86), as a share of total PM2.5 emissions (all NACE activities)
Rationale	Particulate matter (PM) are solid or liquid particles suspended in the air. They can penetrate the human body through the lungs, where they can cause severe illnesses such as heart and respiratory diseases and cancers [1] and are considered a leading risk factor for premature death. They are classified according to their diameter in μm. PM2.5 (PM with a diameter $\leq 2.5 \mu\text{m}$) are responsible for 5 million death annually over the world. In 2021, PM2.5 were responsible for 5 849 deaths, accounting for 5.2% of all deaths in Belgium; they caused the loss of 93 753 years of life due to premature death [2]. PM10 (PM with a diameter $\leq 10 \mu\text{m}$) also have important health consequences. Human activities generate a significant amount of PM (burning of fossil fuels, construction, industries, etc.).
Calculation	Done by the Federal Planning Bureau for Eurostat based on regional and national emissions inventories, an activity model and emission factors (activity data * emission factor) using NACE classification [3] Primary indicator (A): - Numerator: Annual PM2.5 emissions in human health activities, in g - Denominator: Population of the corresponding year (calculated as mean of population at beginning and end of year) Indicator B: - Numerator: Annual PM2.5 emissions in human health activities, in t - Denominator: / Indicator C: - Numerator: Annual PM10 emissions in human health activities, in g - Denominator: Population of the corresponding year (calculated as mean of population at beginning and end of year) Indicator D: - Numerator: Annual PM10 emissions in human health activities, in t - Denominator: / Indicator E: - Numerator: Annual PM2.5 emissions in human health activities, in t - Denominator: Annual PM2.5 emissions in total (all NACE activities), in t
Data source	Federal Planning Bureau (plan.be) and Eurostat: Air emissions accounts by NACE Rev. 2 activity (Last update of data: 28/11/2025 23:00) [4].
Technical definitions	Amount of PM2.5 / PM10 suspended in air (million T) per year



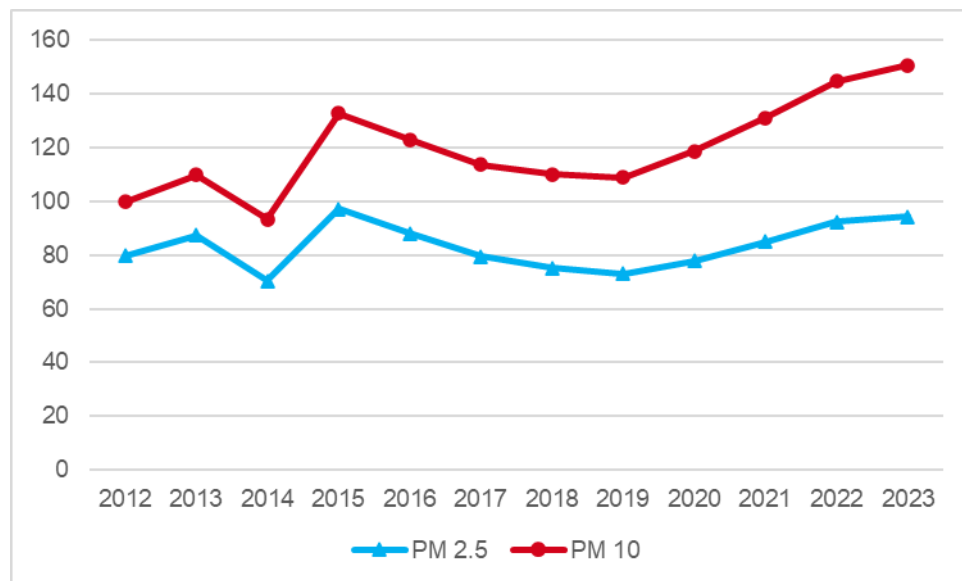
	The healthcare sector was identified via the statistical classification of economic activities in the European Community (NACE Rev. 2): Human health activities (Q86) (excluding residential care). More details on the methodology: https://ec.europa.eu/eurostat/web/environment/methodology [5]
International comparability	NACE (Statistical Classification of Economic Activities in the European Community, https://ec.europa.eu/eurostat/web/nace/overview) classification allows European comparison. However, comparability between country is not guaranteed due to differences in the allocation of road transport emissions (also impacting PM emissions) to NACE activities across countries (see also ENV-4 for more details).
Limitations	The data come from a model based on activity, not measurements. Residential care activities and social work activities without accommodation (Q87–Q88) were aggregated, making it impossible to isolate data for Q87 alone. Consequently, only human health activities (Q86) are considered as a proxy for the health care system, while residential care activities were excluded. Differences with other EU countries and jumps observed in data (in 2015 and 2021) can partly be explained by methodological factors: • Since 2021, Wallonia has applied a new and more accurate method to estimate energy consumption (more especially natural gases), based on data directly obtained from distribution network operators (as already implemented in Brussels and Flanders before 2021). Nevertheless, previous years were not retroactively modified, which can partly explain a jump in data in 2021 in Wallonia. However, the impact is reduced for PM emissions compared to GHG emissions, as they mainly depends from road transports (85%). The portion attributable to natural gas consumption only impacts the breakdown of regional emissions inventories, accounting for approximately 15% of PM emissions. • Emissions from road transport data (total quantities emitted), impacting PM emissions, are based on national/regional emissions inventories and the COPERT 5 model and allocation keys among NACE sectors vary between countries. In Belgium the allocation key is based on excise duties for Eurostat 2025 data, whereas previous estimates (e.g. 2024 data) relied on vehicle registrations. Excise duties are considered more reliable; however, this new approach appears to have an important impact for Q86 emissions: PM2.5 emissions in human health activities in Eurostat version released in 2024 are stable across the years for the 2017-2022 period while an increase is observed in the Eurostat version released in 2025. • Excise duties are calculated on a five-year basis (2010, 2015, 2020) using an “structural survey” of the National Bank of Belgium while intermediate years are based on less detailed surveys and extrapolations. As 2014 is based on an extrapolation of 2010 data, a jump in excise data is observed in 2015, which can partly explain the 2015 jump in PM2.5 emissions.
Dimension	Environmental sustainability
Supervisor	Carl Devos
Reviewers	Jehan Charlier

2.2.2 Results

BELGIUM

The PM_{2.5} emissions (emissions of particle matter with a diameter $\leq 2.5 \mu\text{m}$) have increased (+18.3%) between 2012 and 2023 (see Figure 28) for human health activities (Q86), reaching 94.3 tonnes in 2023. The PM₁₀ (emissions of particle matter with a diameter $\leq 10 \mu\text{m}$) emissions have increased by 50.8% over the same period to reach 150.5 tonnes in 2023.

Figure 28 – PM_{2.5} and PM₁₀ emissions (in tonnes) for human health activities for Belgium

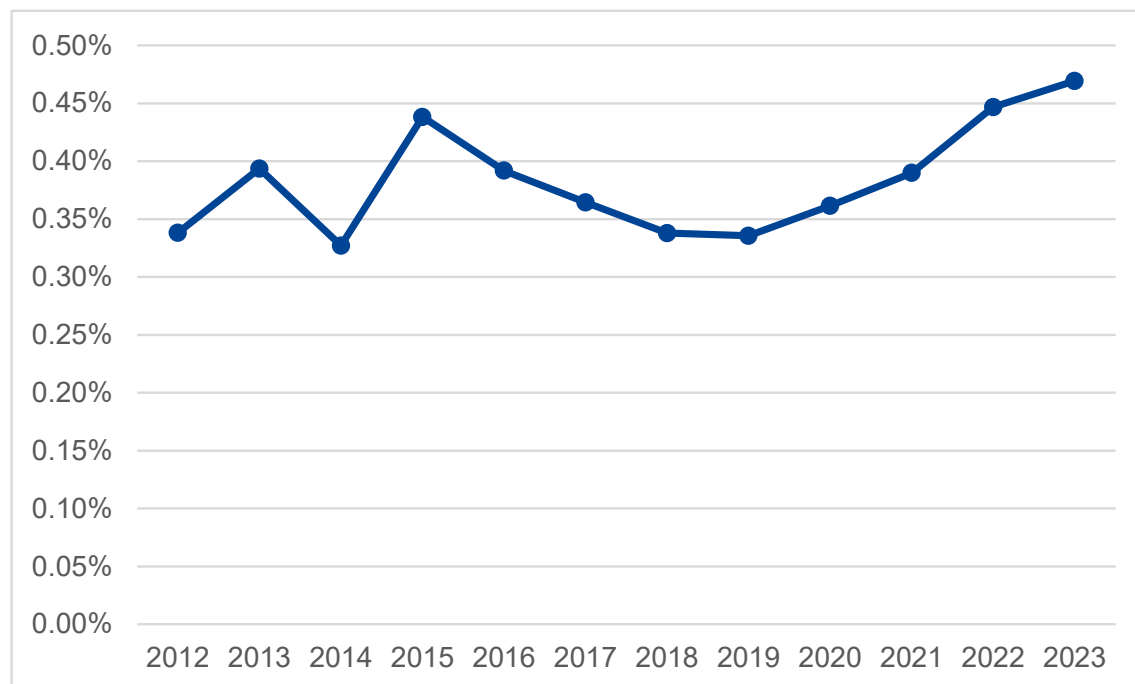


Source: Federal Planning Bureau

The proportion of PM_{2.5} emissions in human health activities is also growing compared to the total of PM_{2.5} emissions in the NACE model (Figure 29): from 0.34% in 2012 to 0.47% in 2023. This can be explained by the fact that over that period, the total of PM_{2.5} emissions fell by 14.8% in total while it increased by 18.3% for the health activities.



Figure 29 – Evolution of the proportion of health activities (Q86) in total NACE PM2.5 emissions in Belgium

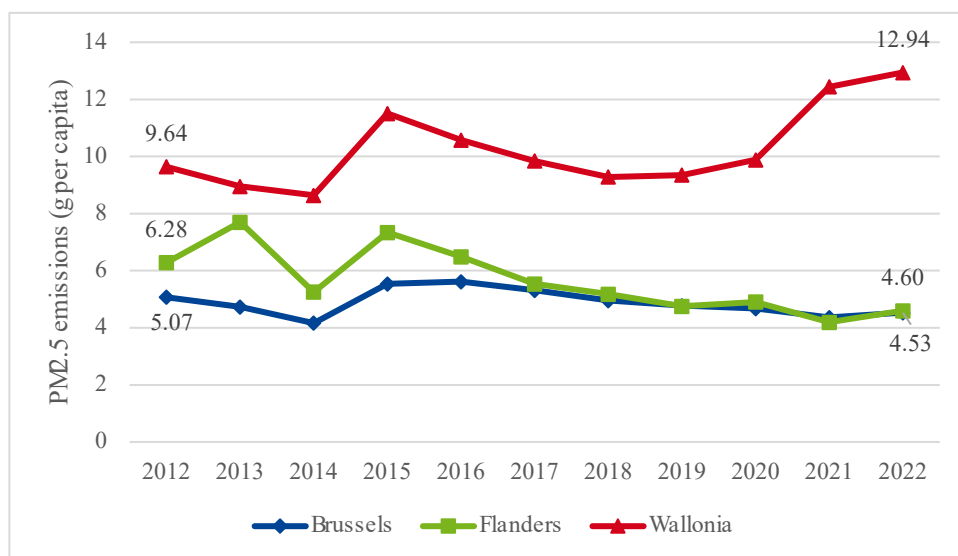


Source: Eurostat

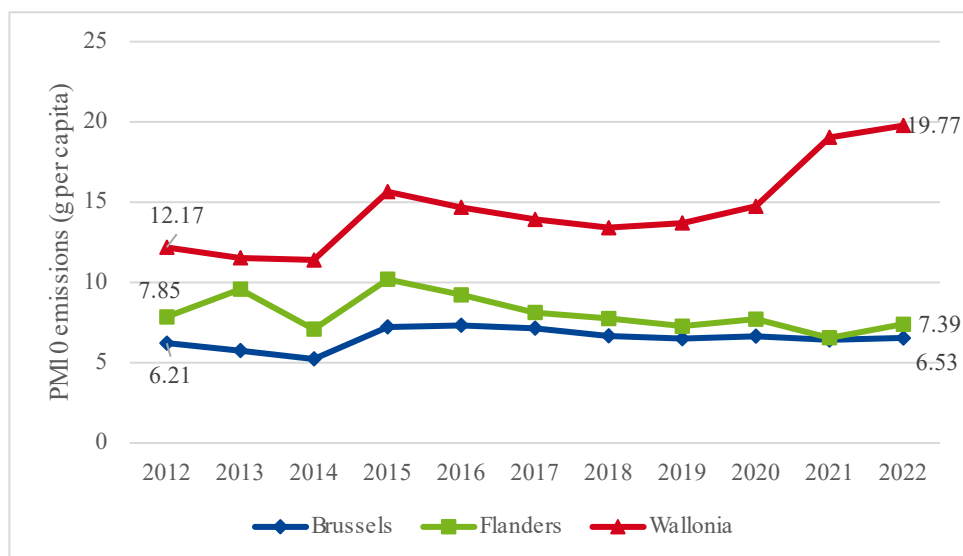
REGIONAL COMPARISON

Wallonia's PM2.5 emissions in health activities (Q86) are higher than those of Brussels and Flanders. Over the 2012-2022 period, PM2.5 Emissions per capita in health activities have increased in Wallonia (+34.2%), especially between 2020 and 2021, while they have decreased over the period 2012-2022 in Brussels (-10.7%) and in Flanders (-26.8%) as shown in Figure 30. For the 2012-2022 evolution of PM10 emissions, Brussels (+5.2%) and Flanders (-5.9%) are almost stable while Wallonia shows a more important growth (+67.8%) (Figure 31).

As PM emissions are mostly influenced by transports (85%), the change of methods in Wallonia to estimate the consumption of natural gas has only a limited impact. The higher impact in Wallonia is therefore not only explain by methodological factors. The higher distances could be another explanation factor.

Figure 30 – PM_{2.5} emissions (g per capita) for human health activities per region

Source: Federal Planning Bureau.

Figure 31 – PM₁₀ emissions (g per capita) for human health activities per region

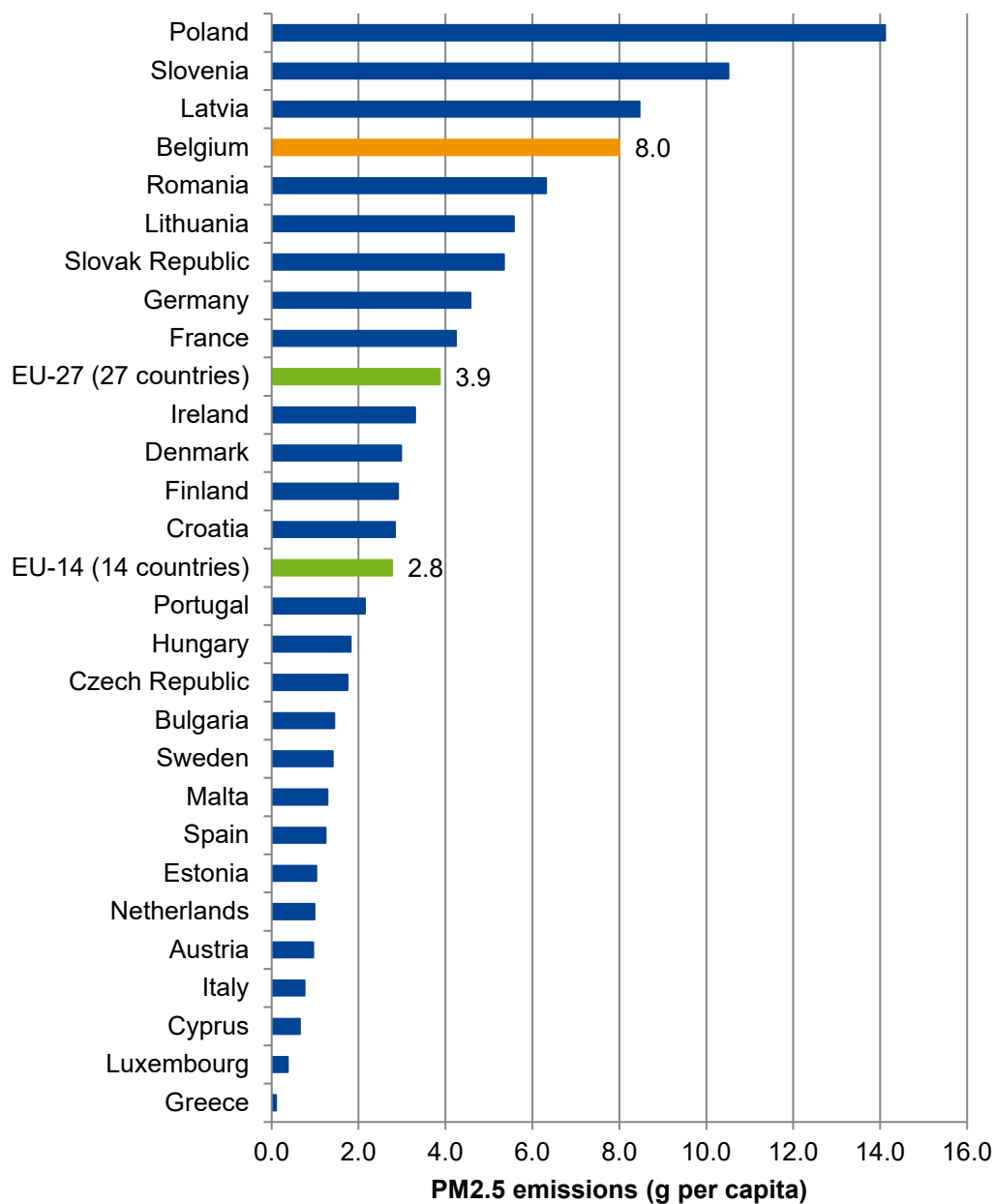
Source: Federal Planning Bureau

INTERNATIONAL COMPARISON

Compared to other European countries Belgium, Belgium (8.0 g per capita) emits twice as much PM_{2.5} as EU-27 (3.9) and almost three times as much as EU-14 (2.8) in the human health activities in 2023 (Figure 32). Over the 2012-2023 period, Belgium has increased by 11.5% its PM_{2.5} emissions in the health activities (Q86 of the NACE), while EU-14 decreased by 25.2% and EU-27 by 44.1% (Figure 33). However, comparison between countries should be used with caution as methodological factors can partly explain differences (see the limitations in the documentation sheet).

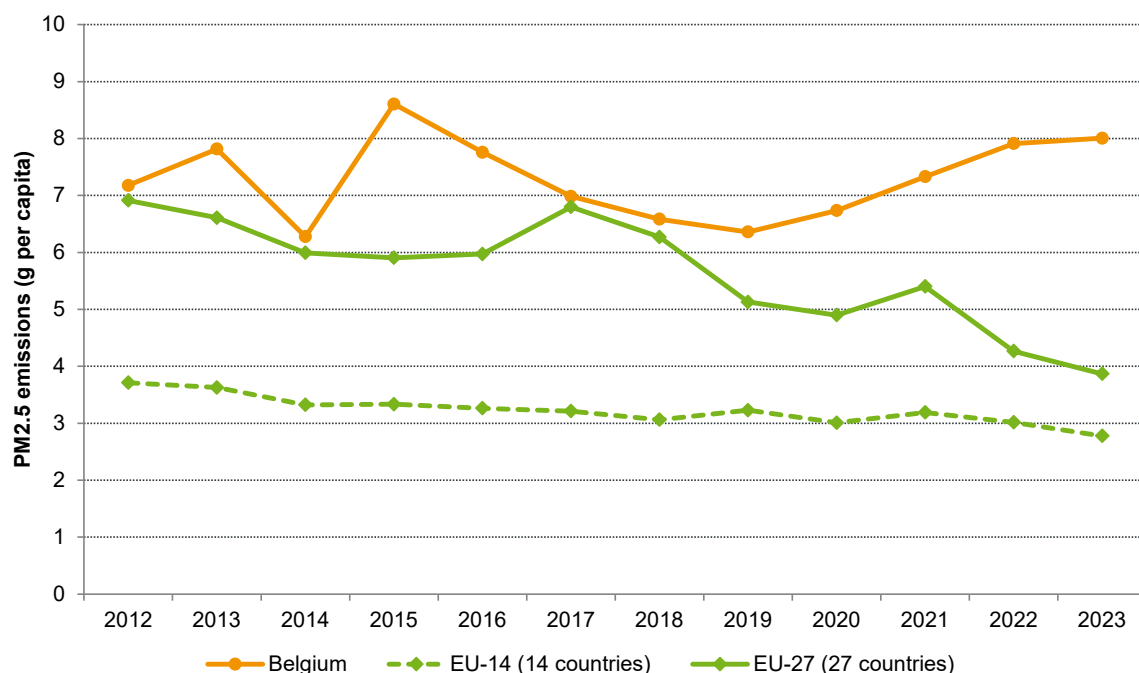


Figure 32 – PM2.5 emissions for human health activities: international comparison in (2023)



Source: Eurostat (air emissions accounts)

Figure 33 – PM2.5 emissions for human health activities: international comparison (2012-2023)



Source: Eurostat (air emissions accounts)

KEY POINTS

Particulate matter emissions are still growing in the health sector in Belgium

- PM2.5 are dangerous small particles that can cause severe illness such as heart and respiratory diseases and cancers (5 million deaths per year over the world).
- The health sector was responsible for only 0.5% of total Belgian PM2.5 emissions in 2023. Expressed in tonnes, a 18.3% increase in PM2.5 emissions from the healthcare sector is observed over the 2012-2023 period (with 94.3 tonnes in 2023). By considering the increase in the population, the increase was slightly reduced (+11.5%, with 8 g per capita in 2023). Such results should nevertheless be used with caution as they are influenced by methodological factors.
- Higher PM2.5 emissions were observed in Wallonia (12.9 g, compared to 4.6 and 4.5 g per capita in Flanders and Brussels) and in this case, methodological factors are not the main explanation, other factors such as the higher distances may also have influenced the results.
- Other European countries have achieved better outcomes than Belgium, with PM2.5 emissions per capita increasing by 11.5% in Belgium over the 2012–2023 period, compared with decreases of 25% in EU-14 countries and 44% in EU-27 countries. However, cross-country comparisons should be interpreted with caution, as methodological differences may partly explain these disparities. In particular, the introduction of a new method in Belgium to allocate road transport emissions to the health sector had a substantial impact on the results (see the documentation sheet). Under the previous methodology, the trend in Belgium was more stable.



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2.3 Annual emissions of acidifying gas in the healthcare sector (ENV-6)

2.3.1 Documentation sheet

Description	Primary indicator: Annual emissions of acidifying gas in human health activities (Q86), in grammes (g) of SO₂ eq per capita Secondary indicator: Annual emissions of acidifying gas in human health activities (Q86), as a share of total direct acidifying gas emissions (all NACE activities)
Rationale	Acidification is an environmental problem linked to atmospheric emissions, with potential negative impacts on plant growth, animals, and the quality of soil and groundwater. The acidification index (ACID) includes the following acidifying gases: sulphur dioxide (SO₂, mainly produced by the combustion of fossil fuels), nitrogen oxides (NO_x, mainly produced by combustion in internal combustion engines and gas-fired power stations) and ammonia (NH₃, mainly produced by the use of nitrogen fertilisers and livestock farming).
Calculation	Done by the Federal Planning Bureau for Eurostat based on regional and national emissions inventories, an activity model and emission factors (activity data * emission factor) using NACE classification [1] Primary indicator: • Numerator: Annual emissions of acidifying gas in human health activities (Q86), in grammes (g) of SO₂ eq • Denominator: Population of the corresponding year (calculated as mean of population at beginning and end of year) Secondary indicator: • Numerator: Annual emissions of acidifying gas in human health activities (Q86), in grammes (g) of SO₂ eq • Denominator: Annual emissions of acidifying gas in total (all NACE activities), in grammes (g) of SO₂ eq
Data source	Federal Planning Bureau (June 2025 for regional data) and Eurostat: Air emissions accounts by NACE Rev. 2 activity (Last update of data: 28/11/2025 23:00) [2]
Technical definitions	ACID index = $0,03125 * SO_2 + 0,021739 * NO_x + 0,058824 * NH_3$ The healthcare sector was identified via the statistical classification of economic activities in the European Community (NACE Rev. 2): Human health activities (Q86) (excluding residential care). More details on the methodology: https://ec.europa.eu/eurostat/web/environment/methodology [3]
International comparability	NACE (Statistical Classification of Economic Activities in the European Community, https://ec.europa.eu/eurostat/web/nace/overview) classification allows European comparison. However, comparability between country is not guaranteed due to differences in the allocation of road transport emissions (also impacting acidifying gas emissions) to NACE activities across countries (see also ENV-4 for more details).
Limitations	The data come from a model based on activity, not measurements. Residential care activities and social work activities without accommodation (Q87–Q88) were aggregated, making it impossible to isolate data for Q87 alone. Consequently,

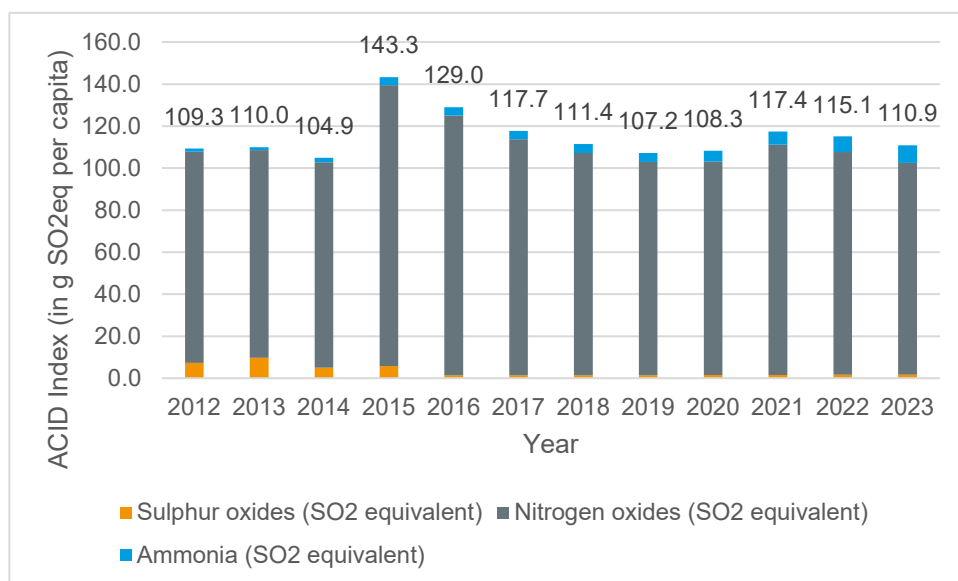


	only human health activities (Q86) are considered as a proxy for the health care system, while residential care activities were excluded. Differences with other EU countries and jumps observed in data (in 2015 and 2021) can partly be explained by methodological factors: • Since 2021, Wallonia has applied a new and more accurate method to estimate energy consumption, based on data directly obtained from distribution network operators (as already implemented in Brussels and Flanders before 2021). Nevertheless, previous years were not retroactively modified, which can partly explain a jump in data in 2021 in Wallonia. However, the methodological change in Wallonia only affects the allocation key used to disaggregate regional emissions inventories, which represent a small share of acidifying gases compared with those originating from road transport. It should also be noted that the 2022 data for Wallonia are based on projections, as the data were not yet complete at the time of receipt (June 2025 for regional data). • Emissions from road transport data (total quantities emitted), impacting acidifying gas emissions, are based on national/regional emissions inventories and the COPERT 5 model and allocation keys among NACE sectors vary between countries. In Belgium the allocation key is based on excise duties for Eurostat 2025 data, whereas previous estimates (e.g. 2024 data) relied on vehicle registrations. Excise duties are considered more reliable; however, this new approach appears to have an important impact for Q86 emissions: emissions of acidifying gas in human health activities in Eurostat version released in 2024 are slowly decreasing across the years while an abrupt increase in 2015 is observed in Eurostat version released in 2025. Excise duties are calculated on a five-year basis (2010, 2015, 2020) using an “structural survey” of the National Bank of Belgium while intermediate years are based on less detailed surveys and extrapolations. As 2014 is based on an extrapolation of 2010 data, a jump in excise data is observed in 2015, which can partly explain the 2015 jump in acidifying gas emissions.
Dimension	Environmental sustainability
Supervisor	Carl Devos
Reviewers	Jehan Charlier

2.3.2 Results

BELGIUM

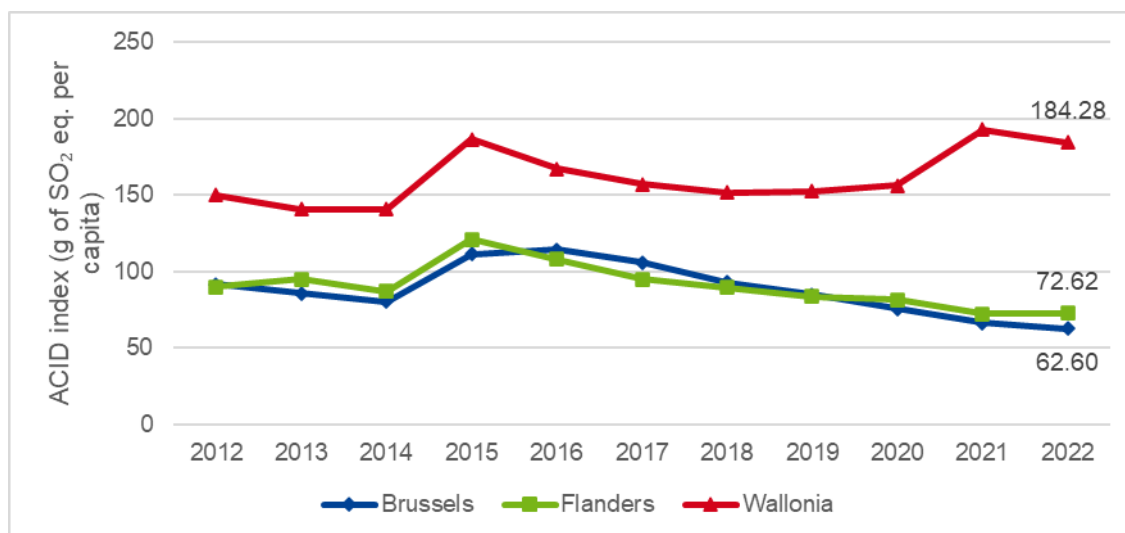
Per capita, emissions of gases responsible in acidification in Belgium is stable for human health activities over the 2012-2023 period (+1.4%). The most important part is due to NO_x emissions. The proportion of SO₂ is decreasing over time while the proportion of NH₃ is increasing over the period (see Figure 34).

Figure 34 – ACID index for Belgium: human health activities (Q86)

Source: Eurostat 2025

REGIONAL COMPARISON

Although the sharp increase observed in Wallonia in 2021 and 2022 can be partially attributed to methodological factors, similar to the increase observed across all regions in 2015 (see the limitations described in the documentation sheet), Wallonia consistently remains well above the other two regions throughout the period. Moreover, methods are expected more aligned between regions from 2021 onwards. More in-depth analysis is therefore required to understand the underlying causes of these differences.

Figure 35 – ACID index for human health activities (Q86) by region

Source: Federal Planning Bureau (June 2025); 2022 data in Wallonia are based on projections.



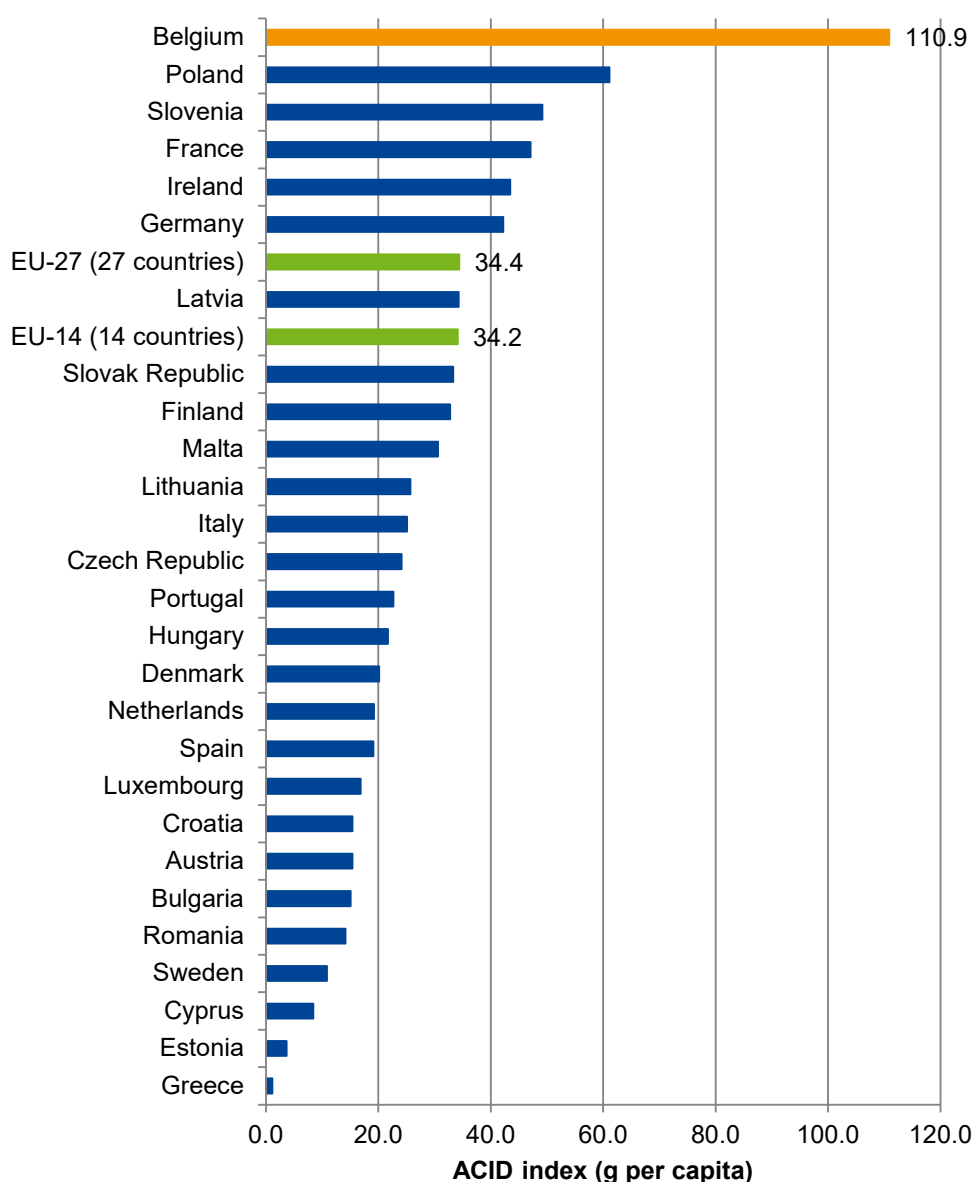
INTERNATIONAL COMPARISON

Belgium has the highest ACID index among European countries for human health activities (110.9 g per capita in 2023), which is three times the value of EU-14 countries (34.2 g per capita) and EU-27 countries (34.4 g per capita), see Figure 36.

Belgium's ACID index is getting better after a peak in 2015 (explained by methodological factors), but is stable for the 2012-2023 period (+1.4%), while European countries are almost decreasing (EU-14: -37.6% over the period, EU-27: -36.4%, see Figure 37).

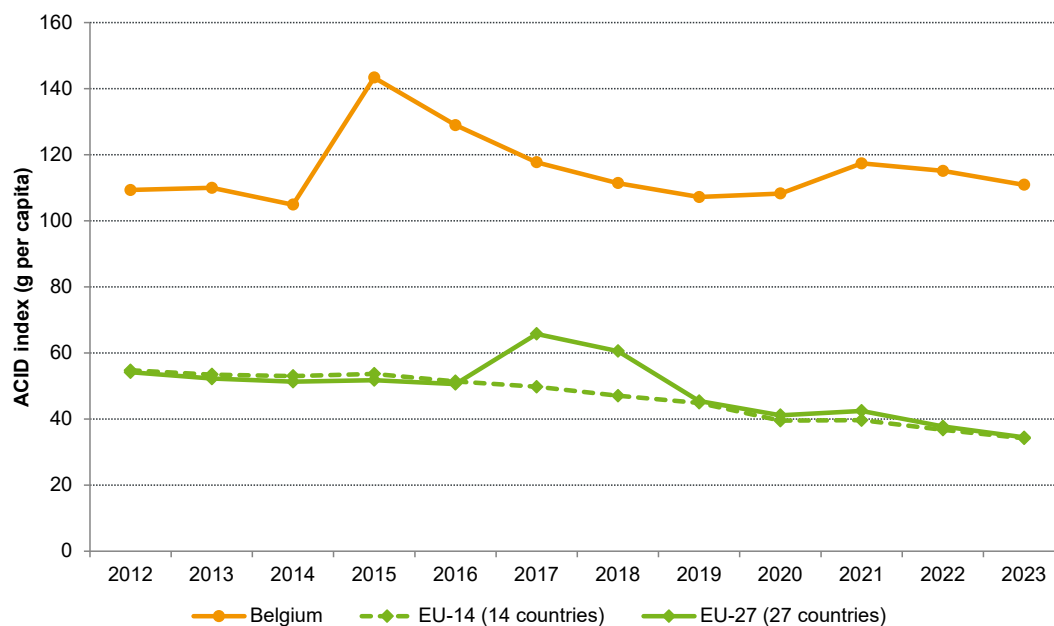
The proportion of human health activities' emissions in all NACE activities is bigger in Belgium (0.57% in 2023) than in EU-27 (0.12%) and EU-14 (0.12%) and is upwards over the 2012-2023 period for Belgium (+7.6%) while it is downwards for EU-27 (-35.3%) and EU-14 (-35.5%) (see Figure 38). The trend in all NACE activities is downwards and it is similar for Belgium (-32.7%), EU-27 (-31.4%) and EU-14 (-30.4%).

Figure 36 – Acid gas emissions in human health activities: international comparison (2023)



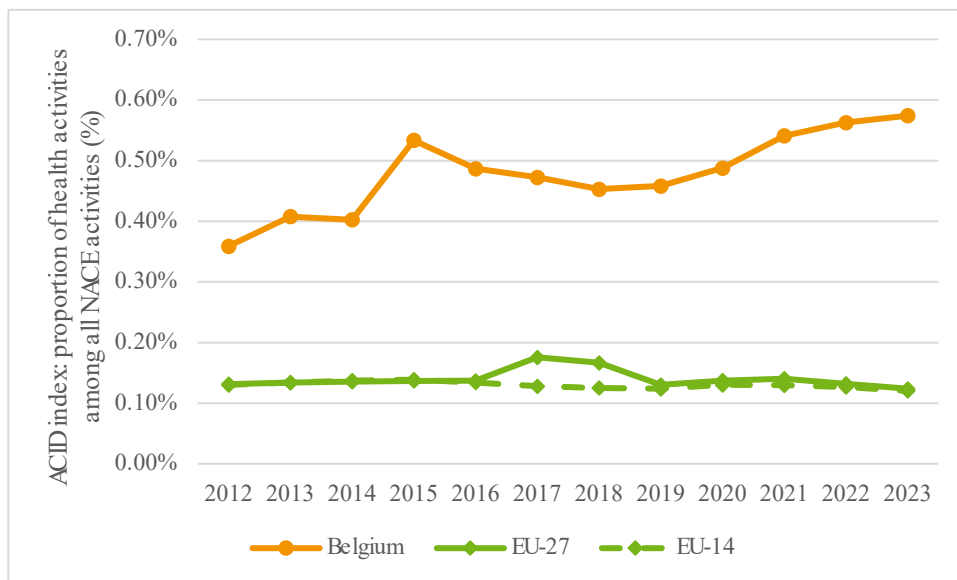
Source: Eurostat (air emissions accounts) 2025

Figure 37 – Acidifying gas emissions in human health activities: international comparison (2012-2023)



Source: Eurostat (air emissions accounts) 2025

Figure 38 – Acidifying gas emissions in human health activities, as a share of total direct acidifying gas emissions (all NACE activities): international comparison



Source: Eurostat (air emissions accounts) 2025



KEY POINTS

- Emissions of acidifying gases, measured using the ACID index, include sulphur dioxide (SO₂), nitrogen oxides (NO_x), and ammonia (NH₃), expressed in SO₂ equivalents. These gases can potentially damage plant growth, animals, and the quality of soil and groundwater.
- In Belgium, emissions of acidifying gases from the healthcare sector have remained stable over time, amounting to 109.3 g SO₂ eq per capita in 2012 and 110.9 g SO₂ eq per capita in 2023 (+1.4%).
- As with other indicators on air emissions, regional differences can be observed, with higher emissions in Wallonia (184.3 g SO₂ eq per capita compared to 72.6 and 62.6 g per capita in Flanders and Brussels, respectively), requiring more in-depth analysis.
- At the European level, acidifying gas emissions from the healthcare sector in Belgium are approximately three times higher than those of the EU-27 and EU-14 averages. While Belgium shows a relatively stable trend over time, European averages display a decreasing trend between 2012 and 2023 (-37.6% for the EU-14 and -36.4% for the EU-27). Moreover, the share of human health activities in total acidifying gas emissions across all NACE activities has increased in Belgium (+8%) but declined at the European level (-35% for both the EU-14 and EU-27 averages). However, cross-country comparisons should be interpreted with caution due to methodological differences (see the documentation sheet).

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2.4 Ozone precursor emissions in the healthcare sector (ENV-7)

2.4.1 Documentation sheet

Description	Primary indicator: A. Annual emissions of ozone precursors in human health activities (Q86), in grammes (g) of NMVOC eq per capita Secondary indicator: B. Annual emissions of ozone precursors in human health activities (Q86), in tons (t) of NMVOC equivalent C. Annual emissions of ozone precursors in human health activities (Q86), as a share of total emissions of ozone precursors (all NACE activities)
Rationale	Ozone in the lower layer of the atmosphere (troposphere) can generate smog, which is harmful to health, especially for people with respiratory disorders. Nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOC), carbon monoxide (CO), and methane (CH₄) are the most important ozone precursors. These substances are called tropospheric ozone precursors, and their ozone formation potential is calculated using an index. This index is called the TOFP (Tropospheric Ozone Formation Potential) index.[1]
Calculation	Done by the Federal Planning Bureau for Eurostat based on regional and national emissions inventories, an activity model and emission factors (activity data * emission factor) using NACE classification [2] Primary indicator (A): - Numerator: Annual emissions of ozone precursors in human health activities (Q86), in grammes (g) of NMVOC eq - Denominator: Population of the corresponding year (calculated as mean of population at beginning and end of year) Indicator B: - Numerator: Annual emissions of ozone precursors in human health activities (Q86), in tonnes (t) of NMVOC eq - Denominator: / Indicator C: - Numerator: Annual emissions of ozone precursors in human health activities (Q86), in tonnes (t) of NMVOC eq - Denominator: Annual emissions of ozone precursors in total (all NACE activities), in tonnes (t) of NMVOC eq
Data source	Federal Planning Bureau (June 2025 for regional data); Eurostat: Air emissions accounts by NACE Rev. 2 activity (Last update of data: 28/11/2025 23:00) [3].
Technical definitions	TOFP index = $1,22 * NO_x + NMVOC + 0,11 * CO + 0,014 * CH_4$ - Nitrogen oxydes (NO_x) - Non-Methane Volatile Organic Components (NMVOC) - Carbon monoxide (CO) - Methane (CH₄) The healthcare sector was identified via the statistical classification of economic activities in the European Community (NACE Rev. 2): Human health activities (Q86) (excluding residential care).



	More details on the methodology: https://ec.europa.eu/eurostat/web/environment/methodology [4]
International comparability	NACE (Statistical Classification of Economic Activities in the European Community, https://ec.europa.eu/eurostat/web/nace/overview) classification allows European comparison. However, comparability between country is not guaranteed due to differences in the allocation of road transport emissions (also impacting acidifying gas emissions) to NACE activities across countries (see also ENV-4 for more details).
Limitations	The data come from a model based on activity, not measurements. Residential care activities and social work activities without accommodation (Q87–Q88) were aggregated, making it impossible to isolate data for Q87 alone. Consequently, only human health activities (Q86) are considered as a proxy for the health care system, while residential care activities were excluded. Differences with other EU countries and jumps observed in data (in 2015 and 2021) can partly be explained by methodological factors: • Since 2021, Wallonia has applied a new and more accurate method to estimate energy consumption, based on data directly obtained from distribution network operators (as already implemented in Brussels and Flanders before 2021). Nevertheless, previous years were not retroactively modified, which can partly explain a jump in data in 2021 in Wallonia. However, the methodological change in Wallonia only affects the allocation key used to disaggregate regional emissions inventories, which represent a small share of ozone precursors compared with those originating from road transport. It should also be noted that the 2022 data for Wallonia are based on projections, as the data were not yet complete at the time of receipt (June 2025 for regional data). • Emissions from road transport data (total quantities emitted), impacting emissions of ozone precursors, are based on national/regional emissions inventories and the COPERT 5 model and allocation keys among NACE sectors vary between countries. In Belgium the allocation key is based on excise duties for Eurostat 2025 data, whereas previous estimates (e.g. 2024 data) relied on vehicle registrations. Excise duties are considered more reliable; however, this new approach appears to have an important impact for Q86 emissions: emissions of ozone precursors in human health activities in Eurostat version released in 2024 are slowly decreasing across the years while an abrupt increase is observed in 2015 in Eurostat version released in 2025. • Excise duties are calculated on a five-year basis (2010, 2015, 2020) using an “structural survey” of the National Bank of Belgium while intermediate years are based on less detailed surveys and extrapolations. As 2014 is based on an extrapolation of 2010 data, a jump in excise data is observed in 2015, which can partly explain the 2015 jump in emissions of ozone precursors.
Dimension	Environmental sustainability
Supervisor	Carl Devos
Reviewers	Jehan Charlier

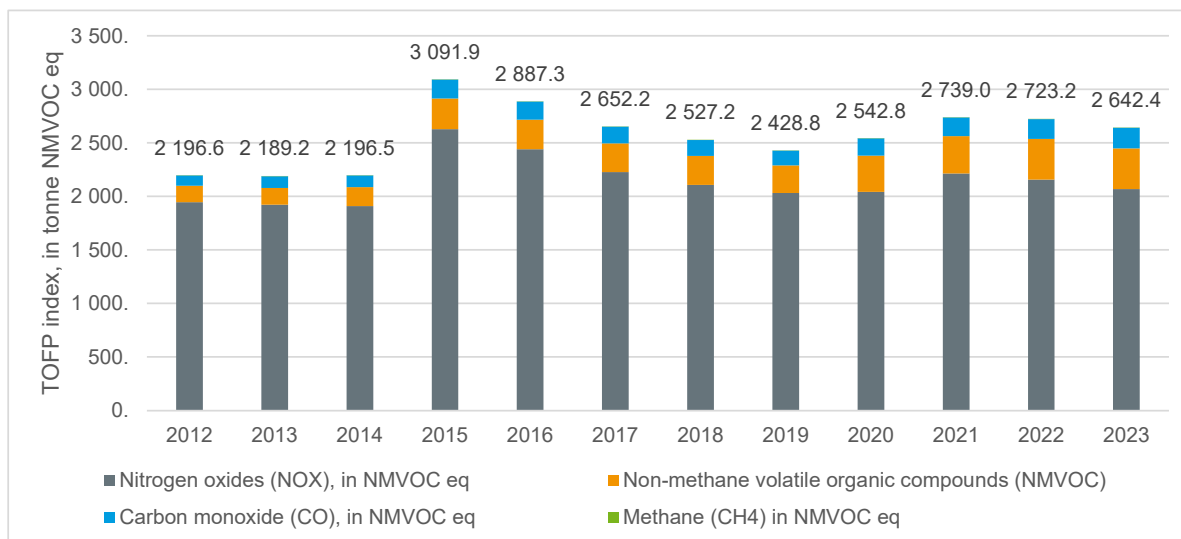
2.4.2 Results

BELGIUM

Ozone can cause damage to people with respiratory disorder. The ozone precursor emissions are measured by the Tropospheric Ozone Formation Potential (TOFP) index. Figure 39 presents the TOFP index for Belgium by type of gas from 2012 to 2023: the most significant source is NO_x emissions (78% to 89% of the TOFP index), followed by non-methane volatile organic components (NMVOC),

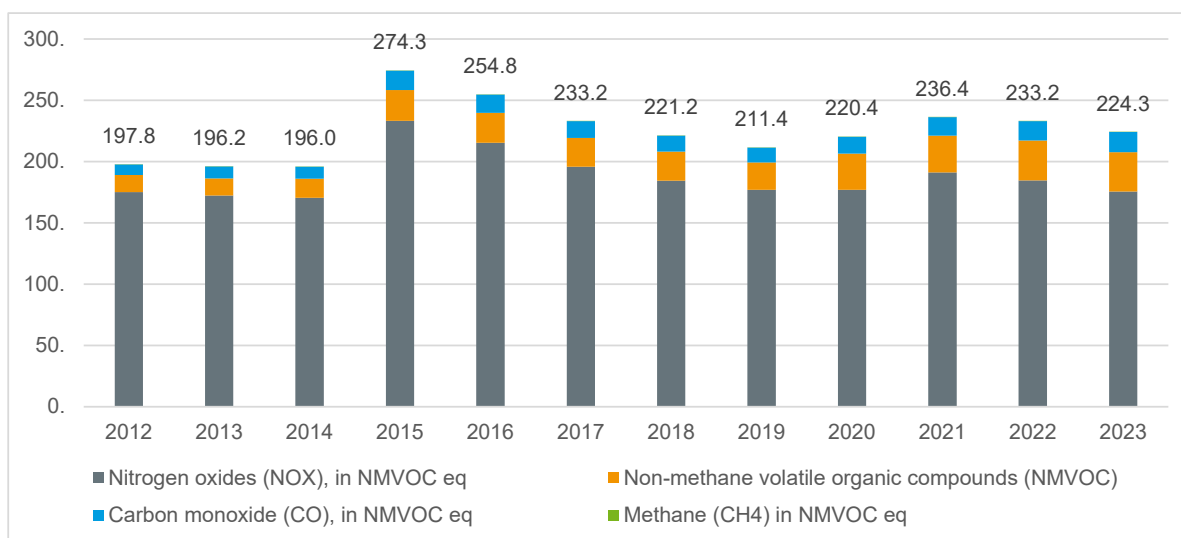
which has an increasing contribution between 2012 and 2023. Carbon monoxide (CO) and methane (CH₄) are also included in the index, but have less influence. After the peak of 2015 (3092 tonnes of NMVOC equivalent and 274.3 g per capita), partially explained by methodological factors (see the documentation sheet), there was a slow decrease then a stabilisation over the last years.

Figure 39 - Ozone precursor emissions in Belgium (TOFP index) for human health activities, in tonne NMVOC (Q86)



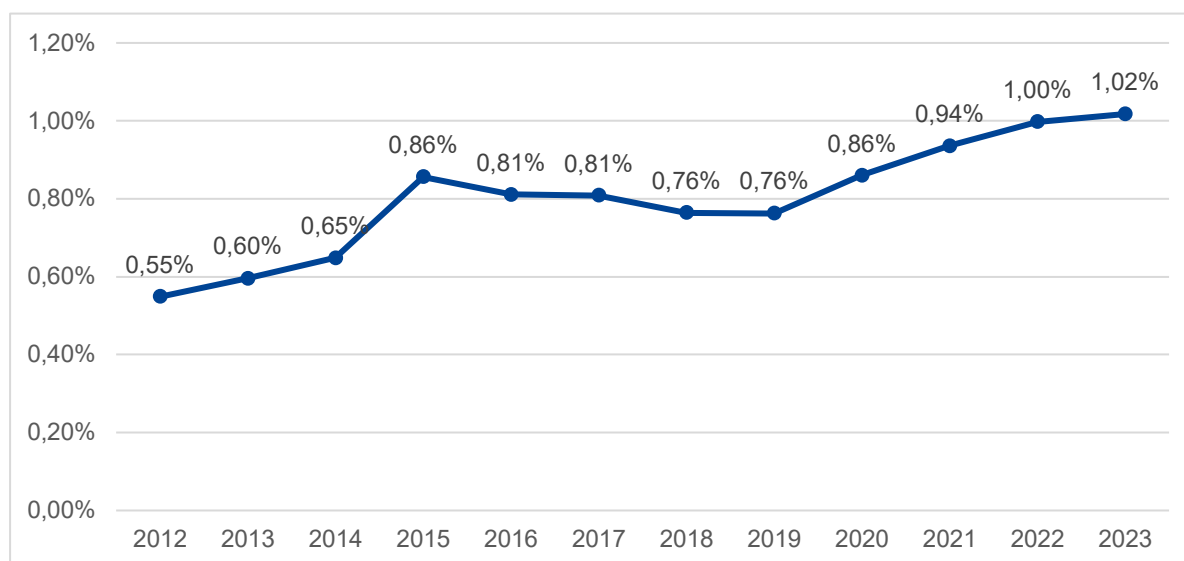
Source: Eurostat (air emissions accounts), November 2025

Figure 40 – Ozone precursor emissions in Belgium (TOFP index) for human health activities, in g NMVOC eq per capita (Q86)



Source: Eurostat (air emissions accounts), November 2025

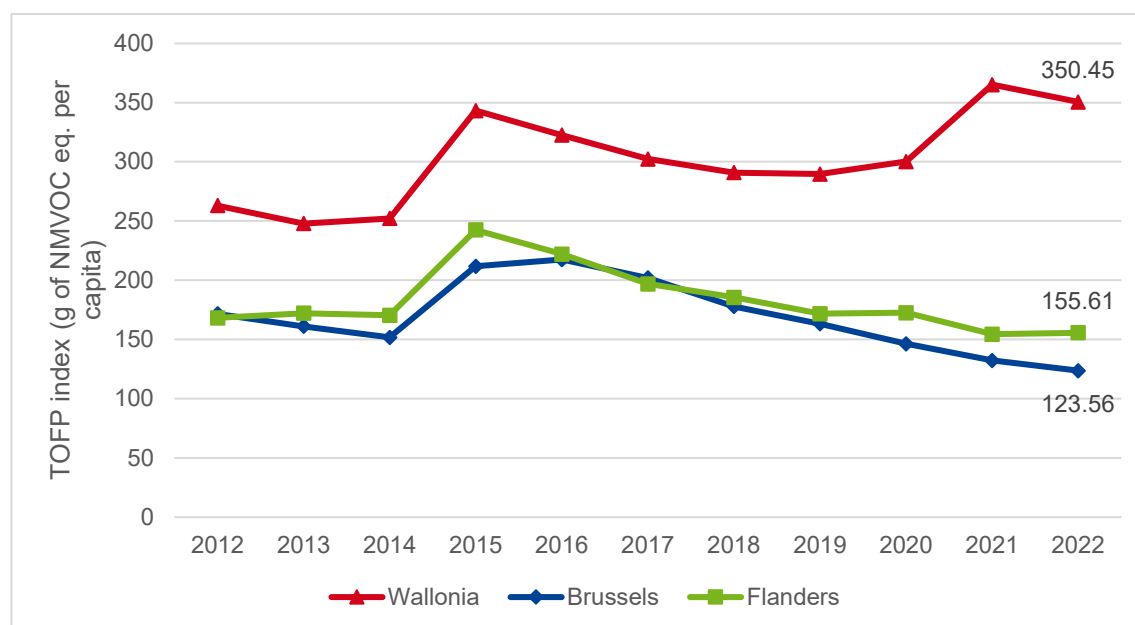
The human health activities (Q86 in NACE) account for only a small proportion of the ozone precursor emissions in Belgium with only 1% of the emissions (see Figure 41) when comparing the TOPF index for all activities vs the TOPF index for human health activities. Still, an increase of 0.47 percentage point is observed over the 2012-2023 period (from 0.55% to 1.02%), mainly due to the decrease of the emissions for all activities (-35.1%) while the emissions for the human health activities increased by 20.3% over the same period.


Figure 41 – Proportion of human health activities in the ozone precursor emissions


Source: Eurostat (air emissions accounts), November 2025

REGIONAL COMPARISON

When looking at the regional data, Wallonia has the highest TOFP index (350 g/capita) with more than twice the value of Brussels (124 g/capita) and of Flanders (156 g/capita); all regions had a peak around 2015-2016, then a decreasing trend; Wallonia has an extra peak in 2021 (Figure 42). Although the sharp increase observed in Wallonia in 2021 and 2022 can be partially attributed to methodological factors similar to the increase observed across all regions in 2015 (see the limitations described in the documentation sheet), Wallonia consistently remains well above the other two regions throughout the period. Methods are the same between regions from 2021 onwards. More in-depth analysis is therefore needed to determine what are the underlying causes of these differences.

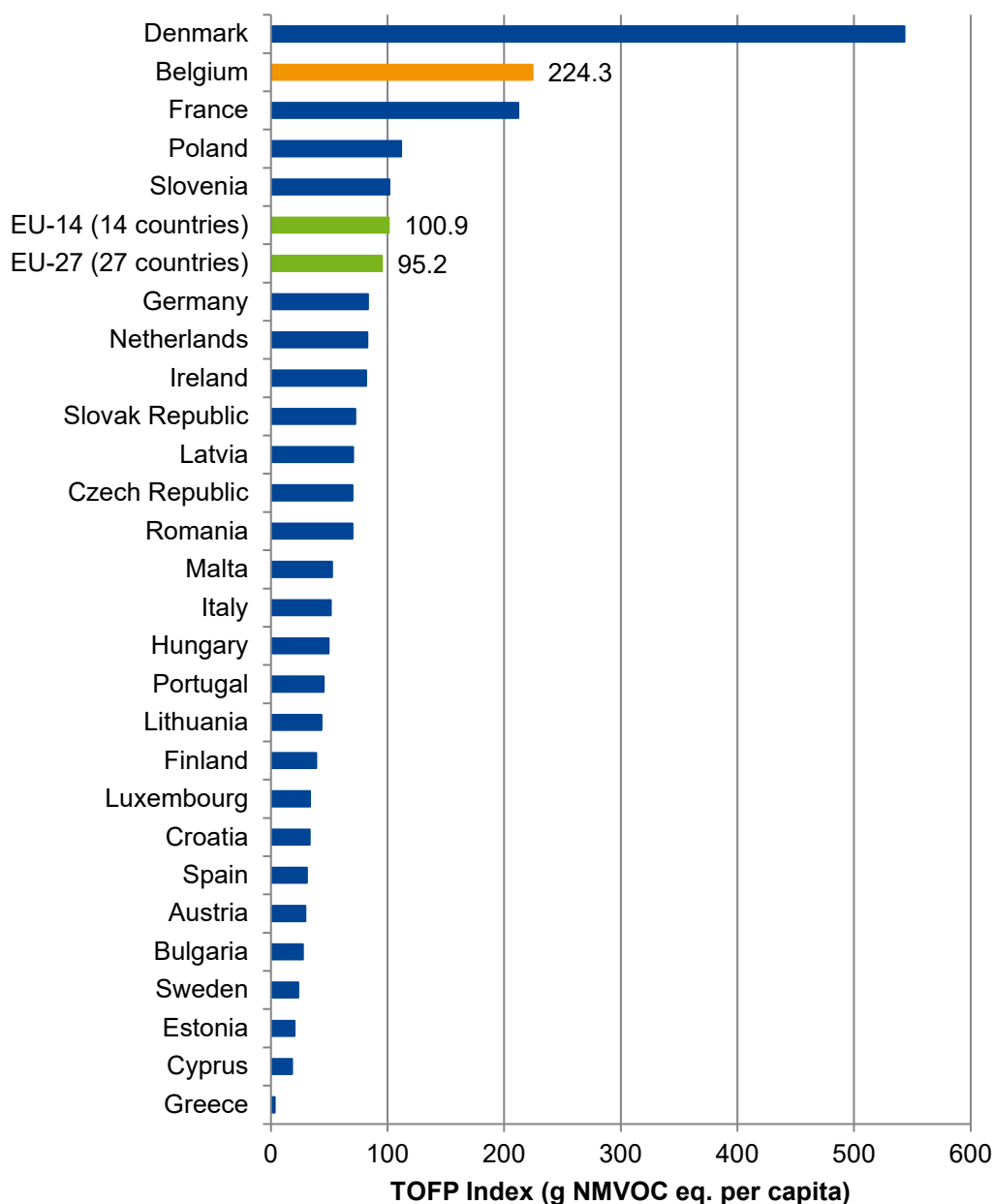
Figure 42 – TOFP index for human health activities (Q86) by region


Source: Federal Planning Bureau (June 2025); 2022 data in Wallonia are based on projections.

INTERNATIONAL COMPARISON

The TOPF index of Belgium is the second highest among European countries in 2023, with 224 g per capita of non-methane volatile organic components (EU-14: 101 g per capita, EU-27: 95 g per capita), as shown in Figure 43. Over the 2012-2023 period, the trend is upward for Belgium (+13.4%) with a peak in 2015, and downward for EU-14 (-30.4%) and EU-27 (-31.0%) (see Figure 44). However, as explained in the documentation sheet, international comparison per NACE sector should be used with caution.

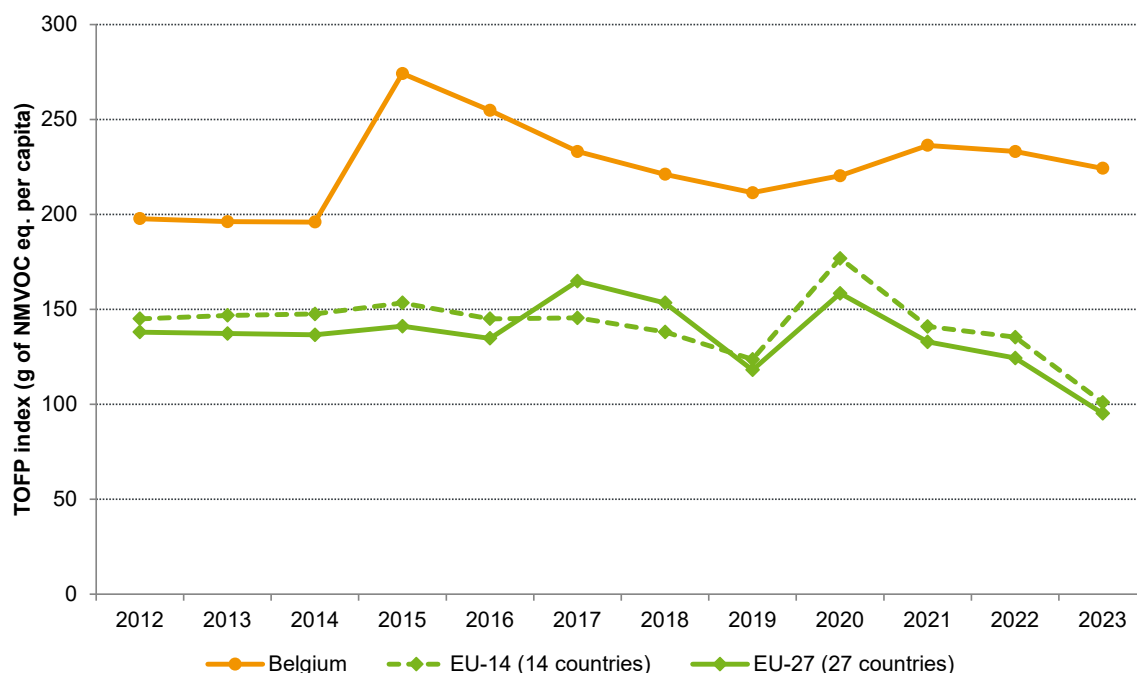
Figure 43 - European comparison for TOPF index (2023)



Source: Eurostat (air emissions accounts), November 2025



Figure 44 – European comparison for TOPF index (2012-2023)



Source: Eurostat (air emissions accounts), November 2025

KEY POINTS

- Ozone in the lower layer of the atmosphere (troposphere) can generate smog, which is harmful to health, especially for people with respiratory disorders. Ozone precursors, measured using the TOPF index, include non-methane volatile organic compounds (NMVOC), nitrogen oxides (NO_x), carbon monoxide (CO), and methane (CH₄), with NO_x as the most significant source of emissions from the healthcare system (78% in 2023),
- Even if human health activities (Q86 in NACE) account for only a small proportion of ozone precursor emissions in Belgium, representing only 1% of total emissions from all NACE activities in 2023, this share has almost doubled since 2012 (0.55% in 2012).
- Regional differences can also be highlighted. Wallonia's emissions per capita are twice as high as those of Flanders or Brussels in 2022 (350.5 compared to 155.6 and 123.6 g of NMVOC eq per capita in Wallonia, Flanders and Brussels, respectively). More in-depth analysis is required to determine the underlying cause of these differences.
- Belgium's per capita emissions in 2023 (224.3 g of NMVOC per capita) are more than twice as high as those of the EU-14 and EU-27 averages (100.9 and 95.2 g of NMVOC per capita). Moreover, they increased by 13.4% between 2012 and 2023, whereas both EU averages declined markedly over the same period (EU-14: -30.4%; EU-27: -31.0%). However, methodological factors may explain these differences (see the documentation sheet). International comparisons must therefore be used with caution.



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3 BUILDING AND ENERGY MANAGEMENT

3.1 Fossil fuel consumption in the healthcare sector (ENV-8)

3.1.1 Documentation sheet

Description	Primary indicator: A. Annual fossil energy consumption of the healthcare sector (gigajoules per capita) Secondary indicator: B. Absolute annual fossil energy consumption of the healthcare sector (terajoules) C. Annual fossil energy consumption of the healthcare sector (% total energy consumption of the healthcare sector) D. Annual fossil energy consumption of the healthcare sector (% fossil energy consumption in Belgium, all sectors)
Rationale	Fossil fuel combustion is a key driver of healthcare's climate footprint, accounting for the majority of energy-related emissions. ¹ Measuring fossil fuel use provides a clear indicator of the sector's reliance on non-renewable energy and its contribution to global warming. Belgium's commitment to a climate neutral health system by 2050 requires tracking this dependency to guide the transition toward renewable energy and sustainable operations. ²
Calculation	Primary indicator (A): - Numerator: Annual fossil fuel consumption in the healthcare sector - Denominator: / Secondary indicators: Indicator B: - Numerator: Annual fossil fuel consumption in the healthcare sector - Denominator: Population of the corresponding year (calculated as mean of population at beginning and end of year) Indicator C: - Numerator: Annual fossil fuel consumption in the healthcare sector - Denominator: Annual energy consumption of the healthcare sector Indicator D: - Numerator: Annual fossil fuel consumption in the healthcare sector - Denominator: All-sector annual fossil energy consumption
Data source	Federal Planning Bureau Eurostat energy supply and use by NACE Rev.2 activity database ³ Eurostat Population (national level) ⁴ Finhosta (compulsory financial hospital registrations, including accounting data)
Technical definitions	For this indicator, Physical Energy Flow Accounts (PEFA) were used, conceptually rooted in the System of Environmental-Economic Accounting (SEEA) framework, the international statistical standard. PEFA are part of the European environmental-economic accounts framework ⁵, structured under Regulation (EU) 691/2011 ⁶. They track energy flows in terajoules across three main stages: from the environment to the economy (natural inputs), within the economy (products), and back to the environment



(residuals). These flows are organized using physical supply and use tables, aligning fully with national accounts principles to support integrated environmental-economic analysis. The data is broken down by supply and use types, energy products, economic activities, indicators, geopolitical entities, time (annual), and unit (terajoules). For this indicator, table B was consulted, covering energy use including both transformation use and end use. As for the determination of the sector, NACE R2 code Q86 corresponding to human health activities (excluding residential care facilities) was utilized. The following products were considered to be fossil fuels: fossil non-renewable natural energy inputs (N01); hard coal (P08); brown coal and peat (P09); derived gases (manufactured gases excl. biogas) (P10); secondary coal products (coke, coal tar, parent fuel, BKB and peat products) (P11); crude oil, NGL, and other hydrocarbons (excl. bio) (P12); natural gas (without bio) (P13); motor spirit (without bio) (P14); kerosenes and jet fuels (without bio) (P15); naphtha (P16); transport diesel (without bio) (P17); heating and other gasoil (without bio) (P18); residual fuel oil (P19); refinery gas, ethane and LPG (P20); other petroleum products incl. additives/oxygenates and refinery feedstocks (P21). Other (non-fossil) fuels considered in the PEFA classification are: natural energy inputs (N00); nuclear non-renewable natural energy inputs (N01); hydro based renewable natural energy inputs (N03); wind based renewable natural energy inputs (N04); solar based renewable natural energy inputs (N05); biomass based renewable natural energy inputs (N06); other renewable natural energy inputs (N07); nuclear fuel (P22); wood, wood waste and other solid biomass, charcoal (P23); liquid biofuels (P24); biogas (P25); electrical energy (P26); heat (P27).

For the Finhosta data, we based ourselves on accounts for coal (C60400 and C60410), gas (C60403 and C60412), fuel oil (C60403 and C60413) and vehicle fuel (C60415).

International comparability

Statistical Classification of Economic Activities in the European Community (NACE) <https://ec.europa.eu/eurostat/web/nace/overview>) allows European comparison. For a description of NACE-Bel, see:

[https://statbel.fgov.be/sites/default/files/Over Statbel FR/Nomenclaturen/NACE-BEL%202008_FR.pdf](https://statbel.fgov.be/sites/default/files/Over%20Statbel%20FR/Nomenclaturen/NACE-BEL%202008_FR.pdf) (pp. 465-474)⁷

However, comparability between countries is not guaranteed. Differences across countries in the allocation of fuel consumption linked to road transport among NACE activities can for example have a noticeable effect and may affect cross-country comparability. A study performed by Eurostat has showed important variations between countries regarding the share of CO₂ emissions from road transport by economic activity, with coefficients of variance greater than 40% for each of the NACE activities, suggesting that the comparability across countries is most likely not given.⁸

PEFA data is annually compiled by Eurostat for EU Member States, EFTA countries, and EU candidate or potential candidate countries, depending on data availability. This broad geographical scope allows for comparative analysis across national economies, while maintaining consistency with the residence principle—meaning energy flows are attributed to resident units regardless of where the activity physically occurs. Given substantial differences in methodologies, data sources and underlying assumptions, international comparisons should be interpreted with caution.

Limitations

The PEFA data come from a model based on activity, not on measurements.

Residential care activities and social work activities without accommodation (Q87–Q88) were aggregated, making it impossible to isolate data for Q87 alone. Consequently, only human health activities (Q86) are considered as a proxy for the health care system, while residential care activities were excluded.

Differences with other EU countries and jumps observed in data (in 2015 and 2021) can partly be explained by methodological factors:

- In Wallonia, a new and more accurate method has been applied since 2021 to estimate energy consumption, using data directly from distribution network operators. Nevertheless, previous years were not retroactively modified, which can partly explain a jump in data in 2021 in Wallonia.

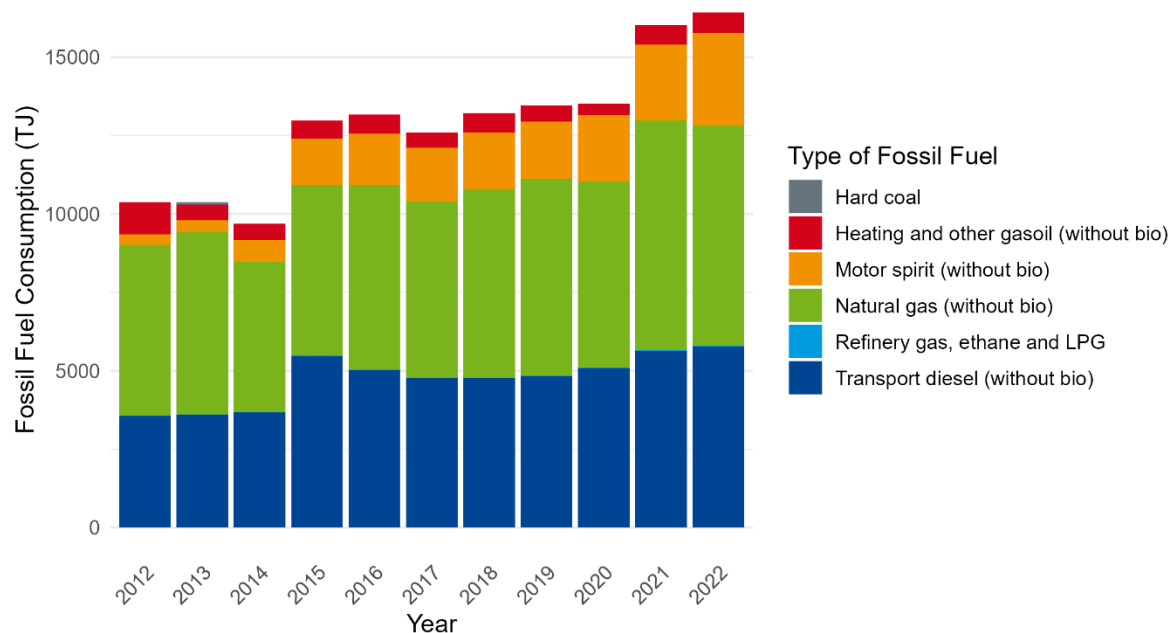


	Fuel consumption linked to road transport are based on the COPERT 5 model and allocation keys among NACE sectors vary between countries. In Belgium the allocation key is based on excise duties for Eurostat 2025 data, whereas previous estimates (e.g. 2024 data) relied on vehicle registrations. Excise duties are considered more reliable; however, this new approach appears to have an important impact for Q86 emissions: GHG emissions in human health activities in Eurostat version released in 2024 are quite stable across the years while an important increase is observed in Eurostat version released in 2025 (see details in “data sources comparison”). Because of the methodological heterogeneity between countries, road transport data were excluded from international comparisons where possible. Excise duties are calculated on a five-year basis (2010, 2015, 2020) using an “structural survey” of the National Bank of Belgium while intermediate years are based on less detailed surveys and extrapolations. As 2014 is based on an extrapolation of 2010 data, a jump in excise data is observed in 2015, which can partly explain the 2015 jump in GHG emissions.
Dimension	Environmental sustainability
Related indicators	ENV-1 GHG emission footprint in the healthcare sector, ENV-4 Annual direct GHG emissions
Supervisor	Helena Van Deynse
Reviewers	Jehan Charlier

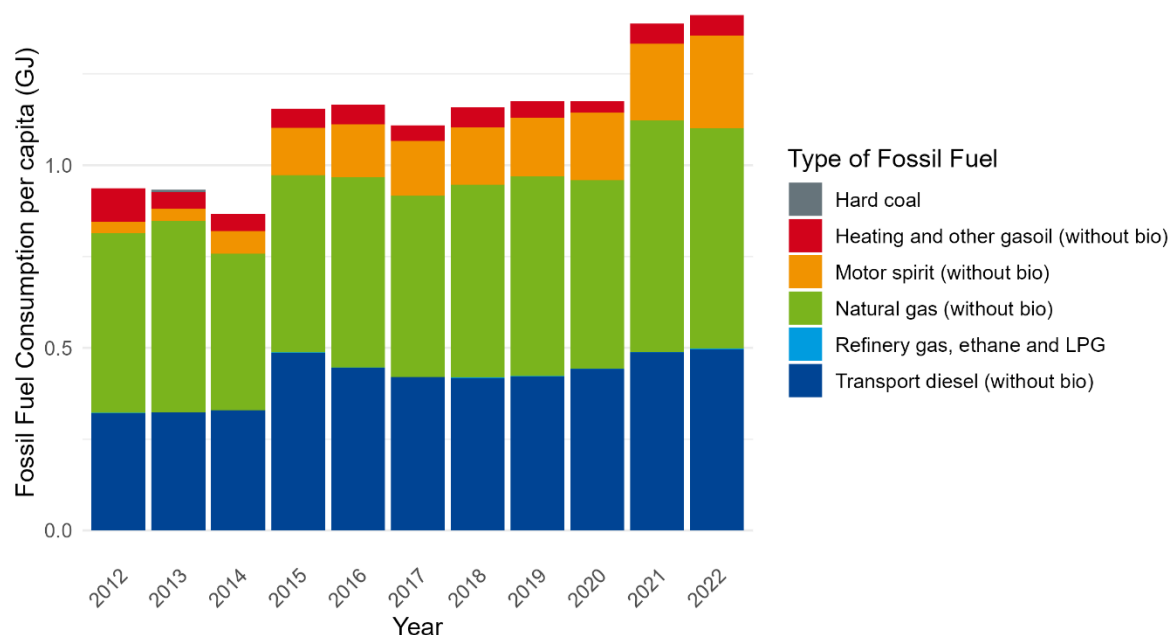
3.1.2 Results

BELGIUM

A total of 16 428 terajoules (TJ) of fossil fuels were consumed by the healthcare sector in Belgium during the year 2022, which is the equivalent of 1.4 GJ per capita. This corresponds to 76% of all energy used in Belgian human health activities (21 679.7 TJ). When considering total all-sector Belgian fossil fuel consumption, 0.7% can be attributed to healthcare. An upward trend over time can be noticed in Figure 45, which persists when accounting for population size (Figure 46). In the healthcare sector, fossil fuels are consumed primarily for transportation (diesel and motor spirits) and for heating purposes (natural gas and oil products), as shown in Figure 45 and Figure 46.

Figure 45 – Fossil fuel consumption by type (2012-2022)

Source: Federal Planning Bureau (PEFA) 2025

Figure 46 – Fossil fuel consumption per capita by type (2012 - 2022)

Source: Federal Planning Bureau (PEFA) 2025

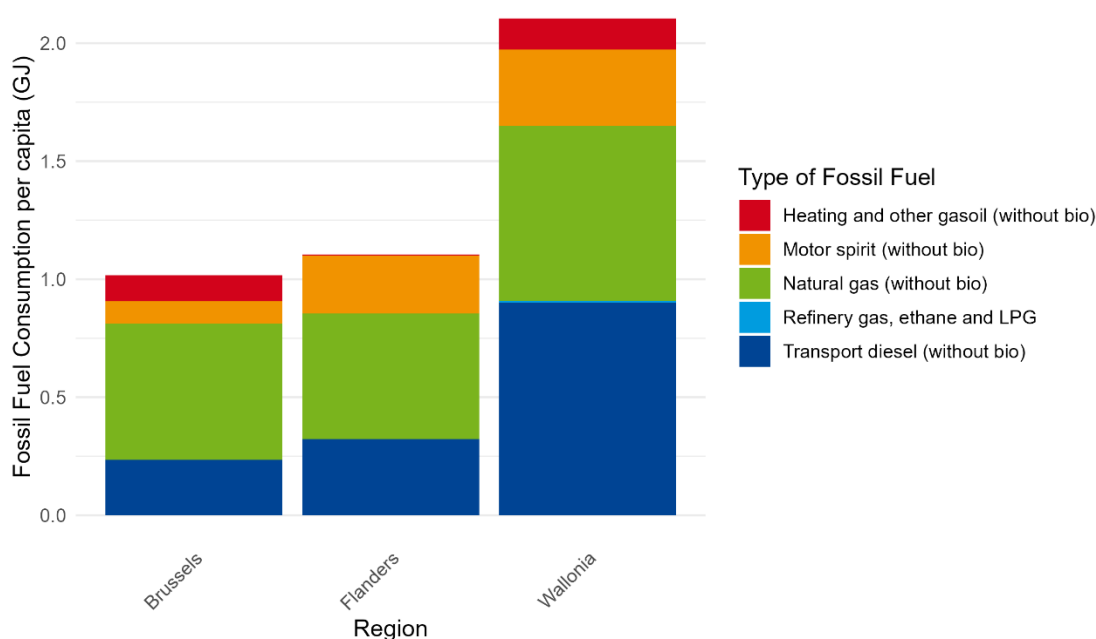
REGIONAL COMPARISON

Regional comparison of per capita fossil fuel consumption in Figure 47 shows similar total consumptions in Brussels and Flanders (1 GJ per capita), while Wallonia has double this amount (2 GJ per capita). This difference can largely be attributed to transportation, mostly diesel but also motor



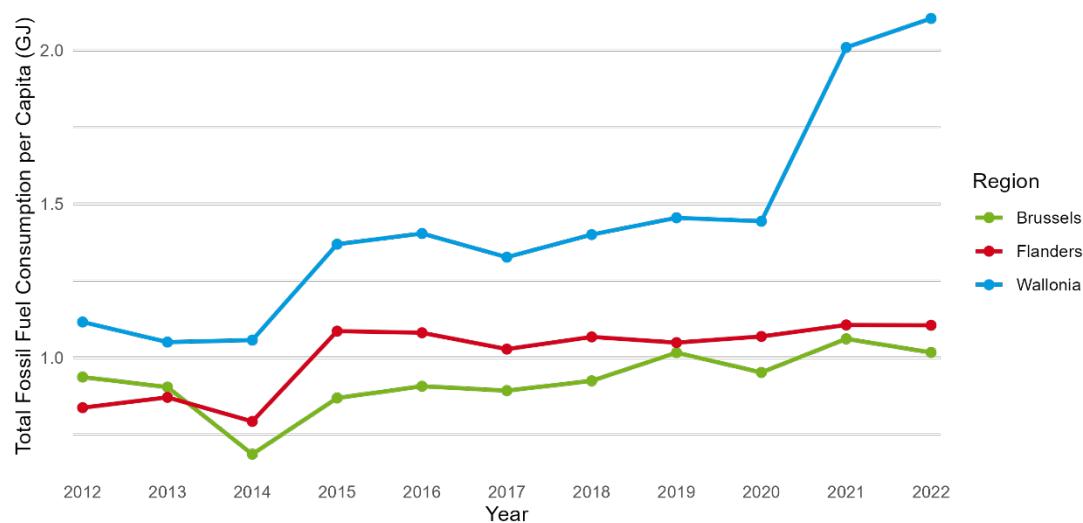
spirits (petrol). When looking at the regional evolution over time in Figure 48, a considerable increase in fossil fuel consumption can be observed in 2021, but this can be explained by a change in methodology in the Walloon region.

Figure 47 – Fossil fuel consumption by region (2012 - 2022)



Source: Federal Planning Bureau (PEFA) 2025

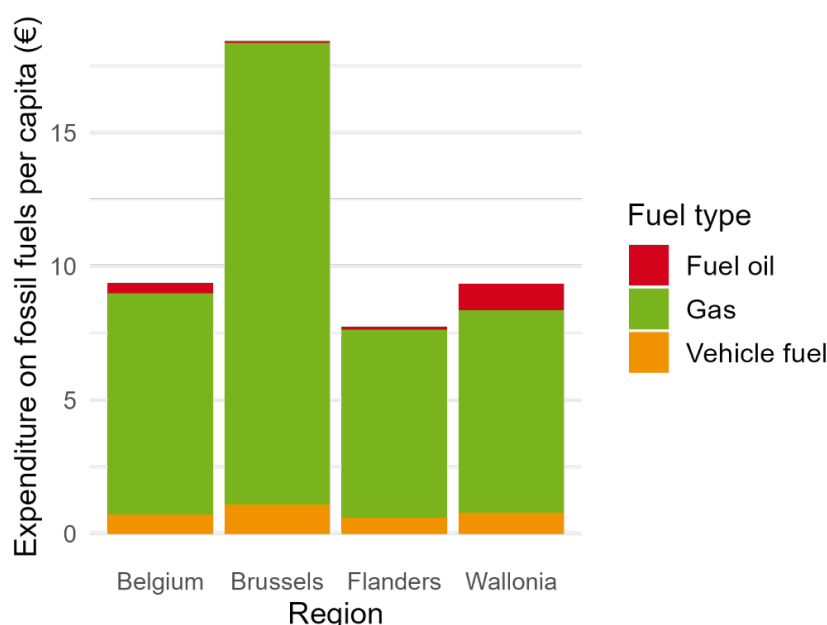
Figure 48 – Evolution of fossil fuel consumption over time by region (2012 - 2022)



Source: Federal Planning Bureau (PEFA) 2025

Finhosta provides a different data source that allows comparison between regions. While these data capture expenditure rather than usage and only concern hospitals, they are not confronted with the inherent methodological differences between regions and therefore represents an interesting complementary data source for comparison among regions. Figure 49 shows that hospitals in Brussels clearly have the largest fossil fuel expenditure per capita. It must be noted, however, that hospitals in Brussels likely serve patients from Flanders and Wallonia as well. Furthermore, hospital expenditure on fuel oil is clearly higher in Wallonia than in Flanders or Brussels. Finally, expenditure on vehicle fuel was largest in Brussels.

Figure 49 – Fossil fuel expenditure in hospitals by region and type of fuel (2024)



Source: Finhosta 2026

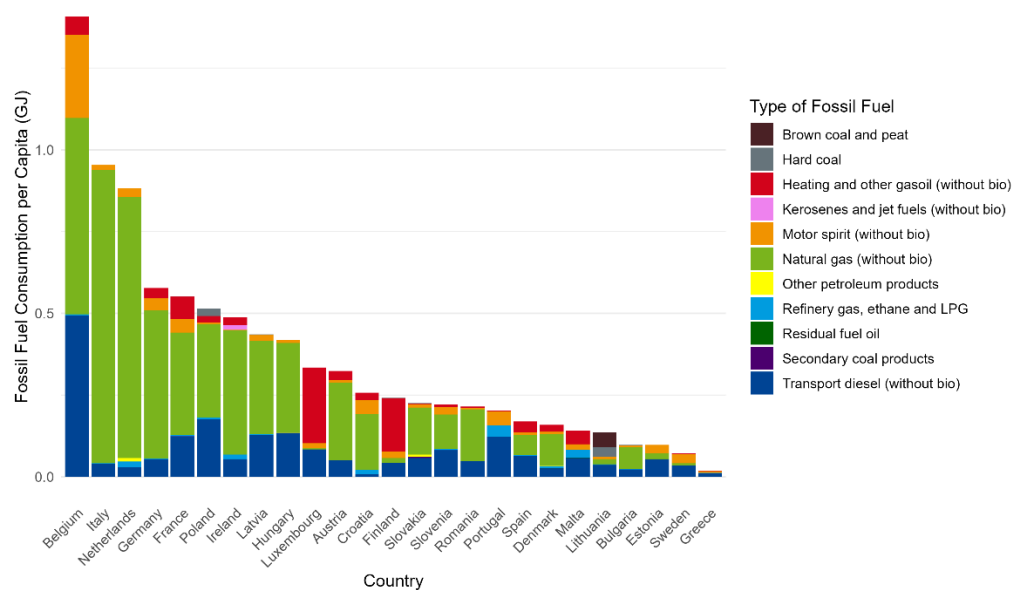
INTERNATIONAL COMPARISON

In most countries, natural gas accounts for the majority of fossil fuel use. In Belgium, however, this share is noticeably smaller. Instead, transport fuels make up a proportionally larger share of healthcare's fossil fuel consumption. As shown in Figure 50, Belgium has the highest healthcare-related per capita fossil fuel consumption in the European Union, which is largely driven by its substantially higher per capita use of transport fuels. Given the methodological heterogeneity for the estimation of transport fuels, this should be interpreted with caution. Therefore, for the longitudinal comparison, Figure 51 shows data with and without the inclusion of transport fuels. While Belgium is either way above both the EU14 and the EU27 average, the gap is much closer when transport is excluded.

With 25%, Belgium also has the largest proportion of energy consumption derived from fossil fuels in healthcare (see Figure 52), where the average of the European Union is only 18%. Finally, as for the proportion of all-sector fossil fuel consumption attributable to healthcare, Belgium ranks substantially above the European Union average of 0.4% (Figure 53).

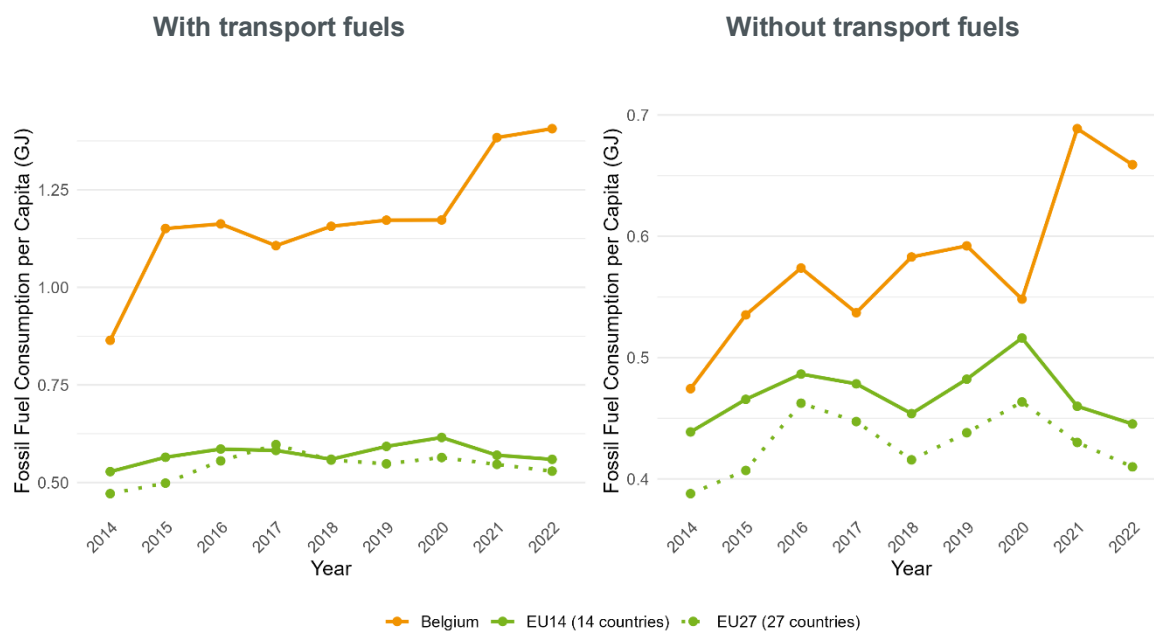


Figure 50 – Fossil fuel consumption per capita by type and country (2022)

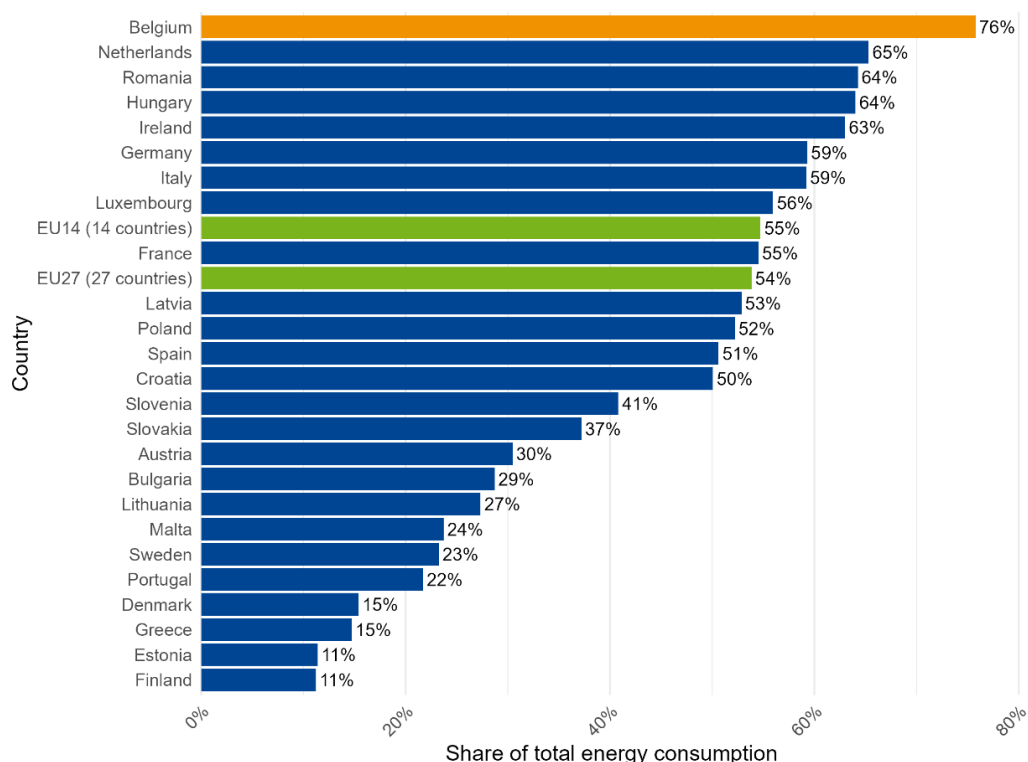


Source: Eurostat energy supply and use by NACE Rev.2 activity database 2025

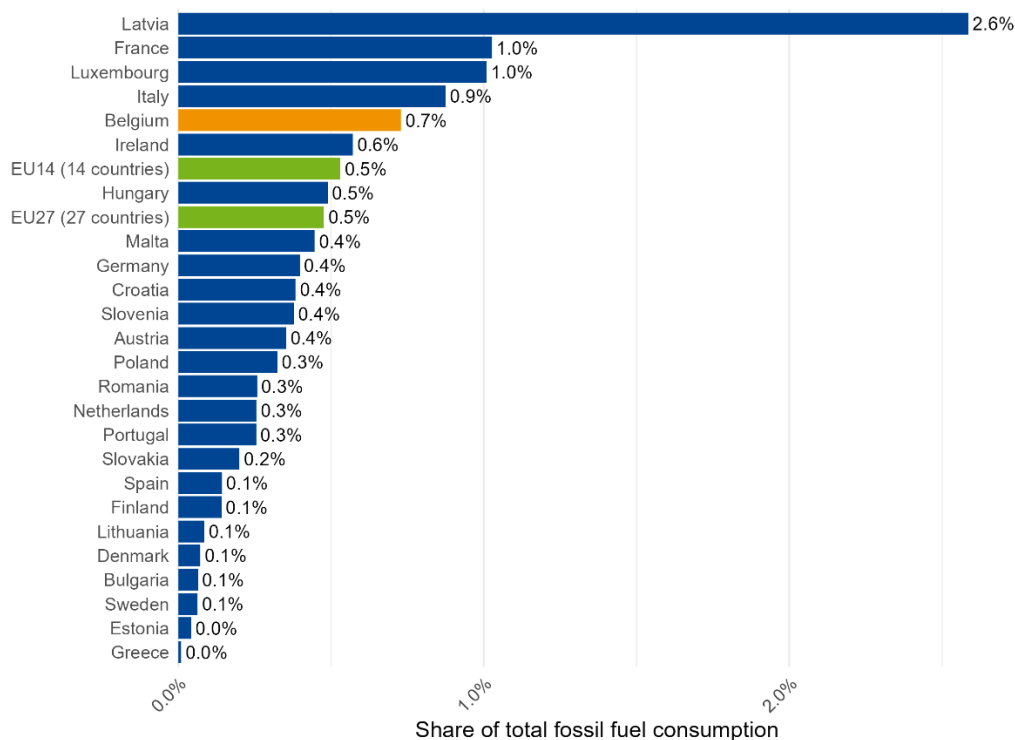
Figure 51 – Fossil fuel consumption per capita and year with and without transport fuels



Source: Eurostat energy supply and use by NACE Rev.2 activity database 2025

Figure 52 – Share of fossil fuel among total energy consumption in the healthcare sector (2022)

Source: Eurostat energy supply and use by NACE Rev.2 activity database 2025

Figure 53 – Healthcare share of all-sector fossil fuel consumption, excluding transport (2022)

Source: Eurostat energy supply and use by NACE Rev.2 activity database 2025



KEY POINTS

- A total of 16 428 terajoules (TJ) of fossil fuels, corresponding to 1.4 gigajoules (GJ) per capita were consumed in the human health activities sector in Belgium during the year 2022. This represents 76% of healthcare's total energy consumption. When excluding transport, human health activities represent 0.7% of Belgium's all-sector fossil fuel use.
- There is an upward trend of fossil fuel usage over time, even when adjusting for population size.
- In the Belgian healthcare sector, fossil fuels are mainly used for transport and heating purposes.
- Wallonia has larger per capita usage of transport fuels and fuel oil than Brussels and Flanders.
- Belgium's fossil fuel consumption is above the EU-average, both with and without inclusion of transport fuels and the largest share of fossil fuel among total energy consumption in the healthcare sector.

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3.2 Energy audits/scans in care facilities in the Flemish region (ENV-9)

3.2.1 Documentation sheet

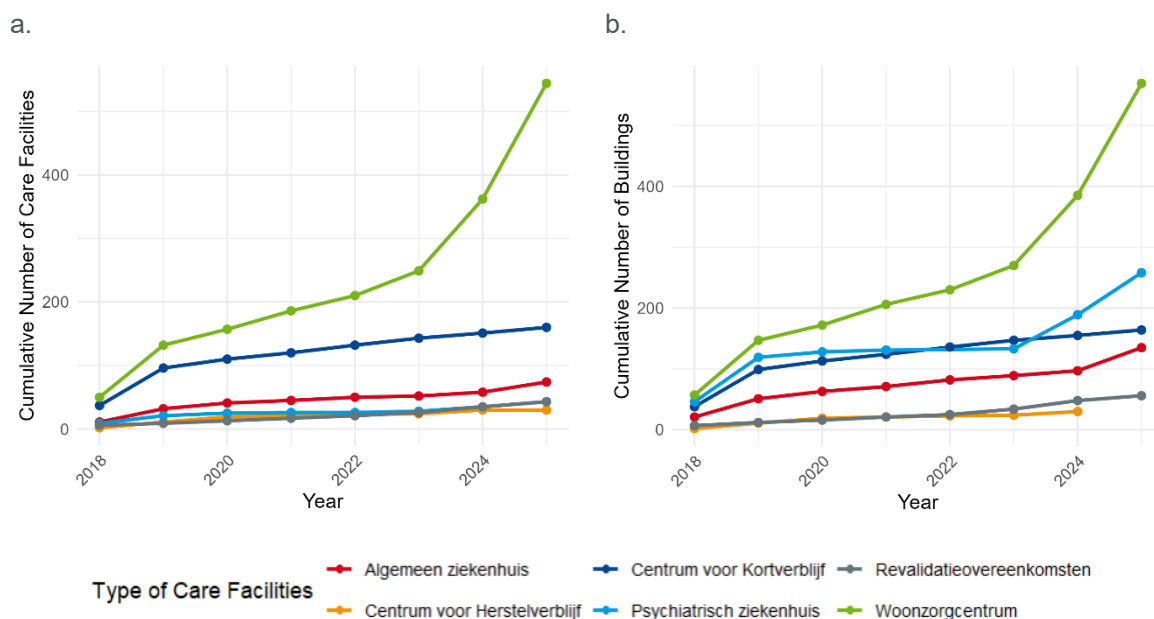
Description	Primary indicator: A. General hospitals that had an energy audit since 2018 in the Flemish region (percentage) Secondary indicator: B. General hospitals that had an energy audit in the Flemish region (number) C. Care facilities and buildings that had an energy audit since 2018 in the Flemish region (number) D. Care facilities that had an energy audit since 2018 (percentage) (per type of facility and per province of the Flemish region) E. Care facilities that received energy subsidies since 2018 (percentage) (per type of facility and per province of the Flemish region) F. Top 10 most commonly recommended and subsidized measures to improve energy efficiency in general hospitals of the Flemish region
Rationale	Hospitals and care facilities are energy-intensive public buildings, and their decarbonisation requires systematic assessment and continuous improvement. International organisations such as Health Care Without Harm (HCWH), the G20 and the Nordic Center for Sustainable Healthcare (NCSH) identify energy-efficient buildings as a key component of climate-related strategies in the healthcare sector ¹⁻³. Energy audits provide a structured basis for identifying inefficiencies and for planning targeted actions to reduce energy consumption and associated greenhouse gas emissions. In Belgium, the Operation Zero project estimates the annual direct emissions of the healthcare sector at 1.084 kt CO₂e, implying an expected ETS2 cost of about 65 million euro per year (at 60 euro per tonne CO₂) ⁴. Energy audits and the corresponding investment subsidies currently generate an estimated potential financial effect of 31 million euro annually for Flanders (calculation by VIPA, based on ⁵ and ⁴). This is relevant in light of recent analyses showing that hospitals face increasing budgetary pressure ⁶. Although lower energy prices temporarily eased operating costs in recent years, future ETS2-related expenses are expected to rise. Energy audits and related investment support therefore offer a structured approach to identifying and implementing cost-efficient energy-reduction measures.
Calculation	Primary indicator (A): • Numerator: The number of general hospitals that had an energy audit since 2018 • Denominator: Total number of active general hospitals (dd. August 2025) Secondary indicators: Indicator B: • Numerator: The number of general hospitals that had an energy audit since 2018 • Denominator: / Indicator C: • Numerator: The number of care facilities/buildings that had an energy audit since 2018 • Denominator: / Indicator D: • Numerator: The number of care facilities that had an energy audit since 2018 • Denominator: The total number of active care facilities (dd. August 2025)



	Indicator E: • Numerator: The number of care facilities that received energy subsidies since 2018 • Denominator: The total number of active care facilities (dd. August 2025)
Data source	The Flemish Infrastructure Fund (VIPA 2025)
Technical definitions	The Flemish Infrastructure Fund (VIPA), in collaboration with the Flemish Energy Company (VEB), supports healthcare and welfare facilities in improving energy efficiency and climate resilience. Since 2018, VIPA offered free (until 2025), tailored energy scans or audits conducted by qualified energy specialists. These audits provide a detailed assessment of a building's energy consumption, technical installations, and the condition of the building envelope, with the aim of identifying measures reducing energy use and enable renewable energy production, as well as offering detailed insight in costs and indicating potential savings. An energy scan focuses on short- to medium-term measures that help achieve the 2030 climate objectives. An energy audit takes a longer-term perspective, proposing measures that contribute to carbon neutrality by 2045–2050 and includes a full energy balance and heat loss calculation. In this analysis, no distinction is made between an energy scan and an energy audit. The outcome of both energy scans and audits is a dynamic action plan listing recommended measures, their estimated payback period, and potential CO₂ reduction. Facilities can adjust this plan themselves, while investment costs and savings are automatically recalculated. Climate subsidies are available for measures with a payback period longer than five years, and all energy-saving measures are eligible for interest-free loans.
International comparability	To the best of our knowledge, there are no public international reports on similar data.
Limitations	Data are only available for Flanders and facilities in Brussels under the authority of the Flemish government. Data on invested amounts by hospitals are unavailable. However, data on governmental subsidies provide some insight on this matter.
Dimension	Environmental sustainability
Related indicators	/
Supervisor	Helena Van Deynse
Reviewers	Frédérique Vander Elst

3.2.2 Results

Since its launch in 2018, an energy scan/audit was conducted in 52 out of 59 active general hospitals. In the healthcare sector as a whole, as shown in Figure 54, 424 facilities and 466 buildings were residential care facilities, representing the majority of assessments. These numbers have known a steep increase in 2023 and onwards, when energy audits had become mandatory for many large and medium sized organisations.

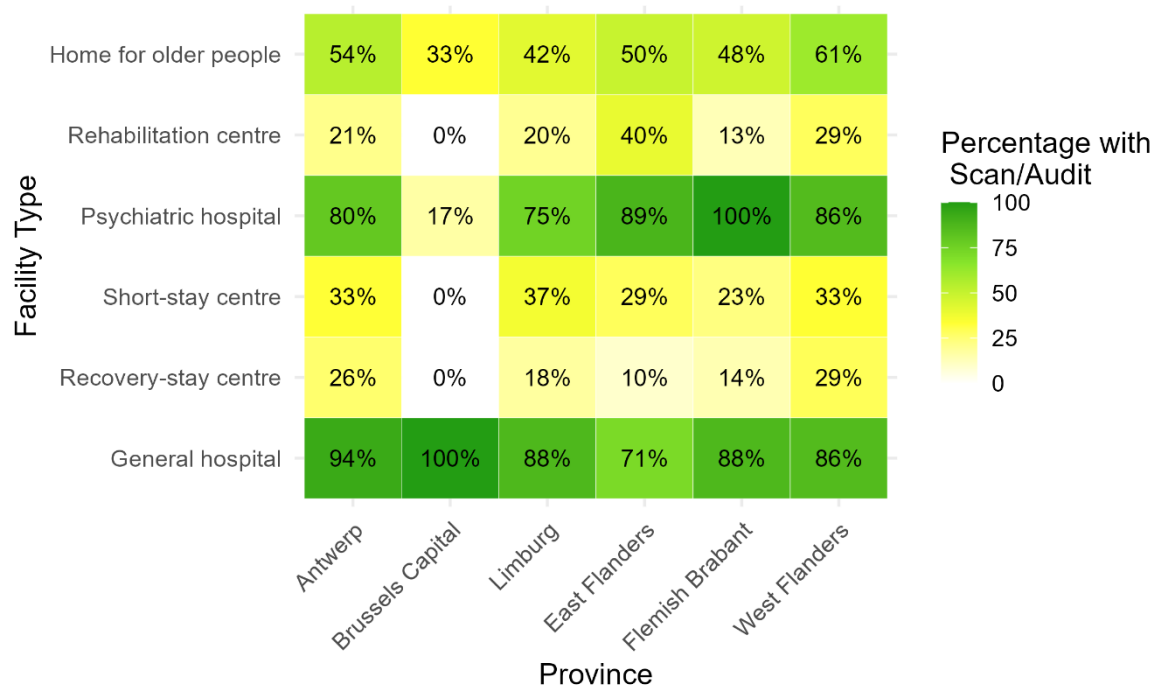
Figure 54 – Cumulative Number of (a) Care Facilities and (b) Buildings with a Scan/Audit

Source: VIPA 2025

While residential care facilities may be the most frequently audited type, this is not the type of care facility with the largest proportion scanned/audited (as displayed in Figure 55), nor subsidized (as shown in Figure 56). General and psychiatric hospitals are indicated as having the largest proportion of facilities scanned/audited as well as subsidised. This is a positive finding given that the greatest potential of healthcare-related reduction of emissions is with hospitals, as they are responsible for approximately 55% of the emissions of the healthcare sector {FPS Public Health, 2025 #356}. Furthermore, it must be noted that the number of facilities in the Brussels Capital Region is very low, thus explaining the extreme values of many facility subtypes in Figure 55. No major differences emerge between Flemish provinces, except a lower share of subsidised facilities in Flemish Brabant. Without information on the result of the scan/audit, it is hard to gain more insight in this finding.

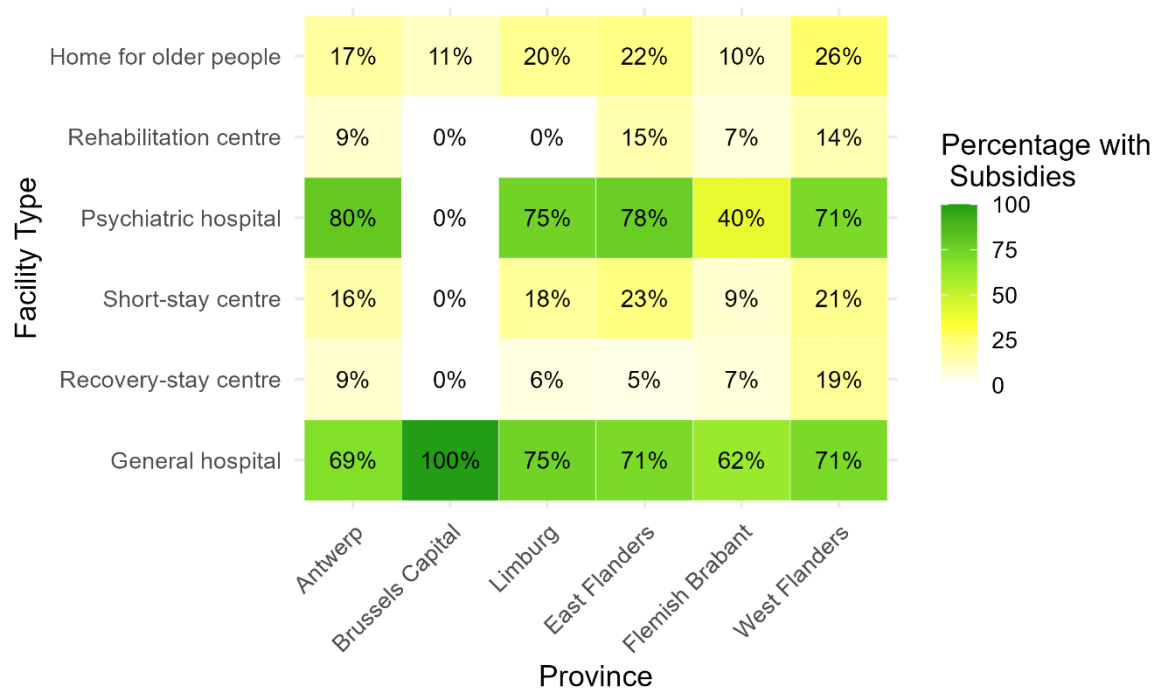


Figure 55 – Proportion of Facilities with Scan/Audit by Type and Province (2018-2025)



Source: VIPA 2025

Figure 56 – Proportion of Facilities with Subsidies by Type and Province (2018-2025)



Source: VIPA 2025

RECOMMENDED AND SUBSIDISED MEASURES

Table 16 shows the top 10 of interventions for general hospitals that were proposed on the basis of an energy scan/audit. The majority of proposed interventions had a payback period longer than five years, thereby potentially qualifying for VIPA subsidies, which are shown in Table 17 ordered by assigned budget. The most frequently recommended and subsidised intervention involved relighting or relamping, while photovoltaic panels consistently ranked among the top three as well. The subsidised measures for general hospitals listed in Table 17 account for 77% of the total amount of €36 654 703.5 spent until today.

Table 16 – Top 10 most recommended measures in general hospitals

	Recommended measure	Frequency	Proportion with payback period ≤ 5y
1.	Relighting/Relamping	189	17%
2.	Photovoltaic panels	140	19%
3.	Monitoring	77	19%
4.	Pump/valve/hydraulic insulation	75	19%
5.	Boiler room renovation	72	0%
6.	Regulation and control measures	72	31%
7.	Heat pumps and cooling systems	63	0%
8.	Aluminium frame renovation	59	0%
9.	Outer facade	52	0%
10.	Roof insulation	48	0%

Source: VIPA 2025

**Table 17 – Top 10 of subsidised measures in general hospitals***Source: VIPA*

	Recommended measure	Frequency	Budget	Proportion of total budget
1.	Relighting/Relamping	20	€ 8 380 520.80	23%
2.	Ventilation renovation	14	€ 4 483 641.60	12%
3.	PV panels	29	€ 4 070 059.66	11%
4.	Boiler room renovation	21	€ 3 303 485.20	9%
5.	Joinery renovation	10	€ 2 242 035.00	6%
6.	Heat pumps and cooling systems	5	€ 1 452 479.73	4%
7.	Central heating	2	€ 1 389 000.00	4%
8.	Other	21	€ 1 095 160.00	3%
9.	Roof insulation	16	€ 1 057 425.00	3%
10.	Pump replacement	18	€ 894 318.80	2%

KEY POINTS

- An energy scan/audit was conducted in 52 out of 59 active general hospitals between 2018 and 2025. This cumulative share increased from 18.6% in 2018 to 88.1% in 2025.
- General and psychiatric hospitals are the most commonly audited and subsidised type of care facility. This is a positive finding given that the greatest potential of healthcare-related reduction of emissions is with hospitals, as they are responsible for approximately 55% of the emissions of the full healthcare sector.
- The most commonly recommended measure for general hospitals was related to relighting or relamping. This category of interventions was also assigned the largest subsidy budget. The second most commonly recommended measure was the installation of photovoltaic panels, which was also the third most frequently subsidized intervention.
- At present, no new VIPA subsidies are available for energy audits in healthcare facilities, as the current Flemish Government has not allocated funds for these climate objectives.



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4 HIGH CARBON MEDICAL PRODUCTS

4.1 Prescribing of low-carbon reliever inhalers (SABA) and preventer (ICS-LABA) inhalers (ENV-10)

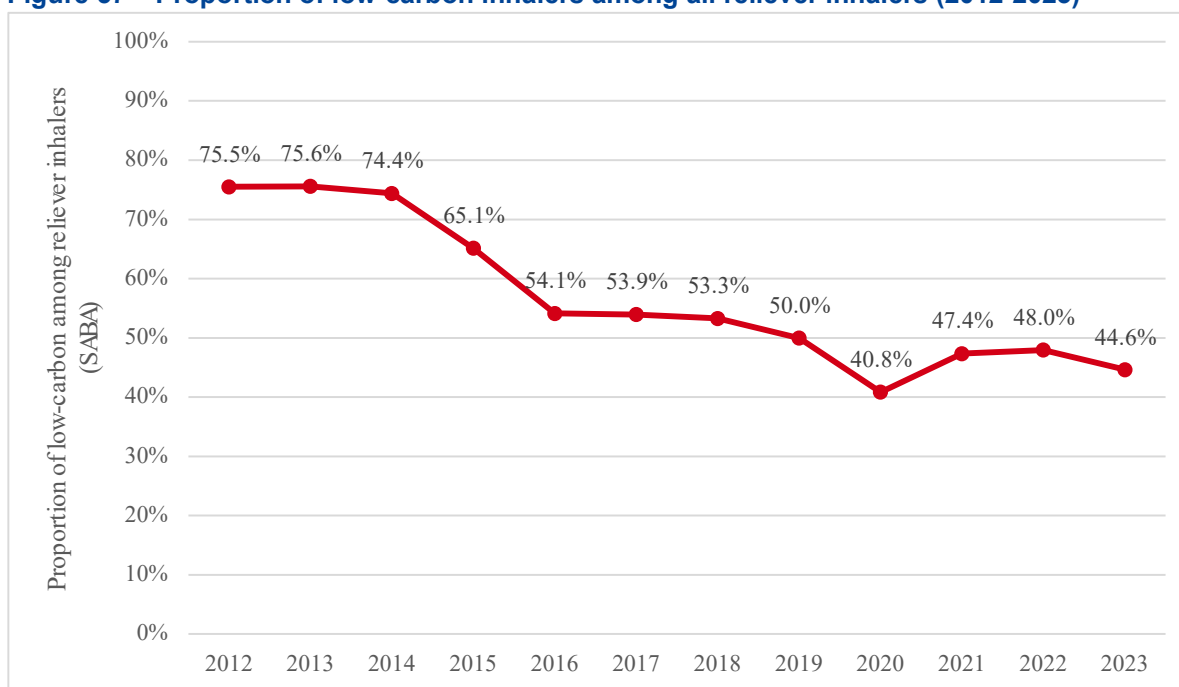
4.1.1 Documentation sheet

Description	Primary indicators: Prescribing of low-carbon reliever (SABA) inhalers as a proportion of all SABA inhaler prescribing (%) Prescribing of low-carbon preventer (ICS-LABA) inhalers as a proportion of all preventer inhaler prescribing (%)
Rationale	Inhalers are used by patients with respiratory diseases (e.g. asthma, chronic obstructive pulmonary disease (COPD)) either to relieve patients from symptoms, or to prevent symptoms. Currently marketed metered-dose inhalers (MDIs) use propellant gases with a high global-warming potential. Other forms of inhalers, such as soft mist or dry powder inhalers (DPIs) have a much more lower impact and should be substituted whenever possible.
Calculation	Sum of all quantities of liquid and dry powder inhalers (=low carbon) divided by the total quantity of inhalers (liquid, dry powder and pressurised metered-dose inhalers)
Data source	IMA – AIM (Pharmanet and Gezondheidszorg – Soins de Santé (GZSS) datasets)
Technical definitions	For relievers, short-acting beta agonists (SABA) have been selected based on a reference file from INAMI – RIZIV (ATC-5 codes: R03AB02, R03AB03, R03AC02, R03AC03, R03AC04, R03AC08, R03AC18); among them, MDIs, DPIs and soft mist inhalers have been selected to calculate the ratio. The same has been done for preventers by selecting inhaled corticosteroid (ICS) and long-acting beta agonists (LABA) (ATC-5 codes: R03AC05, R03AC12, R03AC13, R03AK06, R03AK07, R03AK08, R03AK10, R03AK11, R03AK12, R03BA01, R03BA02, R03BA03, R03BA05, R03BA08).
International comparability	NHS England has a public dashboard. ¹
Limitations	-
Dimension	Environmental sustainability
Supervisor	Carl Devos
Reviewers	Diego Castanares (KCE), Antoine Froidure (Cliniques universitaires Saint-Luc)

4.1.2 Results

BELGIUM

The proportion of low carbon reliever inhalers have been decreasing over the studied period (2012-2023), going from 75.5% in 2012 to 44.6% in 2023 (Figure 57).

Figure 57 – Proportion of low-carbon inhalers among all reliever inhalers (2012-2023)

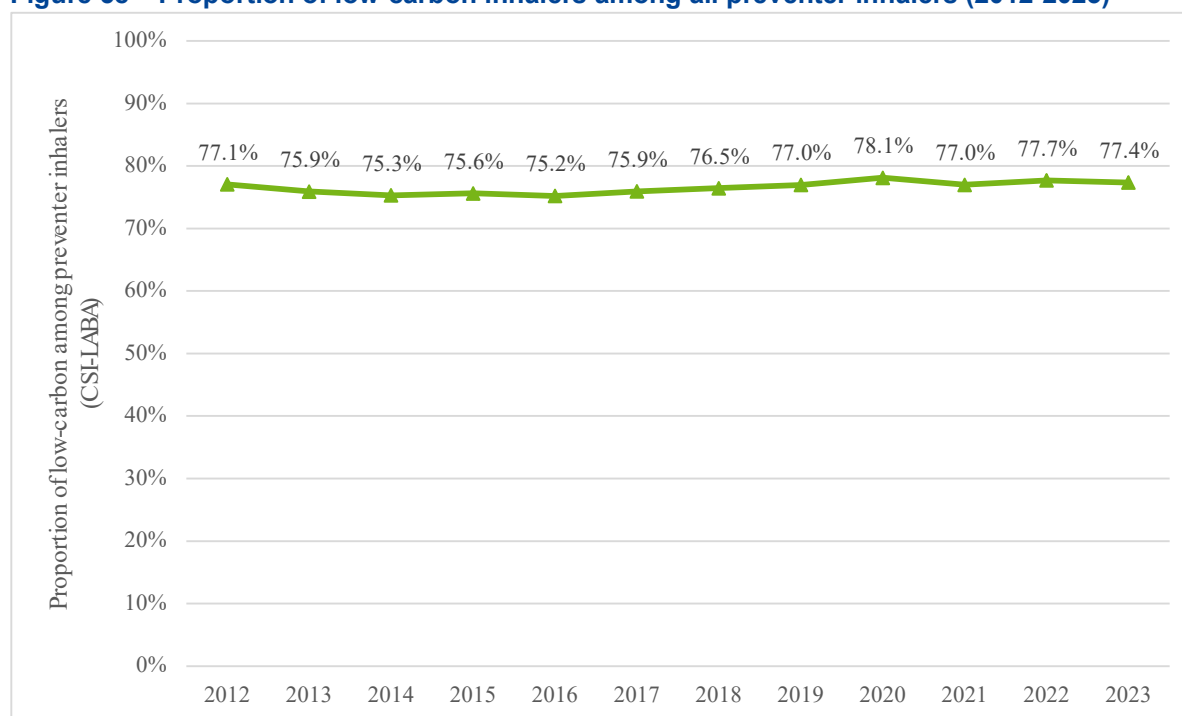
Source: IMA – AIM

This can be explained by two factors: the use of relievers has decreased by 50.7% between 2012 and 2023 (favouring preventers instead for asthma patients, except for children), and some specific low-carbon inhalers have almost disappeared over the period. The move towards more targeted SABA use could imply that when a SABA is used, it is in more severe cases and there is currently a lack of suitable low-carbon, high-efficacy alternatives that can deliver the necessary rapid relief for severe cases.

For the same period, the proportion of low carbon preventer inhalers has been stable: between 75% and 78% (see Figure 58); the total quantity of preventer inhalers has decreased by 7.2% in 2023 compared to 2012.



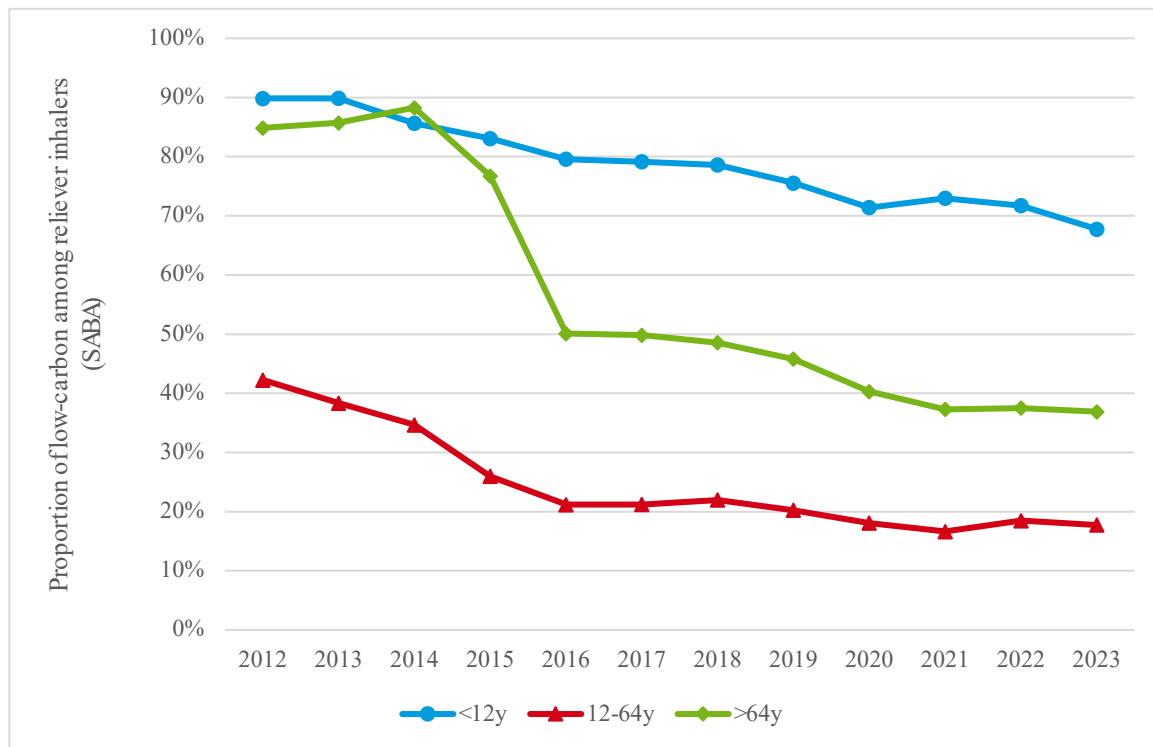
Figure 58 – Proportion of low-carbon inhalers among all preventer inhalers (2012-2023)



Source: IMA – AIM

ANALYSIS BY AGE

For reliever inhalers, adults (12-64 years old) have the lowest proportion of low-carbon inhalers use (17.7% in 2023), followed by older people (>64 years old) with an important decrease in 2015 and 2016 (36.9% in 2023); children (<12 years old) have a high proportion of low-carbon inhalers use, but it is dwindling from 89.8% in 2012 to 67.7% in 2023 (Figure 59). The use of reliever inhalers has strongly decreased over the period for older people (-73.9%), more than for adults (-33.9%) and children (-43.5%).

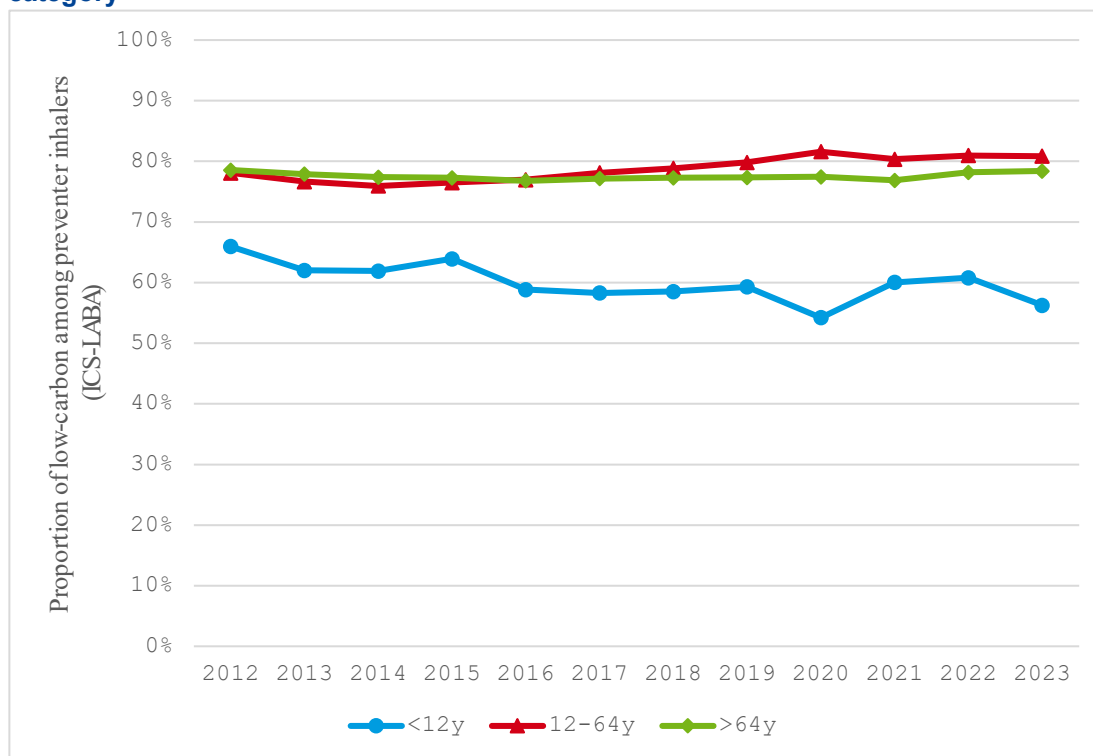
**Figure 59 – Proportion of low-carbon inhalers among reliever inhalers (SABA) by age category**

Source: IMA – AIM

For preventer inhalers, there is almost no evolution over the 2012-2023 period for adults (from 78.1% in 2012 to 80.9% in 2023) and older people (from 78.6% in 2012 to 78.4% in 2023); children's consumption of low-carbon inhalers has decreased from 66.0% in 2012 to 56.3% in 2023 (see Figure 60).



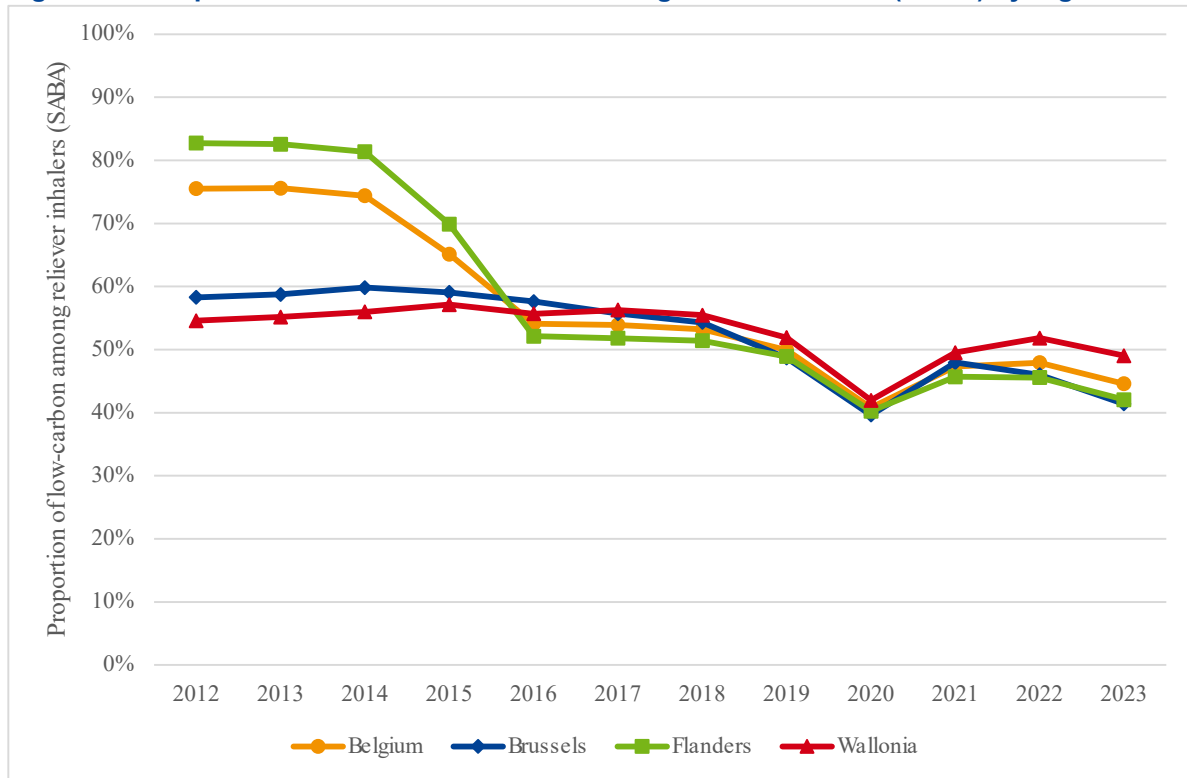
Figure 60 – Proportion of low-carbon inhalers among preventer inhalers (ICS-LABA) by age category



Source: IMA – AIM

REGIONAL COMPARISON

Flanders was the best in 2012 with 82.7% of low-carbon inhalers for relieving patients compared to other regions (Wallonia: 54.6%, Brussels: 58.3%) but the tendency has reversed over time with 42.1% in 2023 for Flanders, 41.4% for Brussels and 49.0% in Wallonia (Figure 61); all regions showed a decrease in the proportion on low-carbon reliever inhalers over the 2012-2023.

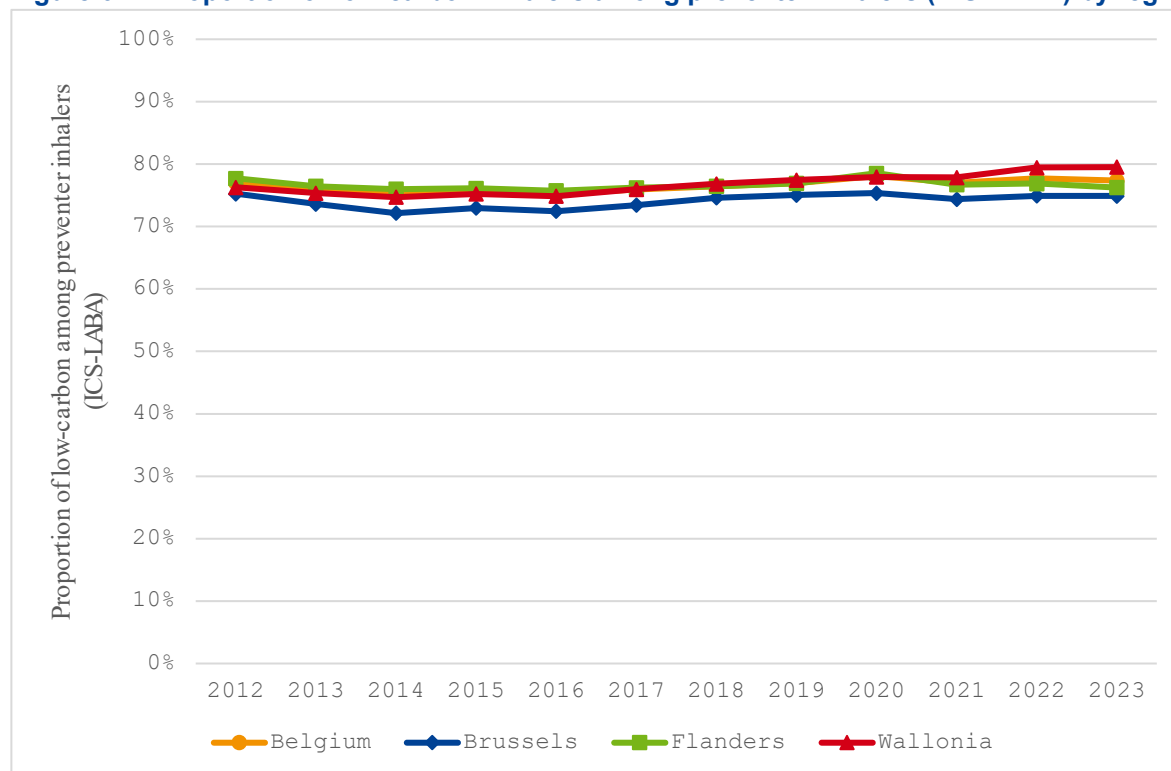
Figure 61 - Proportion of low-carbon inhalers among reliever inhalers (SABA) by region

Source: IMA – AIM

For prevention inhalers, the proportion of low-carbon inhalers has been stable between 72.3% and 79.5% over the 2012-2023 period in the 3 regions (Figure 62), the figures for 2023 are 74.9% for Brussels, 76.3% for Flanders and 79.5% for Wallonia.



Figure 62 – Proportion of low-carbon inhalers among preventer inhalers (ICS-LABA) by region



Source: IMA – AIM

INTERNATIONAL COMPARISON

There are few data available from abroad on the proportion of low-carbon inhaler use for SABA and ICS-LABA. Some publications are based on sales (data collected by IQVIA). Vartiainen et al. calculated that 5.9% of DPI (low-carbon) for 94.1% of PMD (high-carbon) SABA inhalers were sold (in doses) in 2021 in Denmark, Finland, France, Germany, Italy, Norway, Spain, Sweden and the UK.²

In England, this proportion has been monitored and a dashboard is available.¹ The most recent figures available online from the NHS respiratory dashboard (November 2025) show 9.7% of low-carbon use for reliever inhalers and 53.7% for preventer inhalers. Geographic variations were also observed.¹ Tian et al. found out that the low-carbon inhalers proportion used is low over the studied period (2016-2021): 26.3% in 2020-2021 for all inhalers, around 6% for SABA inhalers.³

KEY POINTS

Use of low-carbon inhalers should be pushed for respiratory diseases treatment

- Low-carbon inhaler for relieve purposes (SABA) have been used less often over time (2012-2023), reaching 45% in 2023. A decrease of use of SABA inhalers (-50.7% over the period) has been observed between 2012-2023; it may partly be explained by a change of treatment practice. As reliever inhalers' use becomes more targeted to more severe cases, the lack of effective low-carbon alternatives for severe cases limits their uptake.
- Low-carbon preventer inhalers (ICS-LABA) use has stayed high (77% in 2023), and the total prescribed decreased by 7.2%.
- There are differences of low-carbon use by age category: for reliever inhalers, children (<12y) have a higher proportion (67.7% in 2023, for 17.7 for adults (12-64y) and 36.9 for older people



(>64y)); it is the opposite for preventer inhalers as children reach 56.3% while adults stay high at 80.9% as well as older people at 88.4%

- Similar rates are observed in Flanders (42% in 2023) and Brussels (41%) while Wallonia has a higher rate (49%) for low-carbon reliever inhalers. For preventer inhalers, there are no disparities between regions and the rates over the 2012-2023 period are stable (between 75% and 80%)
- There are few corresponding data available from abroad, but from what has been gathered, Belgium is doing better

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4.2 GHG impact of anaesthetic gases (sevoflurane, desflurane, isoflurane) (ENV-11)

4.2.1 Documentation sheet

Description	Primary indicator: A. Greenhouse gas (GHG) impact of anaesthetic gases (sevoflurane, desflurane, isoflurane), in kg CO₂ eq per capita. Secondary indicator(s): B. Greenhouse gas (GHG) impact of anaesthetic gases (sevoflurane, desflurane, isoflurane), in tonnes CO₂ eq. C. Annual consumption of sevoflurane in the healthcare sector D. Annual consumption of isoflurane in the healthcare sector E. Annual consumption of desflurane in the healthcare sector
Rationale	Anaesthetic gases' use accounts for around 3% of the carbon footprint of the healthcare sector. ¹
Calculation	Primary indicator (A): • Numerator: GHG impact of anaesthetic gases (sevoflurane, desflurane, isoflurane) in kg CO₂ eq • Denominator: Population of the corresponding year For each of the 3 gases analysed, the volume of gas has been calculated. GHG impact of anaesthetic gases (sevoflurane, desflurane, isoflurane) was based on the volume of sales for each gas multiplied by their greenhouse gas impact per liquid volume (kg CO₂ eq./mL), described in Table 18.²
Data source	PH documents (INAMI – RIZIV), sales volumes (IQVIA) published in Talbot et al. ²
Technical definitions	The PH documents are an extract of invoices sent by hospitals to health insurance funds in order to obtain reimbursement for the portion of medication costs covered by compulsory health insurance. At the same time as reporting the delivery of medications covered by compulsory insurance, hospitals are also invited to transmit information on non-reimbursed deliveries.
International comparability	Based on one publication from Talbot et al. with data from 2023. ²
Limitations	Data collected in Talbot et al. are limited to the hospital sector but are expected complete (based on sales). Administrative data collected by RIZIV – INAMI cover hospitals (general and psychiatric). However, for PH documents data, the possibilities for verifying the accuracy and the exhaustivity of the reported data are limited for the anaesthetic gases, and the information should therefore be considered with caution (particularly for data concerning desflurane). Ambulatory use has not been studied due to the lack of data sources.
Dimension	Environmental sustainability
Supervisor	Carl Devos
Reviewers	Marc De Falleur (INAMI – RIZIV), Alain Kalmar (BeSARPP)

4.2.2 Results

BELGIUM

Anaesthetic gases used in Belgium have a high global-warming potential (GWP). Their use must be reduced as much as possible, switching to other means of anaesthesia (intravenous, e.g. propofol) or, whenever this is not possible, gases with a low GWP must be used.^{1,3} The Belgian Society of Anesthesiology, Resuscitation, Perioperative medicine and Pain management has published recommendations in 2023.⁴

Table 18 – Global-warming potential of anaesthetic gases

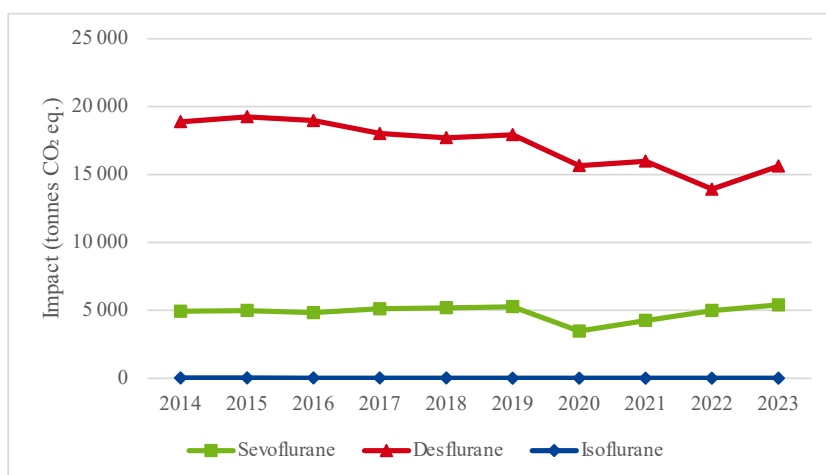
Anaesthetic gas	GWP (100) ^f	Greenhouse gas impact per liquid volume (kg CO ₂ eq./mL)	ATC5
Desflurane	2590	3.795	N01AB07
Isoflurane	539	0.806	N01AB06
Sevoflurane	144	0.219	N01AB08

Source: Talbot et al.²

Sevoflurane is the most commonly used of the 3 gases. It has a global-warming potential lower than desflurane and isoflurane (see Table 18), and it is better tolerated than the latter by patients, hence its more important use.

Figure 63 shows the GHG emissions in tonnes CO₂ eq caused by use of anesthetic gases in hospital in Belgium.² Desflurane has the most important impact, while isoflurane is barely used.

Figure 63 – GHG impact of anaesthetic gases in Belgium (2014-2023)

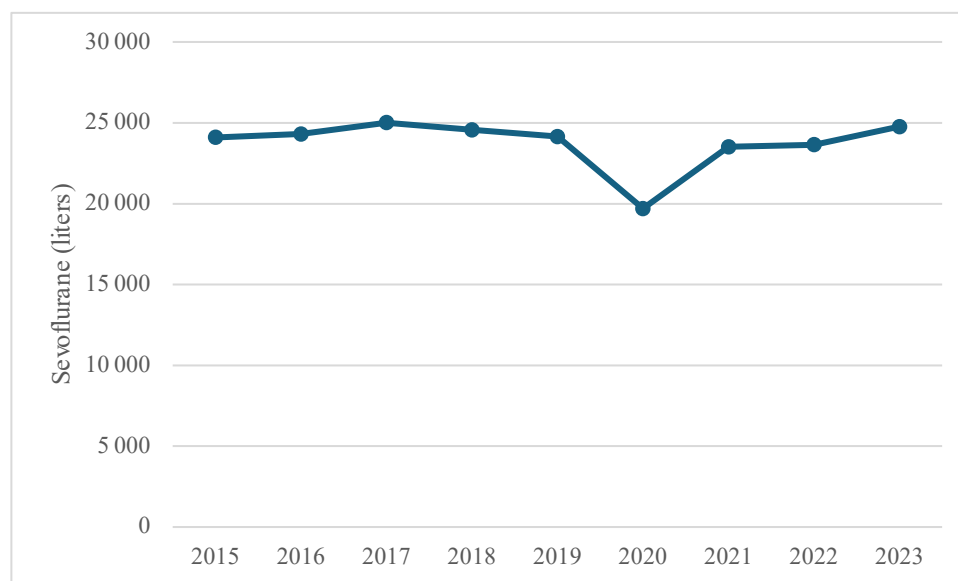


Source: Talbot et al.²

^f Hundred global warming potential: a gas with a GWP(100) of 10 means that 1 kg of the gas is equivalent to 10 kg of CO₂ regarding global-warming potential over 100 years.



Figure 64 – Sevoflurane consumption (2015-2023)

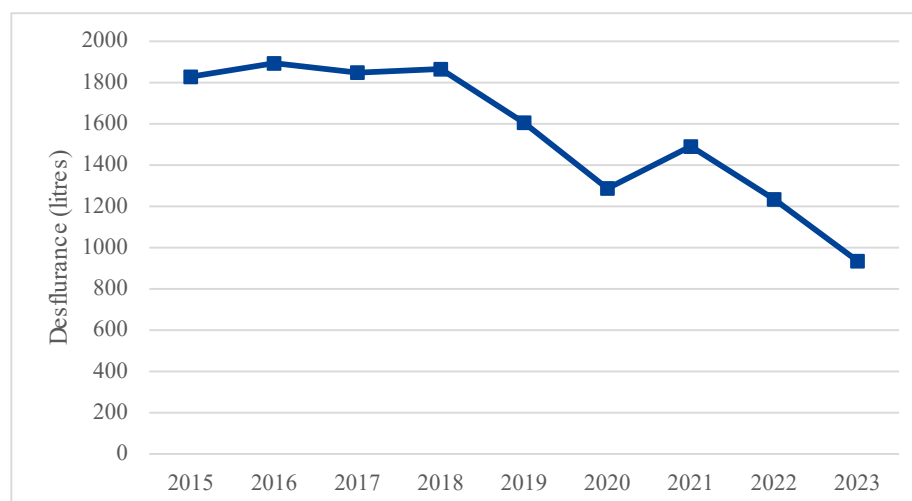


Source: INAMI – RIZIV (PH documents)

Sevoflurane consumption has increased by 5.9% over the period (Figure 64), the dip in 2020 can probably be explained by the reduction in elective surgery activity due to the COVID pandemic.

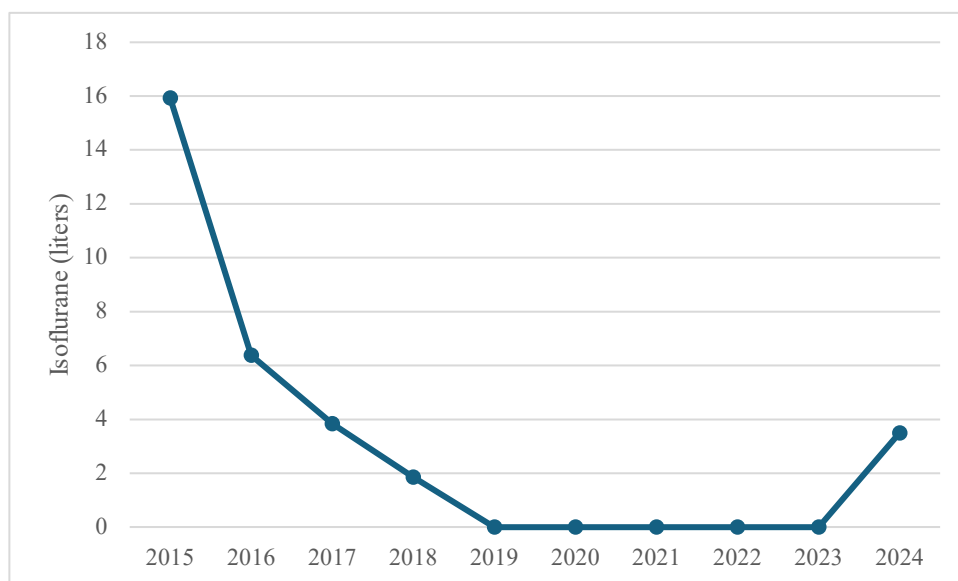
Due to its high global-warming potential (see Table 18), desflurane's use has been restricted in EU since 1 January 2026⁵ and in UK since 2024.⁶ Figure 65 shows its consumption in Belgium (in hospitals) for the 2012-2023 period: a decrease of 48.8% is observed. These results should be treated with caution, as they are not consistent with those from another source (IQVIA) which shows a higher consumption of desflurane. This might be due to some use not being registered in PH documents (e.g. consumption not reimbursed).

Figure 65 – Desflurane consumption (2015-2023)



Source: INAMI – RIZIV (PH documents)

Isoflurane's use is very small (Figure 66) compared to desflurane and sevoflurane (see Figure 63). It is still widely used in veterinary medicine.

Figure 66 – Isoflurane consumption (2015-2024)

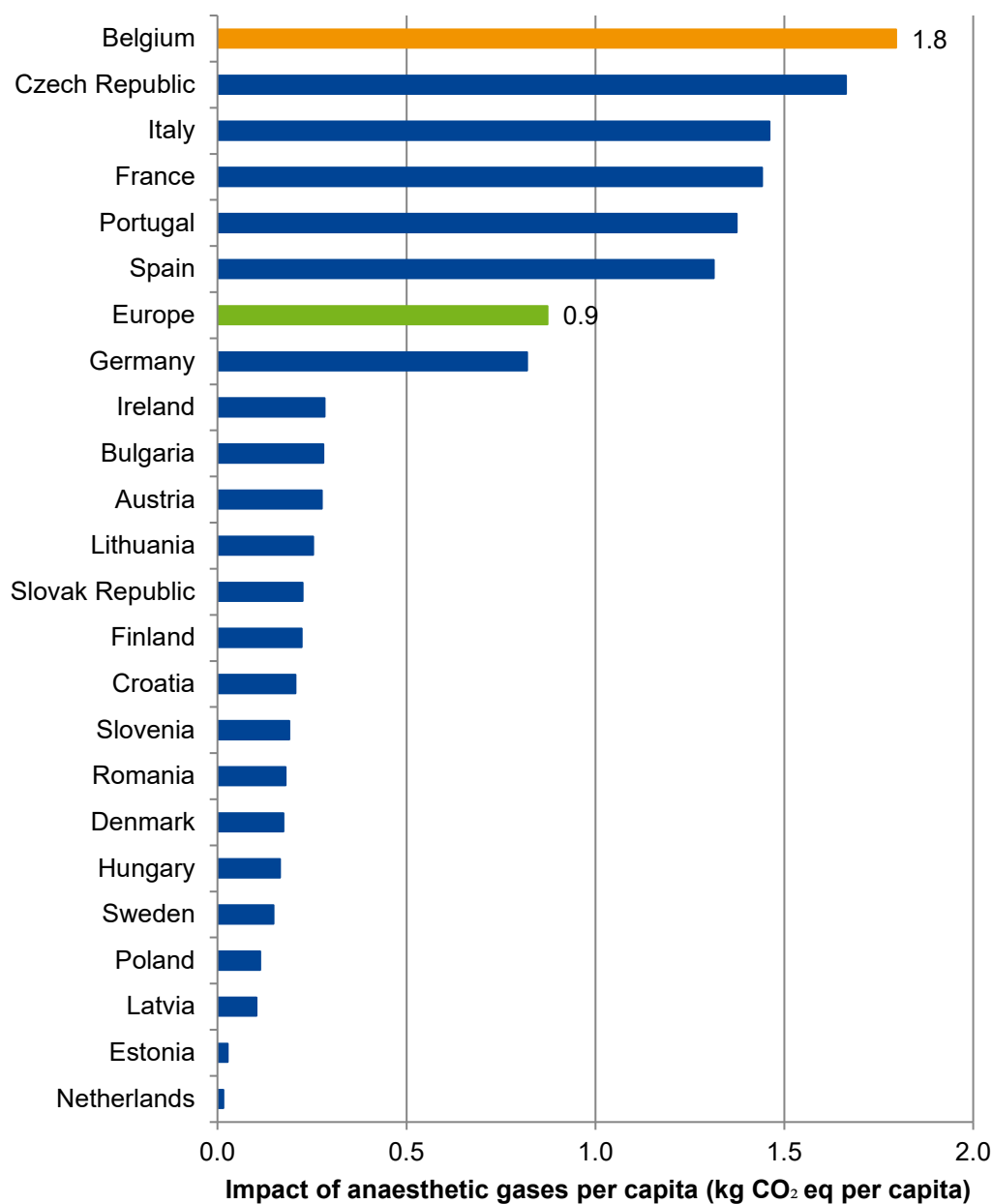
Source: INAMI – RIZIV (PH documents ; 2024: extrapolation from incomplete data)

INTERNATIONAL COMPARISON

GHG impact of anaesthetic gases in Belgium is twice as high as the European average (1.8 kg CO₂ eq per capita for Belgium, 0.9 for 22 European countries, see Figure 67). Belgium has the highest impact compared to all EU countries included in the analysis.



Figure 67 – GHG impact of anaesthetic gases, in kg CO₂ per capita (2023)



Source: Talbot et al. (Europe = all countries from EU-27 individually represented on the graph + UK + Norway)

KEY POINTS

Anaesthetic gases with high GHG impact must be reduced whenever possible

- Anaesthetic gases have a high global-warming potential; their use must be limited. This can be achieved by favouring use of intravenous anaesthesia (e.g. total intravenous anaesthesia, TIVA), selecting gases with low global-warming when gas use is unavoidable, and, whenever possible, using minimal-flow anaesthesia workstations.
- Belgian use of Desflurane has been decreasing over the 2015-2024 period, but not enough compared to other European countries. Sevoflurane is the most used gas and its consumption

has increased by 5.9% over the 2015-2024 period. A room for improvement therefore remains in Belgium.

- As a consequence, GHG impact of anaesthetic gas was twice as high in Belgium in 2023 (1.8 kg CO₂ eq per capita) compared to the European average (0.9 kg CO₂ eq per capita, for 22 countries).
- [EU regulation 24/573](#) prohibits the use of desflurane as an inhalation anaesthetic from 1 January 2026, except where such use is strictly required and no other anaesthetic gas can be used on medical grounds. Improvements are therefore expected.

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4.3 Direct emissions of nitrous oxide in human health activities (ENV-12)

4.3.1 Documentation sheet

Description	Primary indicator: A. Direct emissions of nitrous oxide (N₂O) in human health activities (Q86), in g per capita Secondary indicators: B. Direct emissions of nitrous oxide (N₂O) in human health activities (Q86), in tonnes C. Direct emissions of nitrous oxide (N₂O) in human health activities, as a share of total direct emissions of nitrous oxide (all NACE activities) D. Minutes of N₂O used in hospitals
Rationale	Nitrous oxide (N₂O) is an anaesthetic and analgesic gas with a long history of medical applications.¹ It is the third most important greenhouse gas and the most significant ozone-layer depleting substance emitted today. Emissions primarily come from agricultural use (fertilisers and manure).²
Calculation	Calculations are done by the Federal Planning Bureau for Eurostat based on regional and national emission inventories, an activity model and emission factors (activity data * emission factor) using NACE classification. Primary indicator (A): - Numerator: Annual direct N₂O emissions in healthcare sector (Q86 – human health activities), in g - Denominator: Population of the corresponding year (calculated as mean of population at beginning and end of year) Indicator B: - Numerator: Annual direct N₂O emissions in healthcare sector (Q86 – human health activities), in tonnes - Denominator: / Indicator C: - Numerator: Annual direct N₂O emissions in healthcare sector (Q86 – human health activities), in tonnes - Denominator: Annual direct N₂O emissions in total (all NACE activities)
Data source	Essenscia (association of industrial & medical gases) and INAMI – RIZIV (PH documents) for federal data. IMA – AIM for federal data (inpatient data only). Federal Planning Bureau (plan.be) for regional data. Eurostat: Air emissions accounts by NACE Rev. 2 activity [env_ac_ainah_r2__custom_19043223] (Last update of data: 28/11/2025 23:00) for international data.
Technical definitions	- Air Emissions Accounts record the flows of residual gaseous and particulate materials emitted by resident units (=economic activities) and flowing into the atmosphere. Natural flows of residual gaseous and particulate materials are excluded e.g. volcanos, forest fires. Also excluded are air emissions arising from land use, land use changes and forestry as well as any indirect emissions. - The healthcare sector was identified via the statistical classification of economic activities in the European Community (NACE Rev. 2): Human health activities (Q86) (excluding residential care).



	- For the calculation per capita, the average population of the reference year (calculated as the arithmetic mean of the population on 1st January of two consecutive years) is used as denominator. - More details on the methodology: https://ec.europa.eu/eurostat/web/environment/methodology - Data from Essenscia come from sales of medical N₂O. It has been assumed that all of the nitrous oxide sold for medical use is eventually released to the atmosphere (emission factor of 1 kg/kg).
International comparability	Statistical Classification of Economic Activities in the European Community (NACE) https://ec.europa.eu/eurostat/web/nace/overview allows European comparison. For a description of NACE-Bel, see: https://statbel.fgov.be/sites/default/files/Over_Statbel_FR/Nomenclaturen/NACE-BEL%202008_FR.pdf (pp. 465-474) However, comparability between country is not guaranteed.
Limitations	Federal Planning bureau and Eurostat data come from a model based on activity, not on measurements. There are differences in inventory reviews as well as methodological differences, which might explain differences in the results shown. Residential care activities and social work activities without accommodation (Q87–Q88) were aggregated, making it impossible to isolate data for Q87 alone. Consequently, only human health activities (Q86) are considered as a proxy for the health care system, while residential care activities were excluded. PH documents (from INAMI – RIZIV) and IMA – AIM data might not be comprehensive (missing some non-reimbursed deliveries) and consumption in minutes from PH documents is an upper estimate (0-15 minutes estimated at 15 minutes, same for 15-30 and 30-45 minutes).
Dimension	Environmental sustainability
Related indicators	ENV-11
Supervisor	Carl Devos
Reviewers	Jehan Charlier (Federal Plan Bureau), Marc De Falleur (INAMI – RIZIV), Alain Kalmar (BeSARPP)

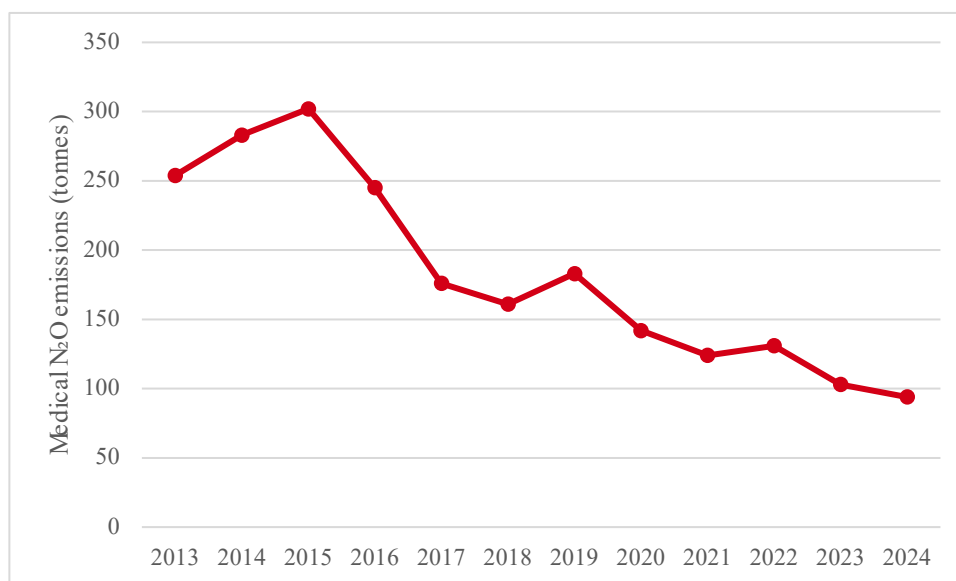
4.3.2 Results

BELGIUM

The nitrous oxide (N₂O) emissions for medical usage in Belgium has decreased from 254 tonnes in 2013 to 94 tonnes in 2024, an evolution of -63% over the period (see Figure 68). This might be due to a switch from central distribution (with leakages of 70-90% of the gas) to cylinders.³



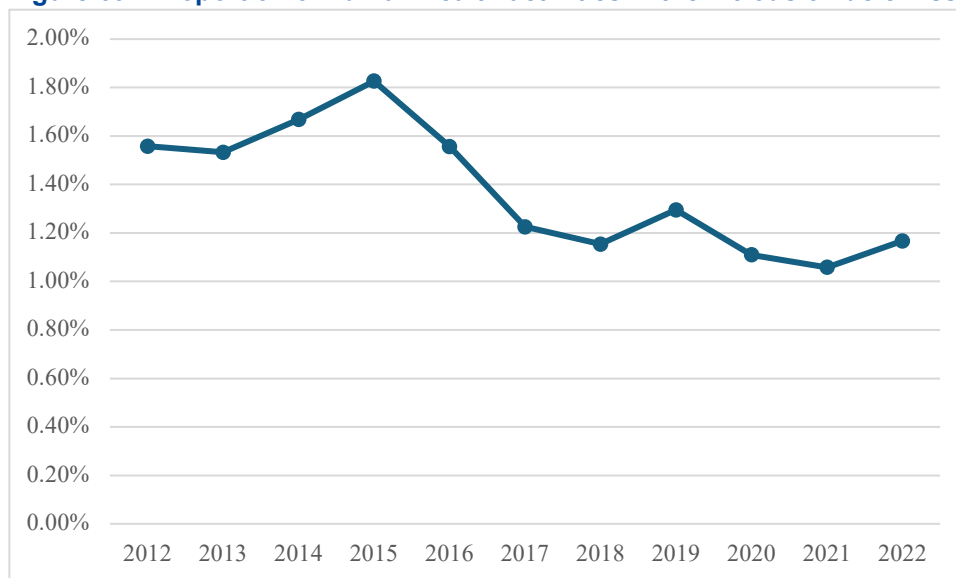
Figure 68 – Medical N₂O emissions (2013-2024)



Source: Essenscia

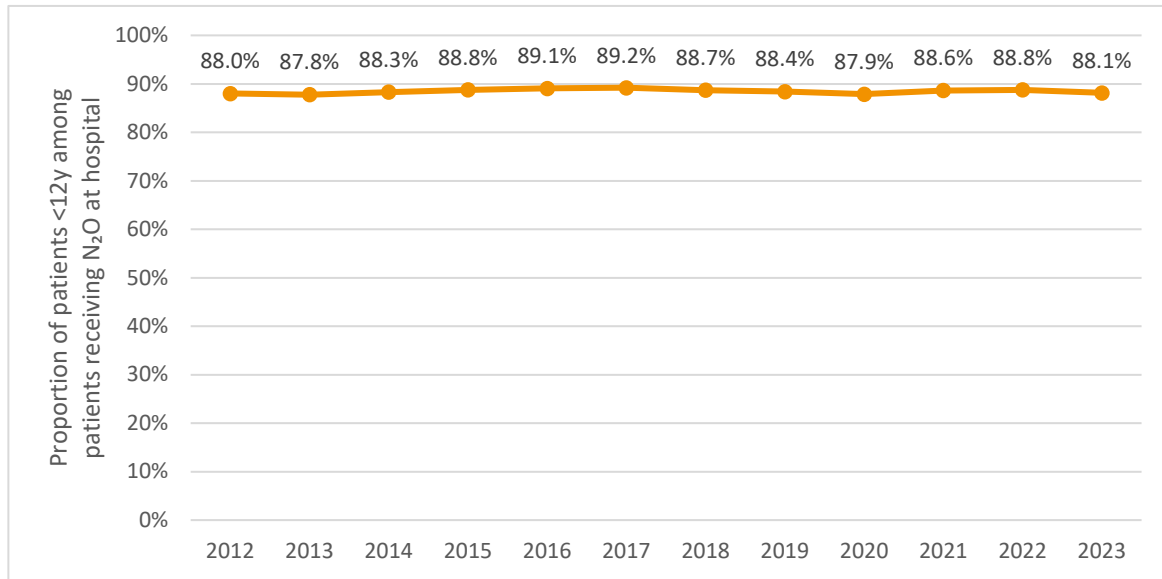
Compared to all activities measured by NACE, human health activities represent less than 2% of N₂O emissions (Figure 69). Human health activities (Q86) has decreased twice as fast as the whole NACE activities: -40.0% over the 2012-2022 period for Q86 compared to -19.9% for all activities.

Figure 69 - Proportion of human health activities in the nitrous oxide emissions



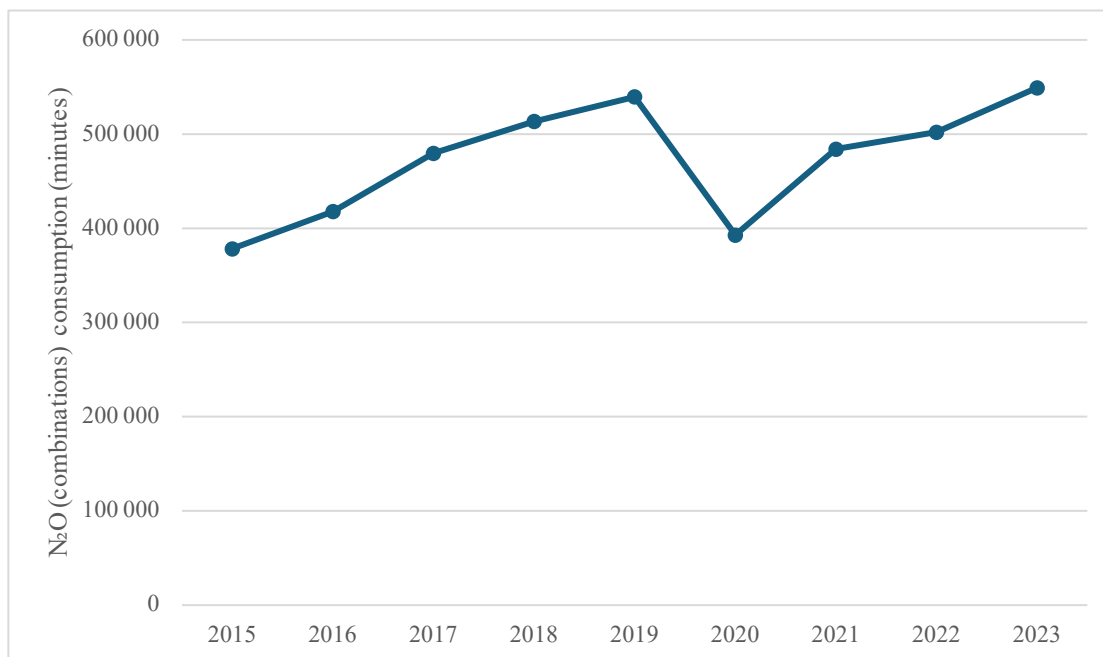
Source: Federal Planning Bureau

IMA – AIM data are collected at the hospital level only, there are no information on ambulatory consumption of N₂O (e.g. private clinics, dentists⁴). Pure N₂O (ATC5=N01AX13) is almost not used (0.4% of the invoiced quantities) compared to N₂O combinations (ATC5=N01AX63, usually 50% N₂O + 50% O₂). The vast majority of N₂O (pure and in combinations) usage at hospital concerns children (<12 years old): 88.1% in 2023 (Figure 70).

Figure 70 – Proportion of paediatric patients among all patients receiving N₂O at hospital

Source: IMA – AIM (GZSS)

Data from INAMI – RIZIV (PH documents) show that the minutes of N₂O used is increasing for the 2015-2023 period in Figure 71: there is a 31.1% increase over that period. An increase in the N₂O consumption in minutes and a decrease in N₂O emissions could partially be explained by a switch from central distribution (with leakages of 70-90% of the gas) to cylinders.

Figure 71 – Consumption of N₂O in minutes (2015-2023)

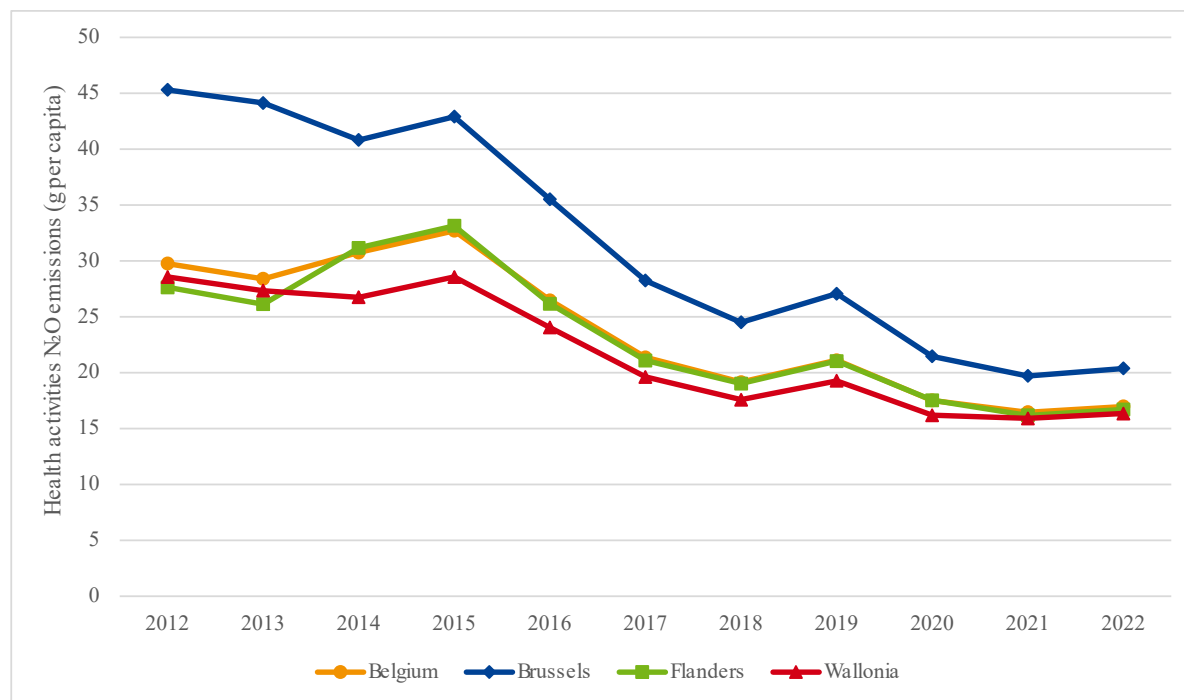
Source: INAMI – RIZIV (PH documents)



REGIONAL COMPARISON

Brussels has higher N₂O emission per capita (20.4 g in 2022) for health activities than Flanders (16.7 g) and Wallonia (16.3 g) as shown in Figure 72, but over the 2012-2022 period, it has decreased more in Brussels (-55.0%) than in Flanders (-39.5%) and Wallonia (-42.8%).

Figure 72 - Regional emissions of N₂O per capita (2012-2022)

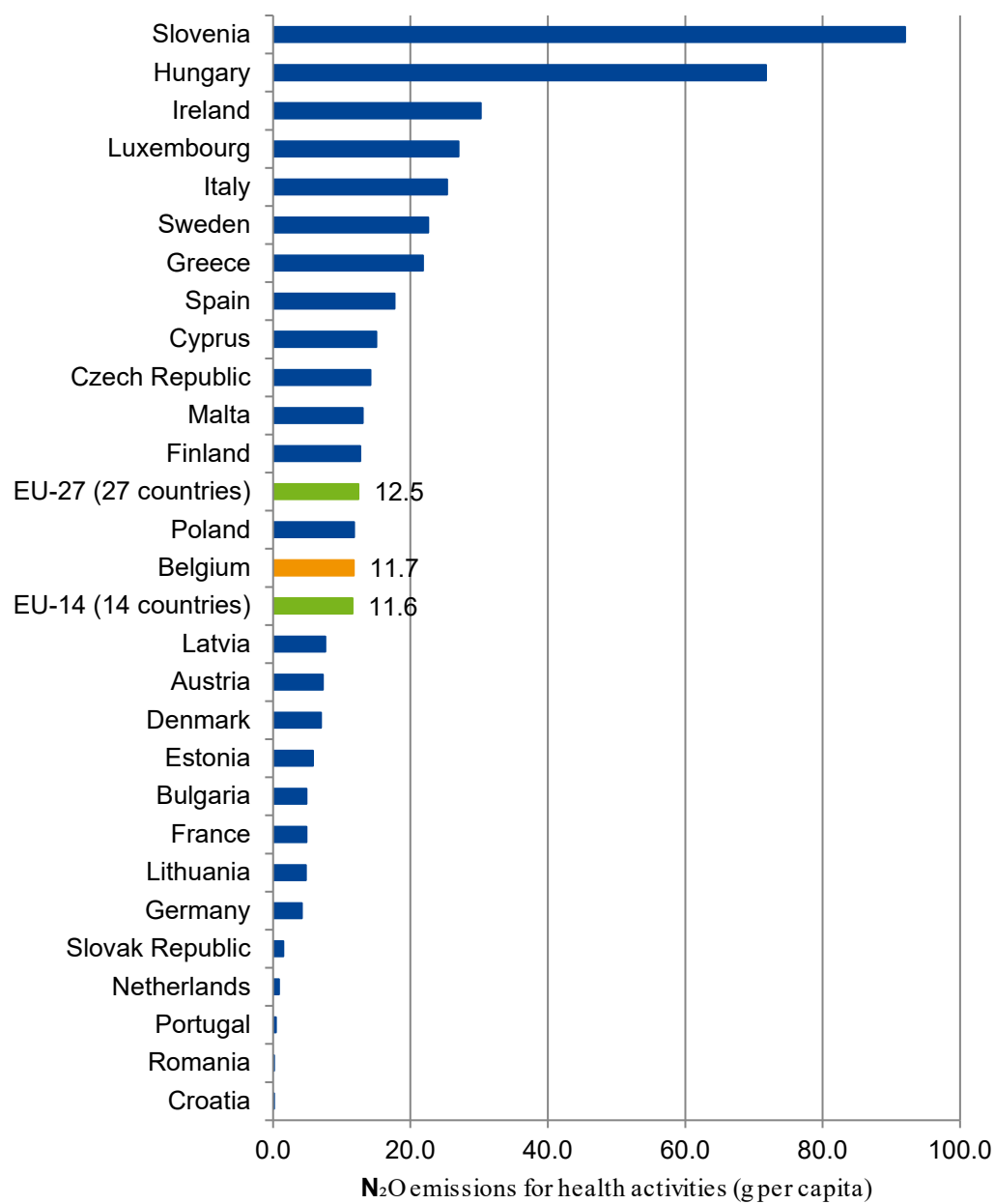


Source: Federal Planning Bureau

INTERNATIONAL COMPARISON

Compared to other European countries in 2023, Belgium's emissions of N₂O (11.7 g per capita) is on par with EU-14 (11.6 g per capita) and a bit below EU-27 (12.5 g per capita) as shown in Figure 73. Belgium has a stronger decrease of N₂O emissions for health activities (Q86) over the 2012-2022 period (-53.5%) than EU-14 (-31.3%) and EU-27 (-18.4%); this is illustrated in Figure 74.

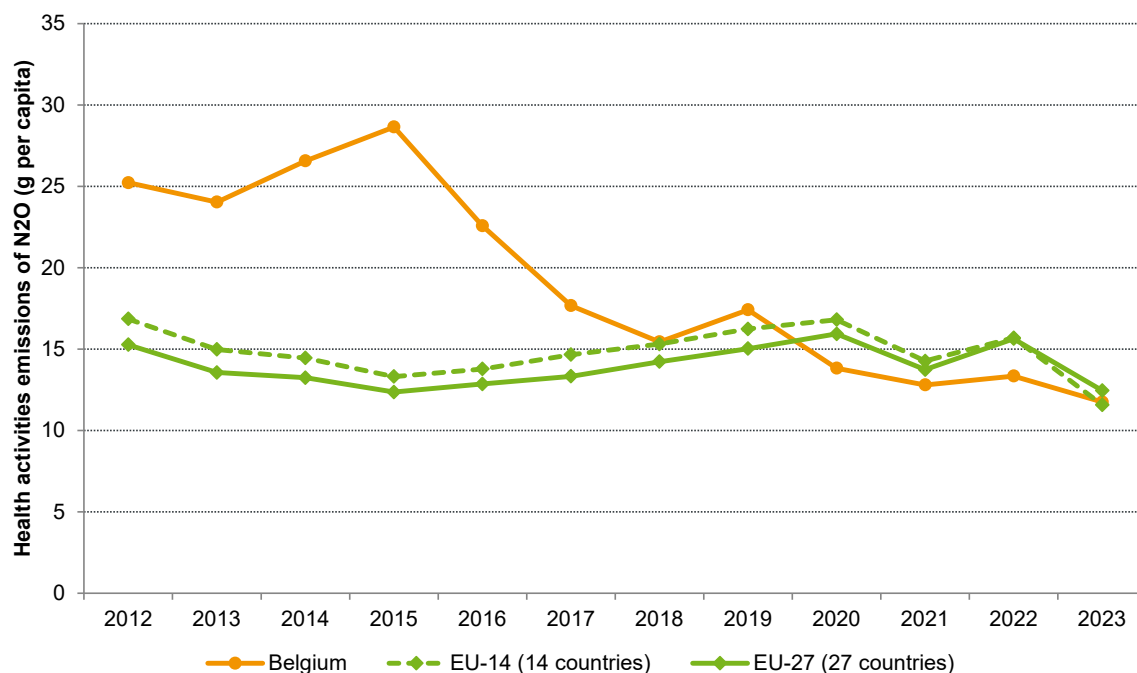
Figure 73 - International comparison: nitrous oxide emissions (2023)



Source: Eurostat (Air Emissions Accounts)



Figure 74 - N₂O emissions in health activities: international comparison (2012-2023)



Source : Eurostat (Air Emissions Accounts)

KEY POINTS

- Nitrous oxide (N₂O) is an anaesthetic and analgesic gas which has a greenhouse effect 120 times that of CO₂. Health activities contribute to less than 2% and its contribution is decreasing over time. Inpatient use is mostly for children (88.1% in 2023).
- Medical N₂O use has decreased (-63%) from 254 to 94 tonnes over the 2013-2024 period and the number of minutes of N₂O used per year has increased by 31.1% from 2015 to 2023. This might be due to a switch from central distribution (high rate of leakage) to cylinders, following BeSARPP recommendations.⁵
- Brussels has more emissions per capita than Flanders and Wallonia, but the difference is narrowing: in 2022, N₂O emissions were respectively 20.4, 16.7 and 16.3 g per capita.
- Belgian emissions per capita are comparable to EU-14 and EU-27.

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5 SUSTAINABLE FOOD

See ENV-13 in Waste management

6 WASTE MANAGEMENT

6.1 Annual food waste (ENV–13) and annual primary waste (ENV–14) in the healthcare sector in the Flemish region

6.1.1 Documentation sheet

Description	Primary indicator: A. Annual amount of primary waste in the healthcare sector in the Flemish region (absolute tonnage + kilograms per capita) Secondary indicators: B. Annual amount of food waste in hospitals and nursing homes in the Flemish region (absolute tonnage + kilograms per capita) C. Amount of waste per type (absolute tonnage + kilograms per capita) in the full healthcare sector (in the Flemish region) D. Amount of waste tonnage per type of healthcare facility (absolute tonnage + kilograms per capita) in the full healthcare sector (in the Flemish region) E. Amount of waste tonnage per processing method (absolute tonnage + kilograms per capita) in the full healthcare sector (in the Flemish region)
Rationale	Waste generation contributes to the environmental footprint of healthcare systems. Hospitals and residential care facilities produce large volumes of waste, including packaging, disposables, and clinical materials, which require energy-intensive treatment and disposal. Research shows that healthcare waste management is closely linked to greenhouse gas emissions, resource depletion and pollution, making it a critical area for sustainability monitoring.¹ According to the World Health Organization, 15% of healthcare waste is classified as hazardous, meaning it can be infectious, toxic, carcinogenic, flammable, corrosive, reactive, explosive, or even radioactive.² Food waste is particularly climate-intensive: when sent to landfill, decomposing organic matter produces methane, a greenhouse gas up to 72 times more potent than CO₂ over a 20-year timespan. Moreover, food production is highly resource-intensive. Globally, food loss and waste are responsible for approximately 8-10% of annual greenhouse gas emissions and drive significant biodiversity loss by occupying almost one-third of agricultural land.³
Calculation	Primary indicator (A): - Numerator: Absolute tonnage of waste - Denominator: Population of the corresponding year (calculated as mean of population at beginning and end of year) Indicator B: - Numerator: Absolute tonnage of food waste - Denominator: Population of the corresponding year (calculated as mean of population at beginning and end of year) Indicator C: - Numerator: Absolute tonnage of waste by type - Denominator: Population of the corresponding year (calculated as mean of population at beginning and end of year)



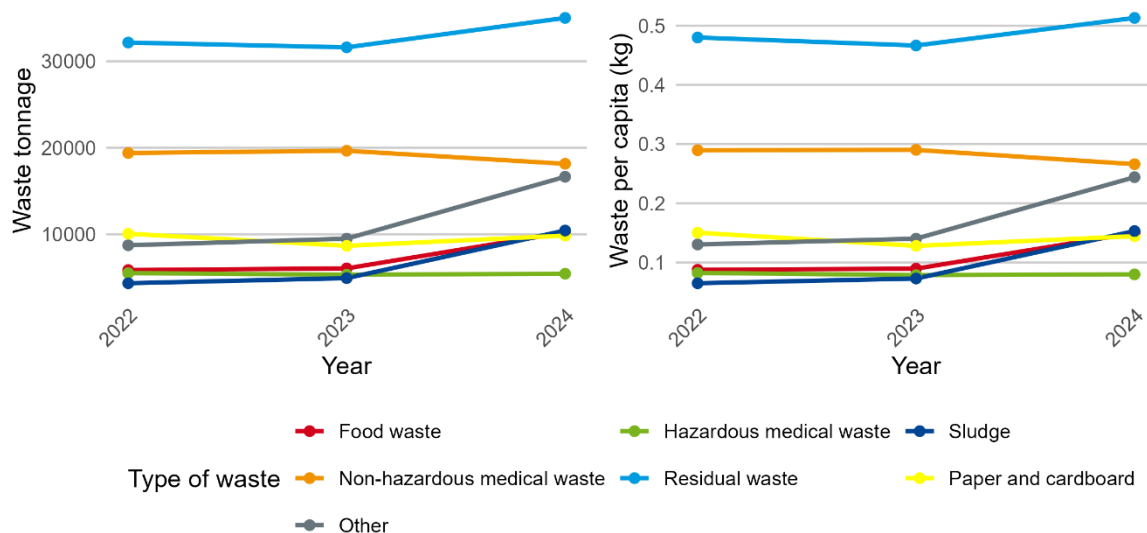
	Indicator D: • Numerator: Absolute tonnage of waste by type of health facility • Denominator: Population of the corresponding year (calculated as mean of population at beginning and end of year) Indicator E: • Numerator: Absolute tonnage of waste by processing method • Denominator: Population of the corresponding year (calculated as mean of population at beginning and end of year)
Data source	The data used in this report were provided by OVAM (Public Waste Agency of Flanders) in November 2025. Since production year 2022, OVAM has relied on MATIS, its materials information system, to compile waste statistics for the Flemish Region. In MATIS, all registered waste collectors, traders, brokers (IHM), and licensed waste processors must report their activities.⁴ Data on primary waste generation are based on declarations from waste collectors, supplemented by reports from waste processors and a few external sources. Waste collected from companies is considered primary waste, while waste originating from other processors is excluded as secondary waste. To ensure completeness, incoming waste streams at processors are also included when they were not reported by collectors, excluding any flows originating from other processors.
Technical definitions	Waste streams were classified using the EURAL classification, a European standardized system for identifying and categorizing waste based on its origin and composition. The six-digit codes were grouped into global categories. The precise codes per group are available on request. Categories containing less than 5% of annual waste were pooled under 'other'. The remaining categories were: food waste, non-hazardous medical waste, hazardous medical waste, residual waste, sludge, paper and cardboard, other. As for waste processing methods, among the categories used by OVAM, several were merged to 'other' (other pre-treatment, drying/separating, loading and transfer and sorting), indicating they undergo secondary processing (for which data were not available). The health sector was determined using the NACEBEL2025 classification, more specifically using the following codes: 86; 87.1; 87.301; 47.730; 47.740. Data on number of hospital beds were taken from the FPS Public Health⁵, and those for nursing homes from our own past work⁶.
International comparability	⁷
Limitations	Data were only available for the Flemish region. Data are only available from 2022 and no trends can be analysed. For the years 2022 and 2023, reporting of waste data was not compulsory, potentially leading to an underestimation. Data of 2024 were received for analysis before thorough validation, thus potentially resulting in an overestimation. For waste processing methods, data were only available on primary processing. Potential sorting errors in medical waste could not be accounted for with the available data and might have led to overestimation of the quantity of hazardous medical waste.
Dimension	Environmental sustainability
Related indicators	/
Supervisor	Helena Van Deynse
Reviewers	Anne Berquin



6.1.2 Results

The healthcare sector in the Flemish region produced a total of 106 kilotonnes of waste in 2024, which is equivalent to 15.5 kg per capita. As can be seen in Figure 75, this predominantly consists of residual waste (35 006 tonnes, corresponding to 33%) and non-hazardous medical waste (18 149 tonnes, corresponding to 17%).

Figure 75 – Absolute and per capita waste per year and per type of waste



Source: MATIS (OVAM) 2025

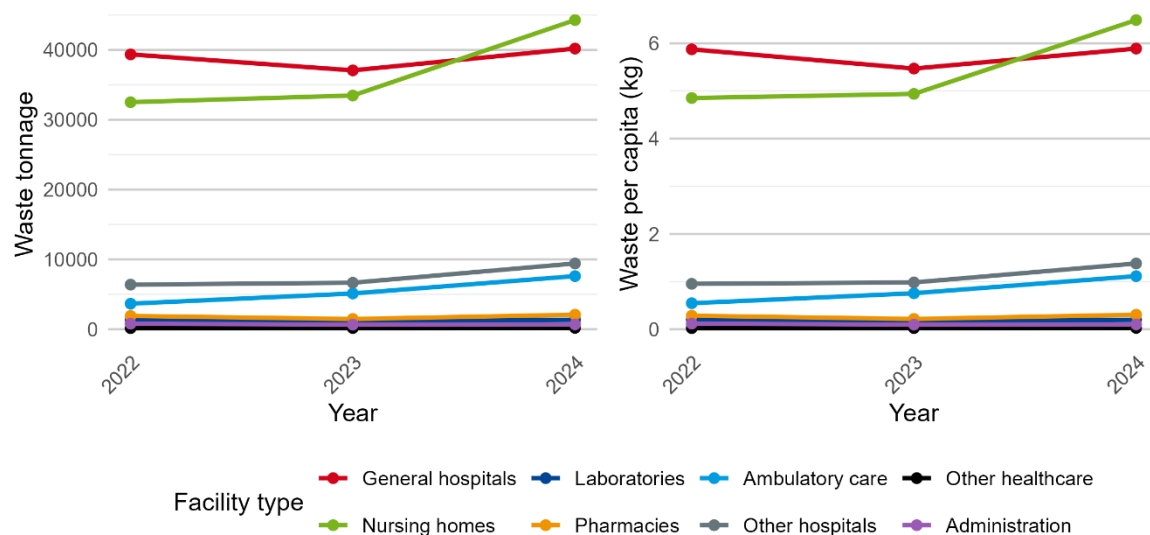
ANALYSIS BY TYPE OF HEALTHCARE FACILITY

Figure 76 breaks the waste down by sector, showing that nursing homes (44 273 tonnes, corresponding to 42%) and hospitals (40 189 tonnes, corresponding to 38%) account for the majority of the waste. While the numbers of these sectors may seem relatively close, this changes when calculating waste relative to the number of beds. Calculated for the year 2022, hospitals produced 4.64 kg/bed/day, while this was merely 1.08 kg/bed/day in nursing homes. With 40% of the waste, non-hazardous medical waste is the largest category in general hospitals, while residual waste accounts for no less than 63% in nursing homes (see Figure 77).

The 'other' category in Figure 76 consists of waste types that represented less than 5% of total generated waste. This included plastic and PMD (plastic, metal and drink carton packaging and electronic waste (including batteries and accu), accounting for 3960 tons (3.7% of waste) and 4383 tons (4.1%) respectively in 2024.

ANALYSIS BY TYPE OF HEALTHCARE FACILITY

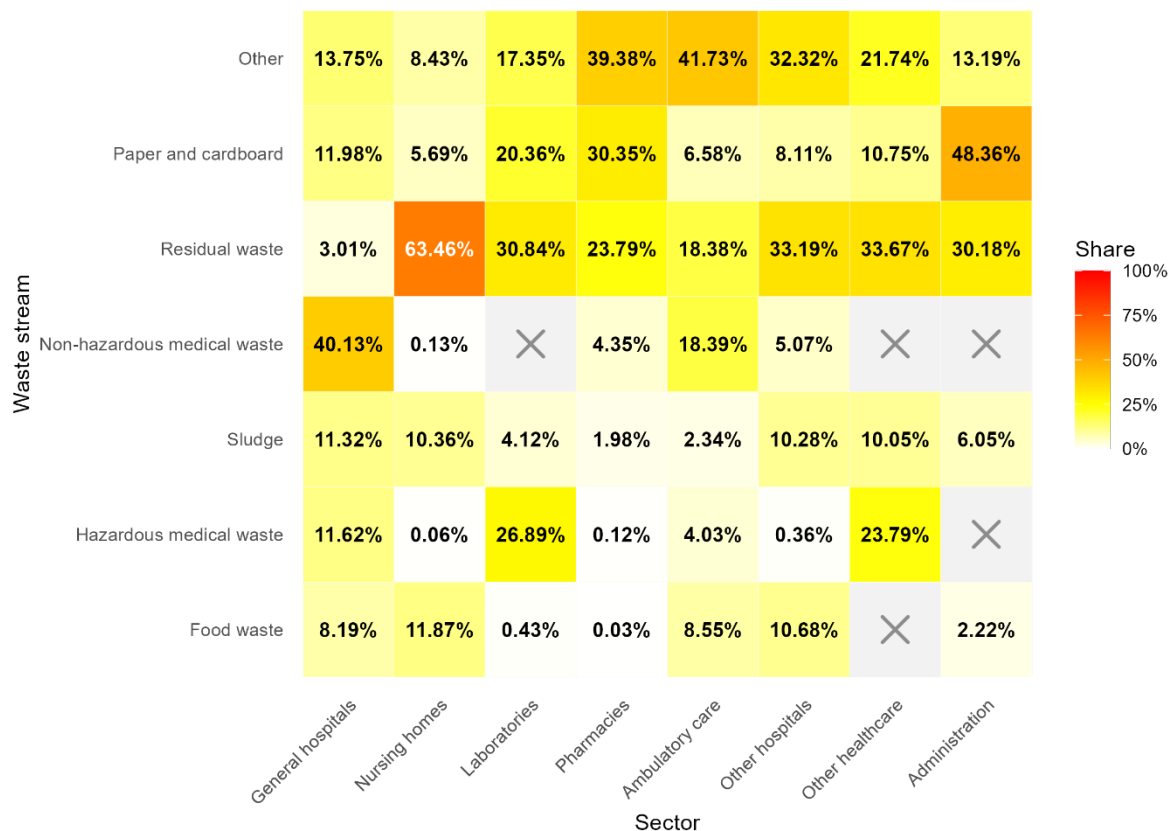
Figure 76 – Absolute and per capita waste per year and per type of healthcare facility



Source: MATIS (OVAM) 2025

Figure 77 – Relative distribution of type of waste per type of healthcare facility

NOTE: percentages represent column-percentages



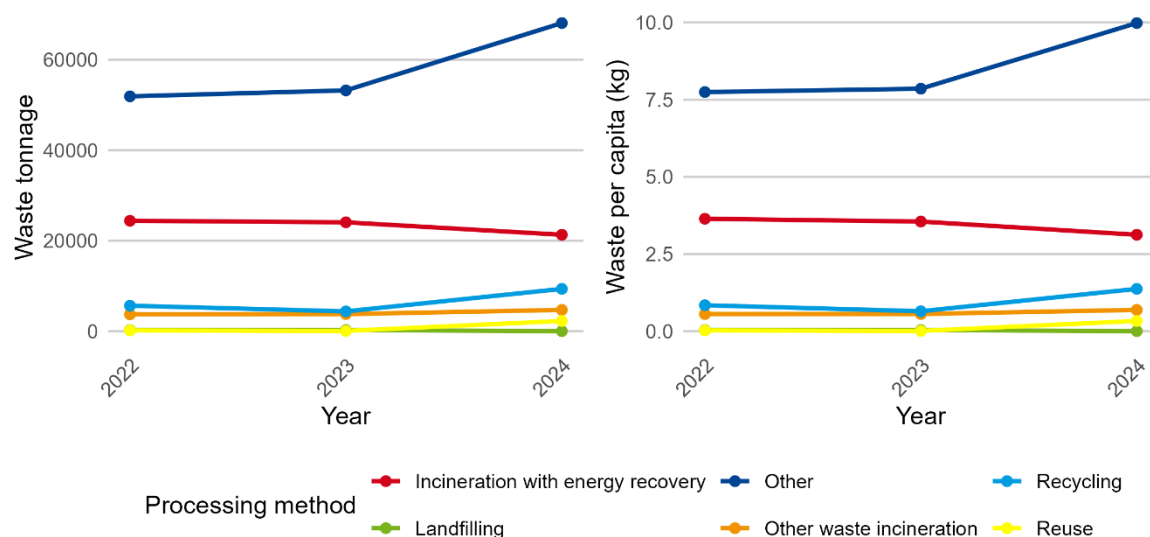
Source: MATIS (OVAM) 2025



ANALYSIS BY WASTE PROCESSING METHOD

As shown in Figure 78, the category of 'other' waste processing is the most common with 64% of waste. This indicates that the majority of waste from the healthcare sector undergoes secondary processing. Figure 79 shows that this is the case for all waste types except medical waste, where incineration is by far the most common method. The high percentage of hazardous medical waste being incinerated is consistent with the guidelines.

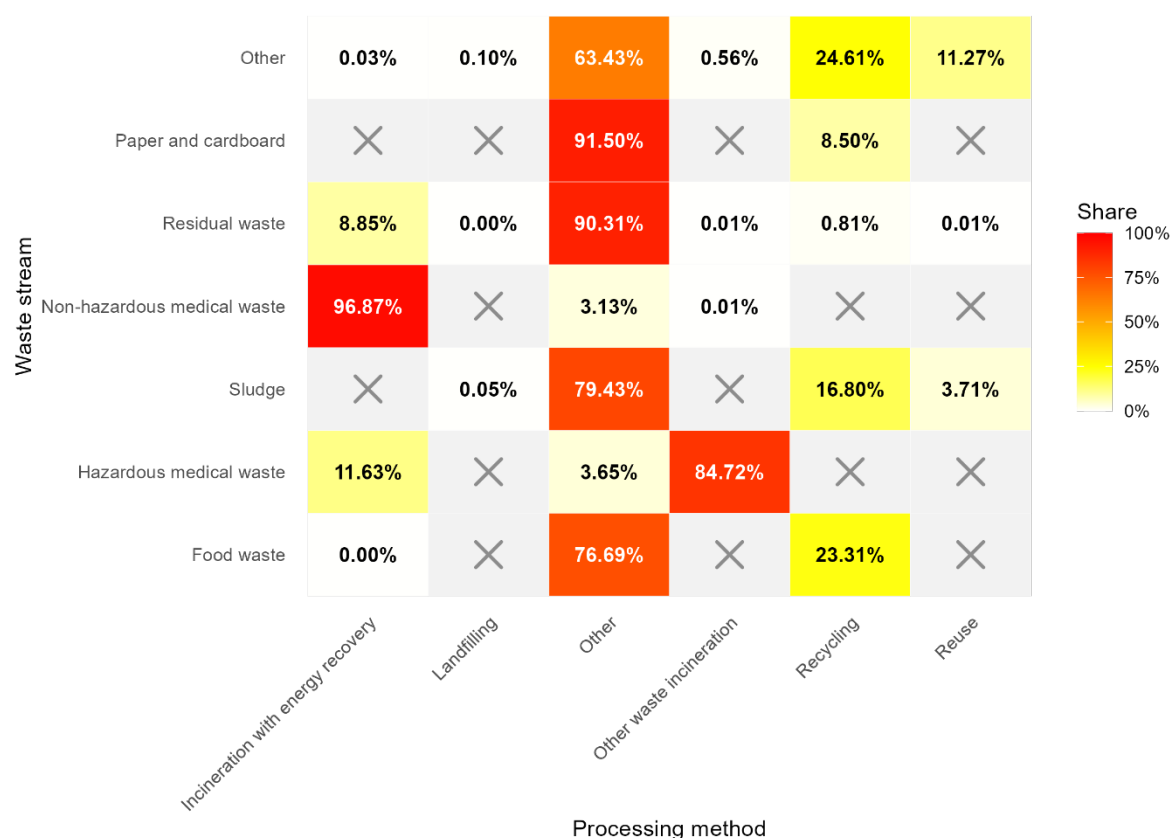
Figure 78 – Absolute and per capita waste per year and per processing method



Source: MATIS (OVAM)

Figure 79 – Distribution of waste processing method per facility type

NOTE: percentages represent row-percentages



Source: MATIS (OVAM) 2025

FOOD WASTE

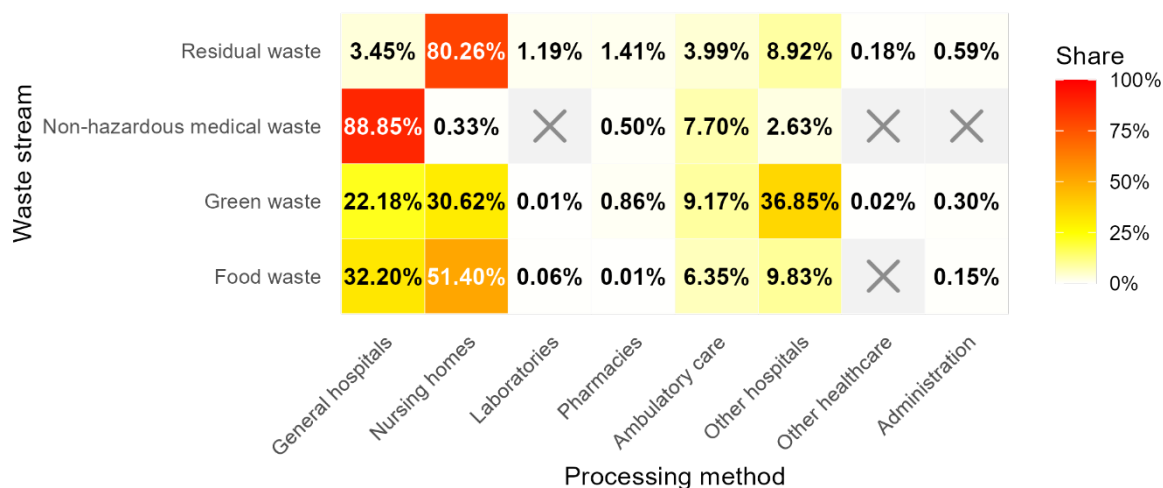
In 2024, 10.2 kilotonnes of food waste were generated in human health activities. Respectively 3.2 and 5.3 kilotonnes of food waste were registered in general hospitals and nursing homes. However, this is likely an underestimation as food waste can, to a larger or lesser extent, also have ended up in residual waste, non-hazardous medical waste or green waste.

Figure 80 shows that 51% of the food waste in the total healthcare sector is produced in nursing homes, while another 32% can be attributed to general hospitals. Figure 81 shows almost none of the (potential) food waste going directly to landfill. However, the large prevalence of 'other' processing likely indicates that a considerable percentage will go to secondary processing, for which we did not have data available.



Figure 80 – Waste streams potentially containing food waste distributed by healthcare facility types

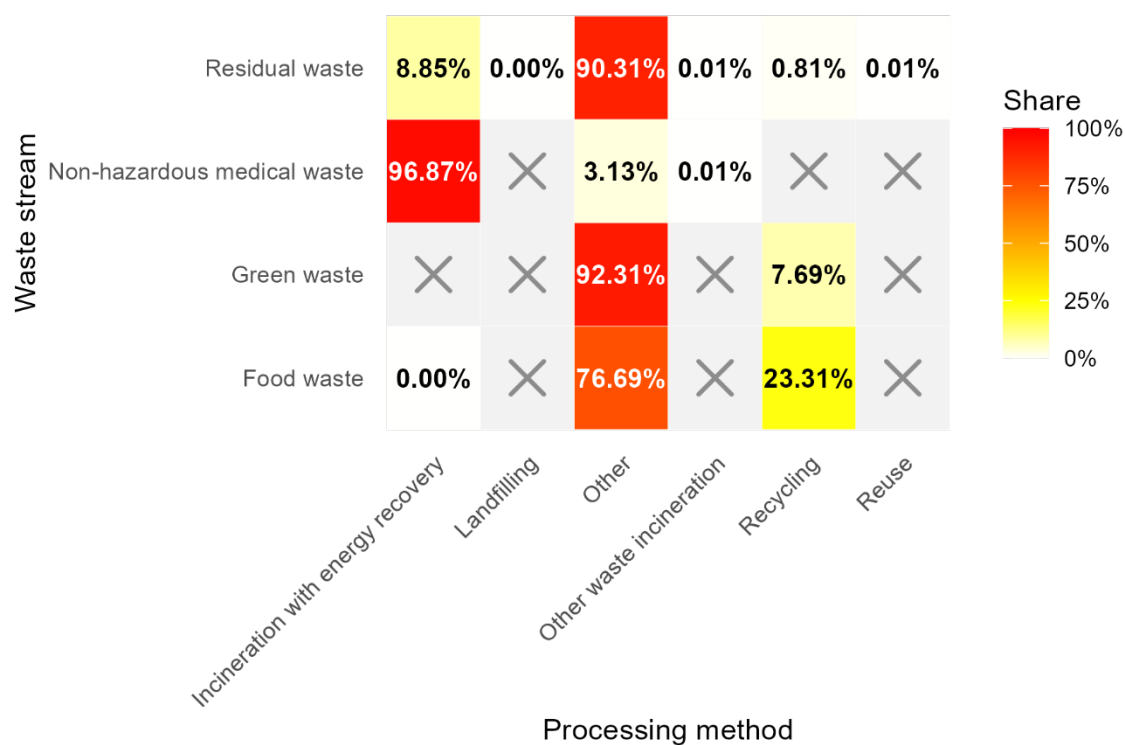
NOTE: percentages are row percentages



Source: MATIS (OVAM) 2025

Figure 81 – Waste streams potentially containing food waste distributed by processing method

NOTE: percentages are row percentages



Source: MATIS (OVAM) 2025



INTERNATIONAL COMPARISON

A systematic review by Mol et al. ⁷ on medical waste in hospitals estimated an average of 0.97 kg/bed/day in Europe, while 2.63 kg/bed/day hazardous and non-hazardous medical waste was produced in Belgium during the year 2023. For hazardous medical waste specifically, the estimation in the aforementioned systematic review was 0.45 kg/bed/day, which was 0.56 kg/bed/day in Belgium. It is important to note, however, that the majority of the original studies used by Mol et al. ⁷ are at least 15 years old. Thus, a comparison of ⁷ disregards longitudinal trends, such as the increase in single-use materials since the COVID-19 pandemic ⁸.

KEY POINTS

- The healthcare sector in the Flemish region produced a total of 105 769 tonnes of waste in 2024, corresponding to 15.5 kg per capita. Estimation of the trends is currently not possible.
- Among these, 10.22 kilotonnes of food waste were registered in the healthcare sector (5.3 kilotonnes in nursing homes and 3.2 kilotonnes in hospitals), though this is likely an underestimation because food waste may have been mixed with other waste streams.
- Nursing homes produced the largest share of waste (42%), followed closely by hospitals (38%). However, in relative terms this corresponds to hospitals generating 4.64 kg/bed/day and nursing homes 1.08 kg/bed/day in the year 2022.
- Within hospitals, non-hazardous medical waste was the largest category of waste (40%), while in nursing homes, residual waste represented 63% of waste.
- Most of the waste (64%) goes to secondary processing, for which data were not available. (Hazardous) Medical waste was primarily incinerated (97%), as recommended in the guidelines (but non-hazardous medical waste were also mainly incinerated (97%), while there is also the option to recycle.
- Almost none of the potential food waste went directly to landfill, which is positive but the high share of “other” processing (77%) suggests that a significant portion was sent for secondary treatment, for which no detailed data were available. More data are therefore needed to determine if food waste was correctly processed.



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7 WATER MANAGEMENT

7.1 Annual water consumption in the healthcare sector in the Flemish region (m³) (ENV-16)

7.1.1 Documentation sheet

Description	Primary indicator: A. Annual water consumption in the healthcare sector in the Flemish region (m³ per capita) Secondary indicators: B. Annual water consumption per bed in hospitals of the Flemish region (m³ per bed) C. Annual water consumption in the healthcare sector in the Flemish region (m³) D. Annual water consumption in the healthcare sector in the Flemish region (as a share of total water consumption)
Rationale	Hospitals and long-term care facilities require large volumes of water for sterilisation, sanitation, laundry, and cooling systems, making them among the highest consumers in the public building category. Monitoring water use is essential for identifying efficiency gaps and implementing conservation measures that reduce resource depletion.
Calculation	Primary indicator: - Numerator: Annual water consumption in the healthcare sector in m³ - Denominator: Population of the corresponding year (calculated as mean of population at beginning and end of year) Secondary indicators: Indicator B: - Numerator: Annual water consumption of hospitals in m³ - Denominator: Number of hospital beds, calculated as the sum of justified acute beds (CD, E, M, NI, and G-beds of non-isolated sites) and licensed subacute beds (B, SP, AKT, and G-beds of isolated sites) of general hospitals. Indicator C: - Numerator: Annual water consumption in the healthcare sector in m³ - Denominator: / Indicator D: - Numerator: Annual water consumption in the healthcare sector in m³ - Denominator: Annual water consumption in total in m³
Data source	Water use: VITO Kennispunt Water ¹ Drinking Water: Data on drinking water consumption is derived from official water billing records (source the "water books") Other Water sources: Data on water use from other sources (e.g. groundwater, surface water, rainwater) and use of cooling water are only available for organisations subject to the water abstraction levy (source the "water levy database") Population data: Statbel ² Data on hospital beds: FPS Public health ³
Technical definitions	Surface water use excluding cooling water is calculated by subtracting cooling water discharge from total surface water abstraction, as recorded in the water levy database. In this cooling water is assumed to originate from surface water. Negative values of



	'surface water use excluding cooling water' indicate that part of the cooling water originates from other sources. The healthcare sector was identified via the statistical classification of economic activities in the European Community (NACE Rev. 2): Human health activities (Q86) and Residential care activities (Q87.1). More details on method and technical definitions can be found on: https://vito.be/nl/economisch-belang-2026
International comparability	International comparability was assessed based on a systematic review by Batista et al. ⁴
Limitations	Data availability limited to Flemish region.
Dimension	Environmental sustainability
Related indicators	/
Supervisor	Helena Van Deynse
Reviewers	Dirk Halet

7.1.2 Results

BELGIUM

The Flemish healthcare sector consumed 6 972 182 m³ (0.68 m³ per capita) of water in the year 2022, corresponding to 1.40% of total water consumption in Flanders, excluding cooling water (from both numerator and denominator). When cooling water is considered, healthcare accounted for 7 698 854 m³ (0.75 m³ per capita) or 0.33% of total water consumption.

A share of 57% of the total water consumption (excl. cooling water) in the health sector can be attributed to hospitals. For hospitals, the total water consumption amounts to 171 m³ per bed per year.

The observed increase in water consumption is due to the increase in cooling water in one hospital. Excluding cooling water, water consumption in the healthcare sector is slightly increasing, with 6 039 891 (0.59 per capita) in 2012 to 6 972 182 m³ (0.68 m³ per capita) in 2022 (see Table 19). This increase is in contrast to the goal of the European Commission to reduce water consumption and improve water efficiency in the EU by 10%⁵. This aim is particularly relevant for Belgium, given is one of the OESO countries with the lowest availability of water⁶.

Table 19 – Annual per capita water consumption (m³), evolution 2012-2022, Flanders

	2012	2014	2016	2018	2020	2022
<i>Including cooling water</i>	0.68	0.70	0.71	0.77	0.75	0.87
<i>Excluding cooling water</i>	0.59	0.60	0.61	0.61	0.60	0.68

Source: VITO 2026

ANALYSIS BY TYPE OF WATER CONSUMED

The distribution of type of water used in 2022 is presented in Table 20. Water consumption consisted predominantly of drinking water (70.78%). Additionally, the evolution of water consumption by type is displayed in absolute number in *Figure 82* and in per capita consumption in *Figure 83*, showing no

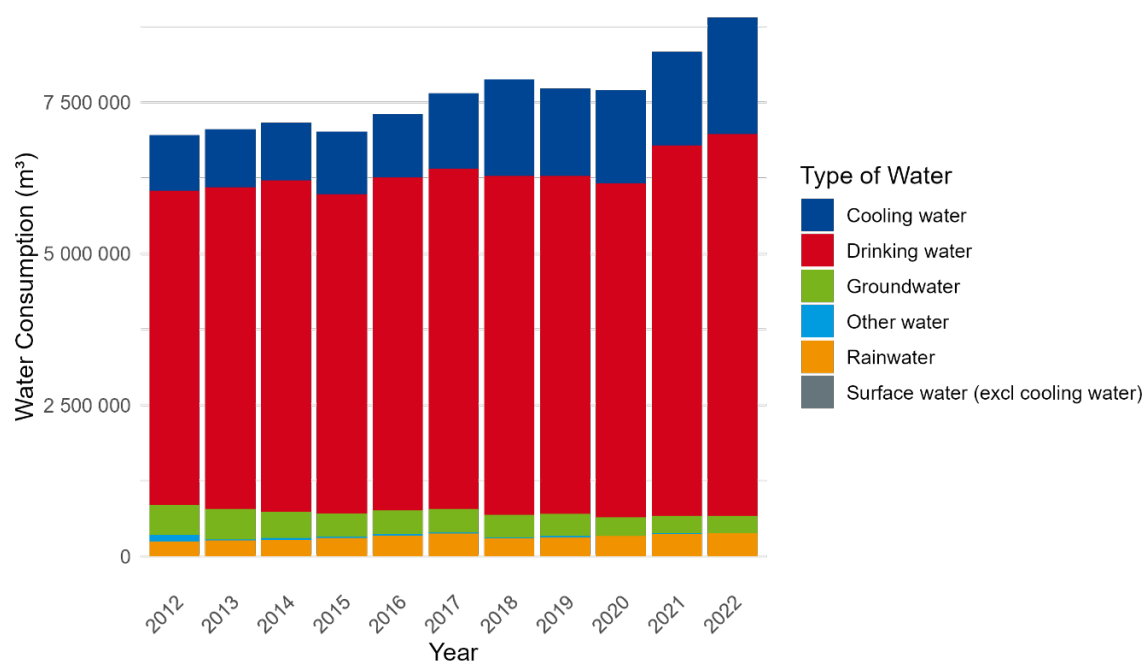
major shifts over time. Notably, all use of cooling water can be attributed to one hospital, AZ Sint-Jan Brugge, who perform part of their cooling activities using of the Brugge-Oostende canal as part of a past environmental project.

Table 20 – Overview of water consumption by type (2020)

Type of water consumed	Absolute Consumption	Consumption per Capita	Proportion including cooling water	Proportion excluding cooling water
Drinking water	6 304 556 m ³	0.61 m ³	70.78%	90.42%
Ground water	278 317 m ³	0.03 m ³	3.12%	3.99%
Rainwater	386 666 m ³	0.04 m ³	4.34%	5.55%
Cooling water	1 934 984 m ³	0.19 m ³	21.72%	/
Other water	2 643 m ³	<0.01 m ³	0.03%	0.04%

Source: VITO 2026

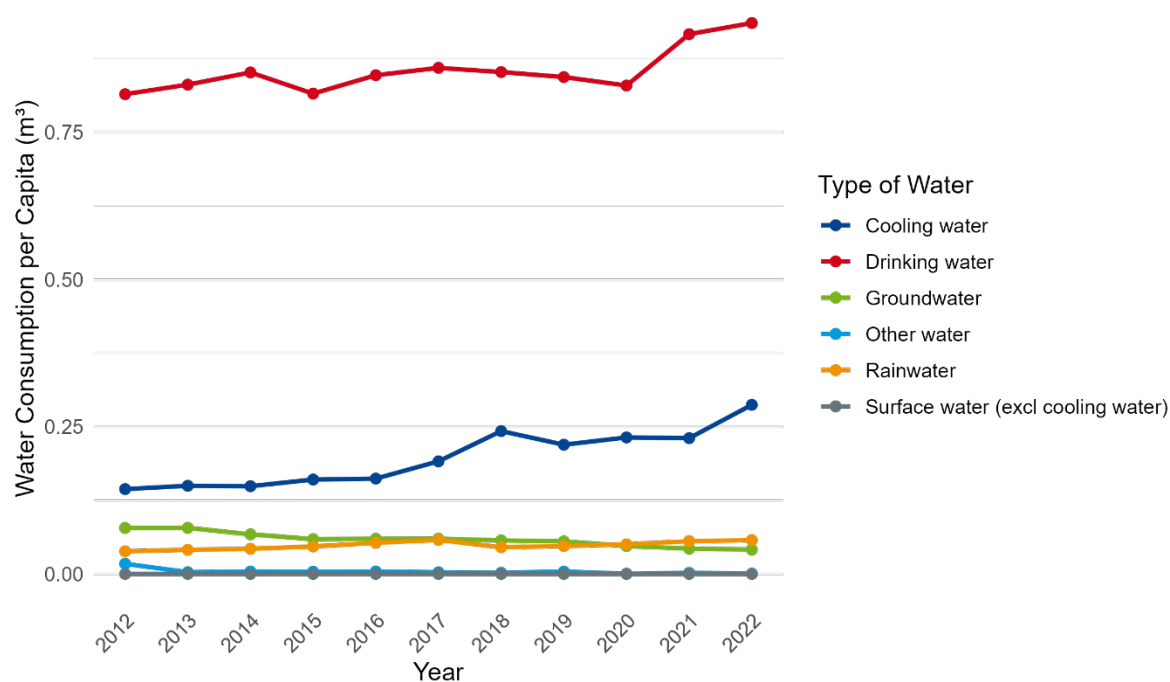
Figure 82 – Evolution of water consumption by type



Source: VITO 2026



Figure 83 – Evolution of per capita water consumption by type



Source: VITO 2026

REGIONAL COMPARISON

Figure 84 shows per capita water consumption in the healthcare sector per province. The province of Flemish Brabant has the lowest water consumption, probably due to many inhabitants seeking care in Brussels, for which no data are available. The largest level of water consumption per capita is found in Antwerp.

Figure 84 – Water consumption per capita by province (excl. cooling water)



Source: VITO 2026

INTERNATIONAL COMPARISON

A systematic review by Batista et al. (2019) on water consumption in the hospital sector summarizes several studies in which water use was calculated, often expressed in cubic meters per bed per year.⁴ Due to substantial heterogeneity among the studies (such as differences in time periods, and hospital contexts) and lack of generalizability, these figures should only be compared in terms of order of magnitude. In European hospitals (Spain, Germany, and Italy), annual water consumption ranged from 103 m³/bed/year to 458 m³/bed/year. When weighted by the number of hospitals included in each study, the European average is 394 m³/bed/year. In 2020, Flemish hospitals consumed 3 595 000 m³ of water for 23 658 beds. This results in a consumption of 171 m³/bed/year, which is clearly in the lower end of the European range found in Batista et al. (2019). It must be noted, however, that the number of beds used for this calculation (i.e. licensed beds) are an overestimation of the real activity. Because of this and the fact that the source studies in Batista et al. (2019) are quite old, this international comparison must be interpreted with caution.

KEY POINTS

- In 2022, the Flemish healthcare sector consumed 6 972 182 m³ (0.68 m³ per capita), representing 1.40% of total water use in Flanders (excluding cooling water). Including cooling water, consumption rose to 7 698 854 m³ (0.75 m³ per capita), or 0.33% of total use. Antwerp shows the highest per capita consumption.
- The increase observed in water consumption in the healthcare sector is due to cooling water use in a single hospital, AZ Sint-Jan Brugge for an environmental project. Excluding cooling water, water consumption slightly increased between 2012 and 2022, from 6 039 891 (0.59 per capita) in 2012 to 6 972 182 m³ (0.68 m³ per capita) in 2022.
- Water use type was mainly drinking water (71%), and trends over time show no major shifts.

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