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BELGIUM'S FIRST BIENNIAL TRANSPARENCY REPORT ON

CLIMATE CHANGE

To the United Nations Framework Convention on Climate Change
under the Enhanced Transparency Framework

.be

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1. Overview

Belgium welcomes the full transition to the Enhanced Transparency Framework (ETF) by submitting its first biennial transparency report (BTR1) under the Paris Agreement. The aim of this reporting is to contribute to the ETF's purpose to provide:

- a clear understanding of climate change action, including clarity and tracking of progress towards achieving individual nationally determined contributions (NDCs) under Article 4 (see chapter 3.2), and adaptation actions under Article 7, including good practices, priorities, needs and gaps, to inform the global stocktake under Article 14 (see chapter 4);
- clarity on support provided in the context of climate change actions under Articles 4, 7, 9, 10 and 11, and, to the extent possible, to provide a full overview of aggregate financial support provided, to inform the global stocktake under Article 14 (see chapter 5).

The report follows the guiding principles of the modalities, procedures and guidelines (MPGs) of the transparency framework set out in Decision 18/CMA.1.

It will be subject to a technical expert review process that will allow it to be improved in subsequent cycles based on areas of improvement identified by the technical expert review team, with which Belgium will fully cooperate.

The national inventory report is submitted as a stand-alone report of the biennial transparency report.

As first BTR, elements on climate change impacts and on adaptation are considered as initial, even if previous information is already available in the 8th National Communication.

In this version, texts in black represent information common to all EU Member States.

The structure of the report is based on the outline included in Annex IV of decision 5/CMA.3 (see table 0 for more details).

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VI. Information to be reported when national communications and biennial transparency reports are submitted jointly every four years	*Not concerned: The next National Communication (NC9) is expected in 2026 with BTR2. This chapter is therefore not applicable at this time*	
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General headings from MPG	Belgian headings	Source of information
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General headings from MPG	Belgian headings	Source of information
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2. National Inventory Report

The GHG inventory is submitted as a stand-alone report, see section 3.5 for the summary. All details are given in the National Inventory Document.

Belgium has its own annual GHG inventory. This is compiled with those of the other Member States to form the European Union inventory. It is this latter inventory that is used in the context of the tracking of progress of the EU NDC, that also covers Belgium. ■

3. Information necessary to track progress

3.1. National circumstances and institutional arrangements

3.1.1. National circumstances

A brief overview of Belgium

Population (on 1 January 2023)	11 697 557 inhabitants
Surface area	30 689 km²
Capital	Brussels
Head of State	HM King Philippe
Prime Minister	Mr Alexander De Croo
National languages	Dutch, French and German
Currency	Euro
GDP 2023 (current prices)	584.699 billion EUR
GDP growth rate 2023 (volume, variation from previous year)	+1.4 %
Inactive population (2023) [1]	1 617 024
Agriculture (Gross added value by sector at current prices, 2023)	4 525 million EUR
Industry (Gross added value by sector at current prices, 2023)	79 736 million EUR
Construction (Gross added value by sector at current prices, 2023)	28 095 million EUR
Services (Gross added value by sector at current prices, 2023)	413 425 million EUR
Population density (on 1 January 2023)	381 inhabitants per km²
Highest point	Signal de Botrange (694 m)
Average temperature (Uccle, 2023) [3]	12.1° Celsius
Precipitation (Uccle, 2023)	1 011 mm
Hours of sunshine (Uccle, 2023)	1 610 hours

3.1.1.1. Institutional structure

Federal structure of the state

After becoming independent in 1830, Belgium gradually moved from a unitary to a federal structure. Today, Belgium is a federal state composed of three communities and three regions.

The three communities are the Flemish Community, the French Community and the German-speaking Community. The three regions are the Flemish Region, the Brussels-Capital Region and the Walloon Region. The communities and regions partially overlap. The French Community exercises its authority in Brussels and in the Walloon Region with the exception of German-speaking municipalities; the Flemish Community exercises its authority in the Flemish Region and in Brussels; the German-speaking Community exercises its authority in the German-speaking municipalities of the Walloon Region (Figure 1).

Each of the communities and regions has its own legislative and executive bodies. In Flanders, the community and regional institutions have merged, so that there is only one Flemish Parliament and one Flemish government (Figure 1).

The Federal state, Communities and Regions all enjoy equal legal status. They intervene on an equal footing but in different areas.

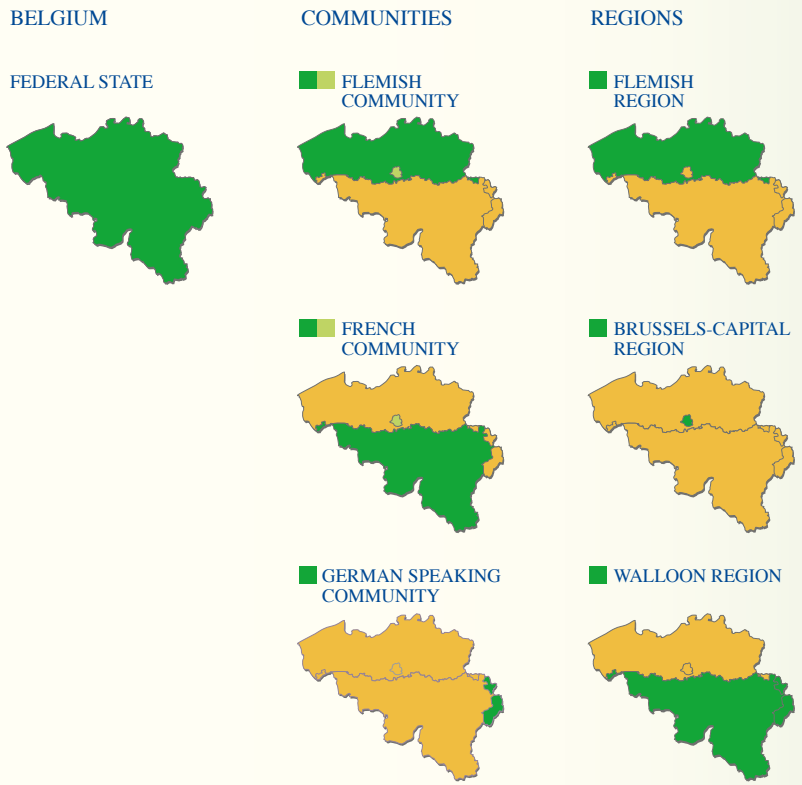
Division of powers

The Federal State is responsible for key policies such as foreign affairs (incl. development cooperation), defence, justice, finance, social security and a considerable part of public health matters and internal affairs. It also exercises competences in the following areas (which are 'mixed competences', being exercised both at federal and regional or community level): economy, transport, environment, energy, research, cities.

The powers of the communities concern matters relating to 'individuals': culture (theatre, libraries, audio-visual, etc.), education, use of languages and matters that can be 'personalised', including some aspects of health policy (preventive and curative medicine) and assistance to individuals (youth protection, social assistance, family assistance, reception of immigrants, etc.). Communities are also responsible for scientific research and international relations in the areas under their authority.

Regions have powers in 'territory-related' areas, in a broad sense. They are responsible for the economy, employment, agriculture, water policy, housing, public works, energy, transport (with the exception of the national railway, SNCB/NMBS and Infrabel), environment, town and country planning, rural revitalisation,

Figure 1 Belgium, a federal state



Source: FPS Chancellery of the Prime Minister

nature conservation, credit, foreign trade, and provincial, municipal and intermunicipal administration. They are responsible for scientific research and foreign relations in the above-mentioned areas.

In the context of the sixth institutional reform, which entered into force in July 2014, new transfers of competence have taken place, leading to increased autonomy for the federated entities. They acquired greater competences in the context of family allowances, employment policy, healthcare or caring for older people. Within this reform, large parts of fiscal matters were transferred from the federal authority to the Regions, which are notably now responsible for taxes on cars and transport and tax exemptions for rational use of energy (RUE) investments.

Coordination structures relating to climate policy

Given Belgium's federal structure, the division of powers between the federal state and the regions and the absence of hierarchy of norms, several structures have been established to ensure consultation and cooperation between the different levels of power and to ensure consistency in the actions of the federal state and the regional entities. The central coordination body with regard to national climate policy is the National Climate Commission, which was established by the cooperation agreement of 14 November 2002. Energy policy is coordinated via a body known as ENOVER/CONCERE. Since the entry into force of the EU Governance Regulation 2018/1999, these two structures decided to organise joint meetings for the establishment and follow-up of the National Energy and Climate Plan and the execution of international and European reporting obligations. Long-term strategy is also their responsibility. Within the coordinated meetings of the National Climate Commission and ENOVER/CONCERE a joint working group has been established with representatives of the federal state and the regions for the preparation and the compilation of the respective contributions of the respective energy and climate plans. Despite the lack of coherence and synergies between the contributions, this working group led to an extensive process of collaboration.

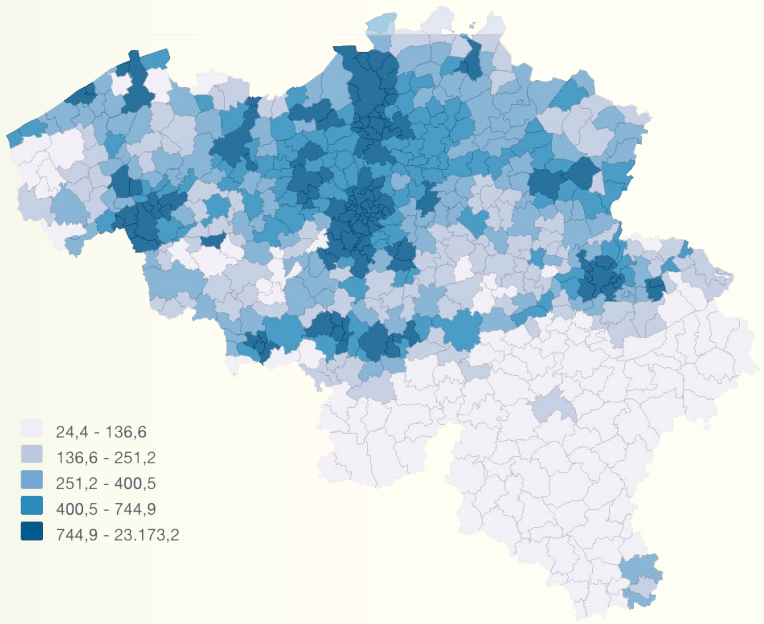
In the event of disagreement, the parties can escalate the issues to the level of the Consultative Committee (Comité de concertation/Overlegcomité), the highest political body in the country. It is the highest political body, presided by the Prime Minister, assembling the competent ministers from the federal government and the ministers of the Regions and the Communities to solve the political issues at stake.

For international and European climate policy, the Coordination Committee for International Environmental Policy (CCIEP) created under the cooperation agreement of 5 April 1995 is competent.

Belgium has a long tradition of consulting various stakeholders when developing its plans, strategies, policies, etc. at all levels. Examples include the Federal Council for Sustainable Development, the Central Economic Council (umbrella institution of the federal social and economic dialogue), Minaraad (strategic advisory council for the Environment policy domain of the Flemish Government), CESE Wallonia (economic, social and environmental council of Wallonia), the Brussels Environment Council (CERBC), Brupartners (economic and social council of Brussels-Capital Region), CWEDD (Walloon Environmental Council for Sustainable Development), SERV (Social and Economic Council of Flanders), youth councils, NGOs, consumer associations, citizen panels, etc. Ways are also being explored to include the voices of more vulnerable audiences.

Some of these stakeholders also have the opportunity to be part of the Belgian delegation during international negotiations. This gives them an opportunity to meet their counterparts over there and also to make their demands known.

Figure 2 Population density by municipality on 1 January 2024



Source: FPS Economy – FPS Economy - Directorate-General Statistics and Economic Information [1]
https://statbel.fgov.be/fr/themes/population/structure-de-la-population/densite-de-la-population#figures

3.1.1.2. Population profile

On 1 January 2023, the population of Belgium numbered 11 697 557 inhabitants. This represents 2.6% of the total population of the European Union (EU-27). (Belgium is the 8th most populated Member State of the European Union). Belgium is very densely populated. With an average density of 381 inhabitants/km² (2023), it is the third most densely populated country in Europe. However, that density varies from one part of the country to another, the north of the country being much more densely populated than the south. Currently, the Flemish Region makes up 57.9% of the population, the Walloon Region 31.5% and the Brussels-Capital Region 10.6%.

In 2022, the population of Belgium grew by 113 549 inhabitants. The slightly negative natural balance was more than offset by the very positive net international migration, which was higher than in other years due to the war in Ukraine.

The declining birth rate, a marked improvement in medical care and a more selective immigration policy have gradually led to a reduction in natural growth and to the ageing of the population.

Belgium GHG intensity in 2022 (9.3 tonnes CO_2-eq/capita – Total net emissions with international aviation (EU NDC) was significantly lower than in 1990 (14.7 tonnes CO_2-eq/capita in 1990). It remains higher than the CO_2 intensity in the EU-27, which decreased from 11.2 to 7.3 tonnes/capita between 1990 and 2022.

3.1.1.3. Geographical profile

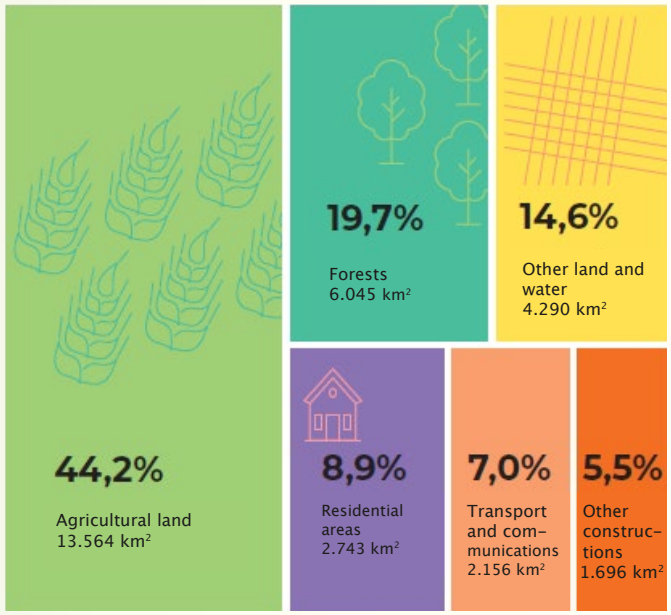
Geographical situation and relief

Belgium is a small country (surface area of 30 689 km²) in north-western Europe and covers 3 454 km² of the North Sea. It has 1 482 km of borders with the Netherlands, Germany, Luxembourg, France and the North Sea (its coastline is 73.1 km long). The Walloon Region occupies the biggest part of the territory (55.1%), followed by the Flemish Region (44.4%) and the Brussels-Capital Region (0.5%). Belgium has three zones of elevation, oriented east-west and south-west: the coastal plain, the central plateau and the uplands. The highest points of the uplands constitute a ridge peaking at 694 metres at the 'Signal de Botrange'.

Ecosystems

Despite the small size of the country and its slight topographical gradient, the climate and geological conditions, together with long-standing human impact in land use, resulted in a diversity of habitats for such a small territory. The diversity of life forms in Belgium is estimated to comprise up to 55 000 species. The main vegetation types found in Belgium are deciduous and conifer forests, grasslands, heathlands, peat bogs, wetlands, lakes and rivers, and marine ecosystems in the North Sea. The distribution of these varies from region to region. For example, about 80% of the forested areas are found in the southern part of the country, while northern Belgium is noted for its semi-natural grasslands,

Figure 3 Land use in Belgium (%)



Source: FPS Economy – FPS Economy - Directorate-General Statistics and Economic Information [1]

wetlands, heathlands and coastal dunes. Recent observation data shows that many species are in decline or have even disappeared [2].

Land use

Agricultural land occupies the main part of the terrestrial surface (44%), followed by forests (20%). Built-up areas cover 9% of the territory while transport and telecommunications use 7% of the land (Figure 3). Built-up areas are increasing every year, mainly at the expense of agricultural land. Forests and other wooded areas remain relatively stable.

3.1.1.4. Climate profile

Our country is located in the middle latitudes of the northern hemisphere, on the western edge of the European continent. The seasonal cycle of insolation and the atmospheric dynamics of the mid-latitudes, as well as the proximity of the Atlantic Ocean, explain the main features of the climate in our regions. Our 'temperate' climate is normally characterised by relatively cool, wet summers and relatively mild, rainy winters.

Its latitude and the proximity of the sea warmed by the Gulf Stream give Belgium a temperate maritime climate characterised by moderate temperatures, prevailing southerly to westerly winds, abundant cloud cover and frequent precipitation. Summers are relatively cool and humid and winters relatively mild and rainy.

The monthly, seasonal and annual normals can be compared for the four different 30-year periods: 1961-1990, 1971-2000, 1981-2010 and 1991-2020. When comparing the average weather for the period 1991-2020 with the average weather for the period 1961-1990, it can be seen that the Belgian climate is changing (Figure 4).

Box 1 gives a summary of the main climatological trends and changes observed in Uccle and in Belgium.

Box 1 Climate trend observed

in Uccle

TEMPERATURE

- A warming of 2.1°C is observed as an annual average between the middle of the 19th century and the last three decades.
- The 6 warmest years occurred after 2005.
- Since 1981: significant annual warming of +0.38°C on average per decade.
- Most significant warming (+0.45°C per decade) in winter.
- Highest summer temperature trend upwards (+0.8°C per decade).
- A new all-time high of 39.7°C was set on 25 July 2019.
- The annual number of high night-time temperatures (at least 15°C) is also increasing (+3.9 days per decade since 1981).

HEAT WAVES

- More frequent since 1981 (+0.3 heat waves per decade).
- More frequent in recent years, with at least one heat wave per year since 2015.
- Tendency to be longer (+2 days per decade) and more intense (+1°C/day per decade).

PRECIPITATION

- A 9% increase in cumulative annual rainfall between the mid-19th century and the last three decades. Since 1981, there has been a slight upward trend, but it is not significant.
- In spring, a decrease since 1981 (-9 mm per decade). This trend is explained by relatively wet springs during the 1980s, and then by mostly dry, and sometimes dry, and sometimes very dry springs since the 1990s.
- In summer and annually, the frequency of heavy daily rainfall (at least 20 mm)) has increased since 1981 (+0.6 days and +0.5 days per decade respectively).
- The highest annual hourly precipitation amounts have increased since 1981 (+3 mm per decade).

SNOW

- Since the beginning of the 21st century: great variability from year to year, with the last six years being relatively snow-free.

DRYNESS

- The duration of spring droughts has been increasing since 1981 (+1.5 days per decade).
- Combining the increase in the duration of spring droughts with the observed decrease in cumulative rainfall during the same season, it can be concluded that the intensity of spring droughts must also have tended to increase since the warming observed in our country towards the end of the 1980s.

WIND

- Annual decrease of the average wind speed of -0.1 m/s per decade since 1981.

SUNSHINE

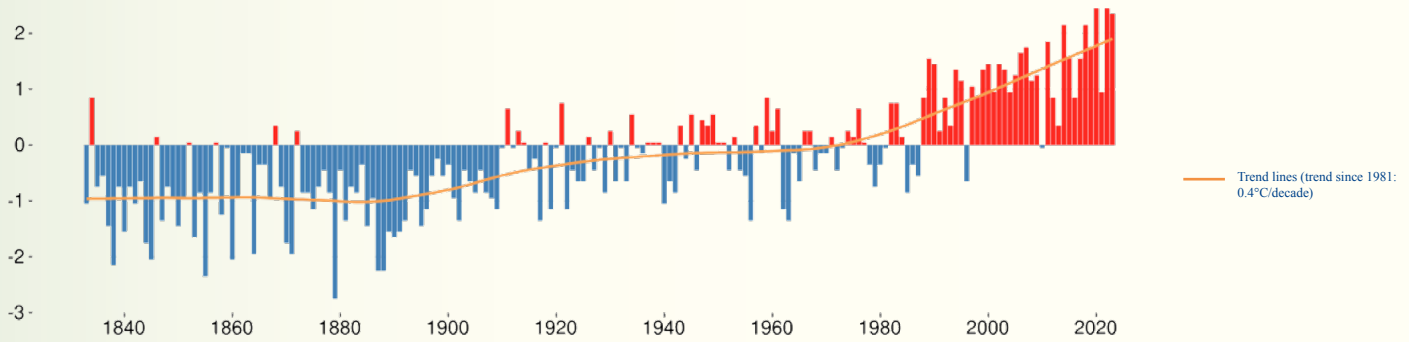
- Since 1981: trend towards an increase in annual sunshine duration (+58 hours per decade), spring (+35 hours per decade) and summer (+20 hours per decade).
- Since 1981: trend towards an increase in global solar radiation measured at the surface (+42 $kWhm^{-2}$ per decade). The improvement of the air quality in our regions, thanks to efforts to reduce the emission of pollutants, seems to be at least partly responsible for the increase in solar energy reaching the surface.

Source: Royal Meteorological Institute of Belgium

in Belgium

	TEMPERATURE – Since 1890: average annual increase of +1.9°C. – Since 1954: annual warming of between +0.27°C and +0.33°C per decade for the average temperature, depending on the region.
	PRECIPITATION – Since 1890: average increase in precipitation of around 15%.
	SNOW – Snowfall in the Ardennes has remained relatively low and stable since the 1990s, although from the mid-2000s onwards it seems to be showing a slight recovery.
	WIND – The average wind speed has tended to decrease over the last few decades and in particular since the beginning of the 21st century. – The intensity of storms, as well as their frequency, has not increased over the last three decades, but rather has tended to decrease.

Figure 4 Trend in average temperature (Uccle, 1833-2023): anomaly in annual averages compared with the 1961-1990 reference period



Source: based on data from the Royal Meteorological Institute of Belgium

In 2023, the average temperature in Uccle was 12.1°C (normal: 11.0°C). This year was the third warmest on record, just behind the record years of 2020 and 2022 (12.2°C).

The average annual minimum temperature set a new all-time record (measured 1892): 8.6°C (normal: 7.3°C). The average annual maximum temperature reached: 15.8°C (normal: 14.7°C) [3].

In Uccle, a total of 1011.4 mm of rain fell (normal: 837.1 mm). This total amount fell in 207 days (normal: 189.8 days). The year 2023 recorded the second longest period of drought since observations began in 1892 in Uccle. No precipitation fell between 16 May and 16 June

The duration of sunshine reached up to 1610h 19min in Uccle (normal: 1603h 40min.

Two heat waves were recorded in 2023: the first in June (8-17 June) and a second in September (4-11 September). The latter heatwave was particularly remarkable: it was the first autumn heatwave in autumn (measured since 1892).

For more information, please see also chapter 4.

3.1.1.5. Economic profile

Belgium's GDP amounted to EUR 584.699 billion in 2023. Although the population of Belgium only represents about 2.6% of the total European population, its GDP at market prices represents 3.4% of the GDP of the European Union.

Services currently make up close to 71% of the added value of the different branches of economic activity (trade, transport and the hotel, restaurant and catering sector represent the largest share in 2023 with 24.5% of total production, followed by business services (19.9%) and by public administration and education (18.6%).

Belgium has a very open economy, situated at the heart of a zone of intense economic activity. In addition, the port of Antwerp ranks second in Europe (after Rotterdam) and is one of the world's top 10. Export of goods and services represented 86.7% of the GDP in 2023 and imports 87.6%, meaning that the country recorded a slight debs. This trade occurs in large part with the European market. About 44% of Belgium's exports are sold to Germany, France and the Netherlands and about one fifth to other EU Member States. Imports follow more or less the same proportions. This situation reflects Belgium's role as the hub of the European Union [4].

Belgium also benefits from the presence of the EU institutions in its capital, along with a high concentration of international agencies and service companies. Other international organisations, such as NATO, are also headquartered in Belgium.

Greenhouse gas emissions per GDP were 233.1 tonnes CO_2-eq. per million euros at 2015 prices in 2022 (total UNFCCC excl. LULUCF) (Data (europa.eu)).

3.1.1.6. Energy

Demand

Primary energy consumption [5]

The total primary energy consumption in 2022 amounted to 52.3 Mtoe.

This is a decrease of 7.9% compared to 2021. This level of primary energy consumption is the lowest since the early 1990s, with the exception of 2020, which was marked by the coronavirus crisis. This situation is mainly due to Russia's invasion of Ukraine and the associated sharp rise in energy prices. This has led to a change in consumption patterns, mainly of natural gas and petroleum products, by businesses and households. The share of renewables and waste has increased to 11.3% of primary energy consumption in 2022, up from 7.6% in 2013. Negative net electricity imports, recorded since 2019, cause the energy source "Other" to fall-sharply, to the point where it will show a negative value in 2022 (see Table 1).

Table 1 Primary energy consumption in Belgium in 2022 per energy source

Energy source	Mtoe	TJ	%
Oil and oil products	20.3	850 872	38.4
Natural gas	13.0	542 656	24.5
Solid fossil fuels	2.7	114 614	5.2
Nuclear energy	10.7	447 885	20.2
Renewable energy and waste	5.9	247 710	11.2
Other*	-0.4	-14 840	-0.7
Total	**52.3**	**2 188 896**	

* "Other" includes net imports of electricity and heat as well as chemical process heat recovery.

Source: FPS Economy [5]

Energy intensity (the ratio of primary energy consumption to GDP expressed in volume) measures the quantity of energy consumed by the economy to generate one production unit. It has been following a downward trend since 1990.

The primary energy intensity in Belgium is continuously higher than the European average. This can be explained by the presence of energy-intensive industries (oil refineries, cokes plants, concrete mixing plants).

Final energy consumption [5]

Final energy consumption, i.e. gross apparent energy consumption after deduction of processing activities and energy loss, amounted to 36.9 Mtoe in 2022.

Between 2013 and 2022, final energy consumption varied between 36.9 and 41.6 Mtoe. This is highly dependent on weather conditions. In years with colder winters, such as 2013, final fuel consumption for heating is higher. This impact is mainly observable in the consumption of natural gas. As a result of Russia's invasion of Ukraine, final energy consumption, like primary energy consumption, will fall sharply in 2022 (-9.4% compared with 2021). The fall is most notable in the consumption of natural gas (-18.3% compared with 2021) and petroleum products (-6.5% compared with 2021). [1]

In terms of market shares of total final consumption, oil products remain the dominant energy source, followed by natural gas and electricity (see Table 2).

The shares of the various energy sources in final energy consumption have remained relatively stable in recent years: the average share of oil products over the last decade is about 48%, natural gas 26%, electricity 17%, renewable energy and waste 5%, solid fossil fuels 2% and heat 1%.

Since 2013, the share of renewable energy and waste in final energy consumption has increased from 4.8% to 7.1%. This share does not include final consumption of green electricity.

The share of petroleum products in total final consumption fell slightly, but remains predominant (47.3 in 2022). The final consumption of petroleum products is divided up between energy uses (68.6%) and non-energy uses (31.4%). The transport sector accounts for 63.3% of their final energy consumption in 2022.

Natural gas accounts for 24.7% of the country's final energy consumption in 2022. 91.1% of this gas is used for energy purposes, of which 34.4% is used in the residential sector. [5]

Supply [5]

Primary energy production

The production of primary energy from renewable energies and fuels has risen sharply from 3.0 Mtoe in 2013 (21.1% share) to 4.3 Mtoe in 2022 (26.9% share). This increase is mainly due to new installations of wind farms and solar panels. Between 2021 and 2022, wind generation increased by 3.0% despite particularly

Table 2 Final energy consumption in Belgium in 2022 per energy source

Energy source	Mtoe	TJ	%
Oil products	17.5	731 622	47.3
Natural gas	9.1	382 327	24.7
Solid fossil fuels	0.7	29 741	1.9
Electricity	6.6	275 606	17.8
Heat	0.4	16 592	1.1
Renewable energy and waste	2.6	109 267	7.1
Total	**36.9**	**1 545 153**	

Source: FPS Economy [5]

Table 3 Primary energy production in Belgium in 2022 per energy source

Energy source	Mtoe	TJ	%
Nuclear energy	10.7	447 885	67.4
Non-renewable waste	0.6	25 250	3.8
Renewable energy and fuels*	4.3	179 020	26.9
Other**	0.3		1.9
Total	**15.9**		

* "Renewable energy and fuels" includes hydro, excluding pumped storage, wind, solar, geothermal, solid and liquid biomass, biogas, renewable waste and ambient heat used by heat pumps.
** "Other" includes chemical process heat recovery and firedamp (coal mine gas).

Source: FPS Economy [5]

low wind speeds and solar generation by 22.4%. Nuclear power generation decreased by 12.5%. [5]

Gross electricity production

In 2022, gross electricity production was 4.5% below its 2021 level, mainly due to a decrease in production from nuclear facilities (-12.8% or -6.4 TWh). Nevertheless, 2022 remains the second year, after 2021, in which gross electricity production is the highest. During this decade, the most remarkable increase can be observed in renewable energy, where production rose by 108.3% or 12.7 TWh compared to 2013. It can also be deduced that the use of oil products and solid fossil fuels has decreased significantly (-8.5% and -55.1% respectively over the past decade), mainly in favour of renewables. The last power plant using solid fossil fuels closed in 2016. The electricity still generated from this fuel group today comes from manufactured gases in the steel industry and small multi-fuel cogeneration plants. [5]

Gross electricity production from renewable energy sources

Renewable electricity production has increased significantly over the last decade. Solar-based electricity generation has seen marked growth for the fifth year in a row (+22.4%). This sharp rise is due, among other things, to the exceptionally high number of hours of sunshine in 2022. Solid biomass production has recovered since the decline in 2014 and peaked in 2017 with 3.8 TWh. Between 2021 and 2022, wind generation increased by 3.0%, thanks to the installation of additional wind farms, despite exceptionally low wind speeds in 2022. [5]

Wind power is the most important source of renewable electricity, partly due to offshore wind farms. These generated 6.7 TWh of electricity in 2022, equivalent to the consumption of about 1 900 000 households (assuming that an average household consumes 3 500 kWh of electricity per year). [5]

Production

The installed electricity capacity in Belgium increased from 20.9 GW in 2013 to 26.6 GW in 2022, an increase of 5.7 GW. Conventional thermal installations (non-nuclear thermal) and nuclear installations have decreased by 0.7 GW and 1.1 GW respectively (Doel 3 was definitively closed in autumn 2022), while renewable electricity generation capacity, mainly solar and wind, has increased considerably. The installed capacities of these two renewable energy sources represent 12.1 GW or 45.3% of the total installed electricity capacity.

Table 4 Primary energy production in Belgium in 2022 per energy source

Energy source	TWh	%
Nuclear	43.9	45.7
Natural gas	21.9	22.9
Solid fossil fuels and steel gas	2.3	2.4
Oil products	0.3	0.3
Renewable energy	24.4	25.5
Other sources*	3.1	3.2
Total	**95.9**	

* "Other sources" includes pumped hydro, recovered heat, non-renewable waste and others.

Source: FPS Economy [5]

Table 5 Gross electricity generation from renewable energy sources in 2022

Electricity	TWh	%
Hydraulic	0.3	1.1
Solar	6.9	28.1
wind	12.4	50.6
Renewable municipal waste	1.0	4.1
Solid biomass	2.8	11.6
biogas	1.0	4.1
Liquid biomass	0.1	0.3
Total	**24.4**	

Source: FPS Economy [5]

The first offshore wind energy zone in the Belgian part of the North Sea has been fully constructed. The latest wind farm in this area has been fully operational since December 2020. The total installed offshore capacity amounts to 2 261.8 MW.

A second offshore wind energy zone, the Princess Elisabeth zone, has already been defined. The first wind farm in this area is scheduled to come into operation in 2027-2028. A total installed capacity of between 3 150 and 3 500 MW is envisaged.

Around 65.9% of solar capacity comes from small solar photovoltaic panels of less than 30 kW. This type of installation is mainly found in the residential sector, which demonstrates its importance.

The increase in total installed electricity capacity does not necessarily lead to an increase in electricity production, mainly due to the intermittency of solar and wind energy sources, but also the complementary nature of gas-fired thermal installations. These are only used when other facilities are unable to meet production needs (in particular, during peaks in consumption or when there is too little sun or wind).[5]

Electricity and gas prices

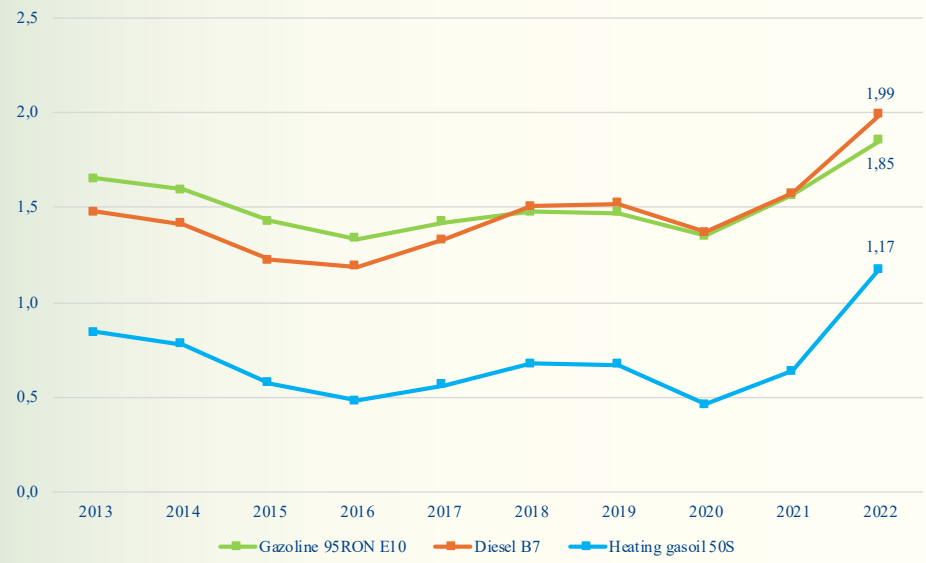
An average Belgian household paid 11.0 eurocents/kWh for its natural gas in 2022, 102% more than in 2021. The price excluding taxes and levies, which includes energy, supply and network costs, represents 88.7% of the total price. The share of VAT and other taxes is 11.3%. Following Russia's invasion of Ukraine, the price of natural gas rose sharply. Compensatory measures have been put in place to ease the cost of natural gas, such as the reduction in VAT from 21% to 6% from April 2022, as well as the basic federal gas flat rate and the extension of the social tariff. [5]

An average Belgian household paid 39.6 eurocents/kWh for its electricity in 2022, 39.2% more than in 2021. The cost of energy represented 57.9% of the total electricity bill. Network tariffs have remained stable and accounted for 23.1%. The share of taxes reached 19.1% of the total bill. [5]

Influenced by the price of natural gas, the price of electricity also rose in 2022 following Russia's invasion of Ukraine. Compensatory measures have also been put in place to ease electricity bills, such as the reduction in VAT from 21% to 6% from March 2022, as well as the federal heating premium, the federal basic electricity rate and the extension of the social tariff. [5]

After a significant drop in 2020, the average official price of oil products per month (maximum price) recovered during 2021, returning to their pre-corruption levels. (see Figure 5). In 2022, the prices of all petroleum products reached unprecedented high levels, as a direct result of the geopolitical situation in Ukraine. To soften the blow, an excise duty reduction of 17.5 euro cents per litre (including VAT) was introduced for petrol and diesel in mid-March 2022. In autumn 2022, prices fell again, mainly due to high inflation, which slowed economic growth and curbed demand. This led to the ratchet system on excise duty for petrol being activated in September 2022, gradually bringing it back to its initial level. In parallel with the reduction in excise duty, a fuel oil voucher has also been introduced.

Figure 5 Annual average official oil price



3.1.1.7. Transport

General description

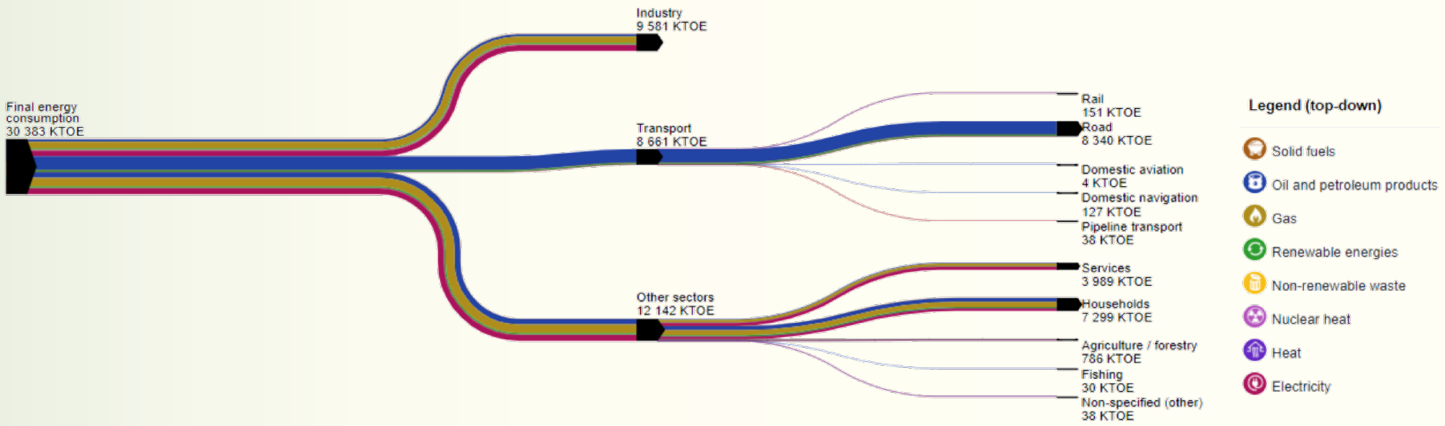
Belgium, which is densely populated and situated at the centre of Europe, is a major centre for transit. The country's economic activity, which is strongly export-oriented in particular with the port of Antwerp, Europe's second largest port, requires a dense road and rail network (one of the densest in the European Union), and also relies on inland waterways. The expansion of the intra-European area has further increased transit traffic, resulting in constant growth of transport (particularly road and air).

While the domestic transport sector[1] accounts for 31.0% of the final energy consumption of Belgium, that same sector is responsible for 63.3% of petroleum product consumption within the total final energy consumed in Belgium in 2022[2] (Figure 6). [5]

Petroleum products (87.6% share of energy quantity) were the most frequently consumed type of energy carriers in the transport sector in 2022. Biofuels (9%: bioethanol and biodiesel), electricity (2%: mainly used for rail transport) and a very small amount of natural gas (1%) made up the remainder. While the energy carriers consumed in road transport sector are 89% petroleum products and less than 1% electricity, the rail sector consumed 84.4% electricity and 15.6% petroleum products[3]. Domestic aviation and domestic navigation depend entirely on petroleum products (Figure 6).

In 2022, the share of renewable energies in final energy consumption in the transport sector was 10.35% (according to the calculation rules of directive (EU) 2018/2001[4]). [5]

Figure 6 Energy balance flow of final energy consumption for Belgium for 2022 (ktoe)



Source: Eurostat

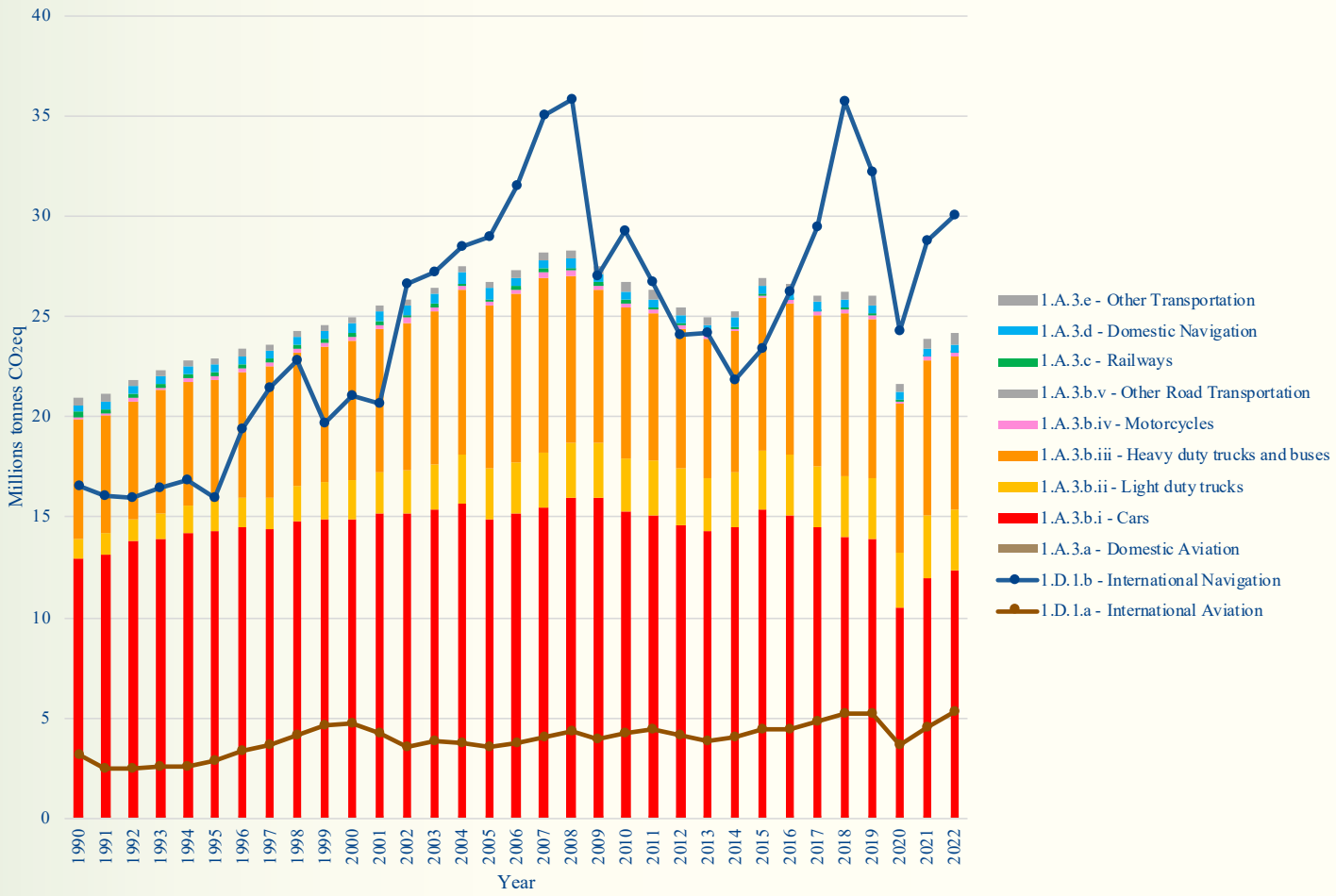
[1] Transport sector = Rail + Road + Domestic aviation + Domestic navigation + Pipeline transport + Not elsewhere specified (transport) (https://ec.europa.eu/eurostat/statistics-explained/index.php?oldid=464172#Technical_specificity_of_Eurostat.27s_energy_balance)

[2] Eurostat Energy Balance Flow for Belgium 2022.

[3] *The Belgian rail network is 88% electrified*

[4] Eurostat: Short Assessment of Renewable Energy Sources (SHARES)

Figure 7 Historical yearly transport emissions in Belgium for domestic (stacked bars) and international (stacked lines) transport modes



Source: EEA GHG Data viewer

Domestic transport emissions have evolved rather steadily (stacked bars in Figure 7), compared to international maritime and aviation transport emissions that fluctuate more strongly depending on international market trends (stacked lines in Figure 7).

Road transport is the main contributor to domestic transport emissions and accounted for 96% of transport emissions in 2022. This share has been fairly constant over time. Heavy duty vehicles (HDV, i.e. trucks, tractors, buses and coaches, mainly freight transport by trucks and tractors) account for 33% of domestic road transport emissions in 2022 [National GHG Inventory 2024]. This is slightly higher than in pre-covid years. In the urban region of Brussels, the share of HDV emissions in Brussels road transportation is a lot lower: 16% [Brussels GHG inventory 2024].

Passenger transport

In 2024, there are more than 6 million passenger cars in Belgium. The number of passenger cars has been increasing every year[5].

In 1990, Belgium had one car for every 2.57 inhabitants. In 2023, it is one car for every 1.94 inhabitants: so there are more and more vehicles on the roads. Since 1990, the car density - the number of private cars per 1 000 inhabitants - has increased by almost 33%. [1]

Driving the growth of the passenger car fleet, are companies (including leasing companies): they account for 60% of newly registered passenger cars [www.ecoscore.be]. In 2010, private cars still accounted for 63% of new passenger cars.

More than private individuals, companies are opting for alternative powertrains. This is largely due to (para)fiscal measures.

The number of fleet and leased cars continues to rise, while the number of passenger cars registered by individuals has been capping since 2018. By 2023, around one in five passenger cars are registered by businesses.

In 2023, one in five fleet cars is a new car, and for leased cars it will be as much as one in three. By comparison, for private passenger cars it is barely one in 30. This low fleet renewal limits the share of alternative powertrains for private passenger cars to 4%. The share of electric cars is barely 0.7% in 2023.

Figure 8 Share of alternative powertrains in newly registered cars, 2023

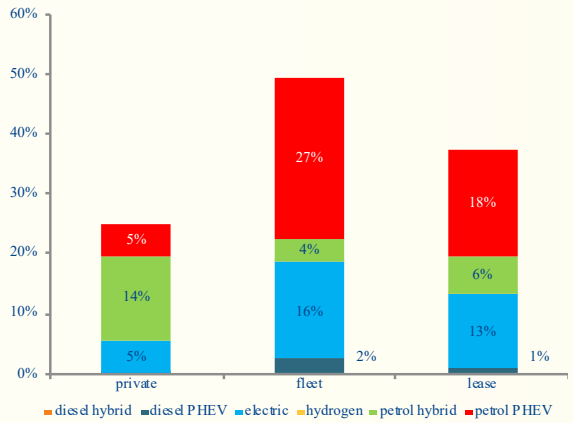
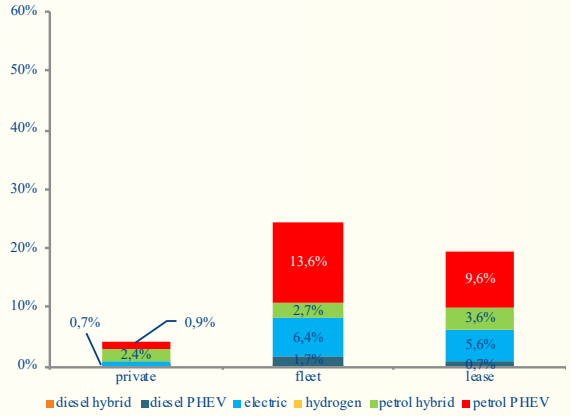


Figure 9 Share of alternative powertrains in total car stock, 2023

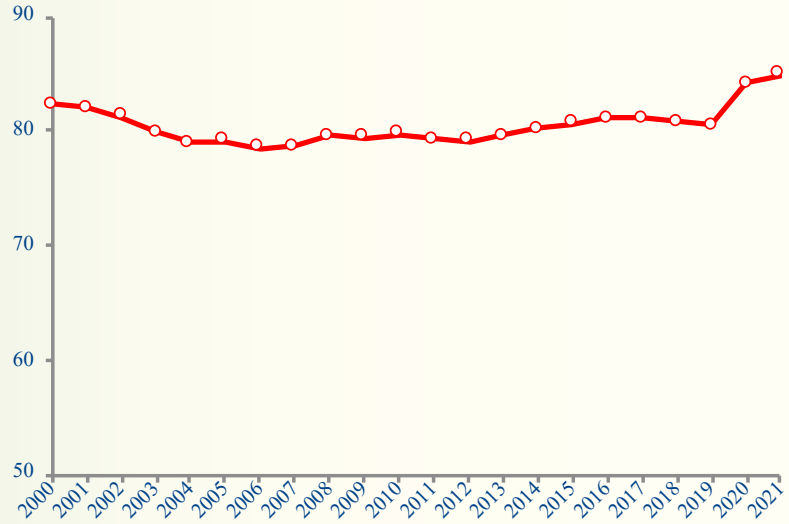


Source: www.ecoscore.be

[5] https://statbel.fgov.be/en/themes/mobility/traffic/vehicle-stock#figures

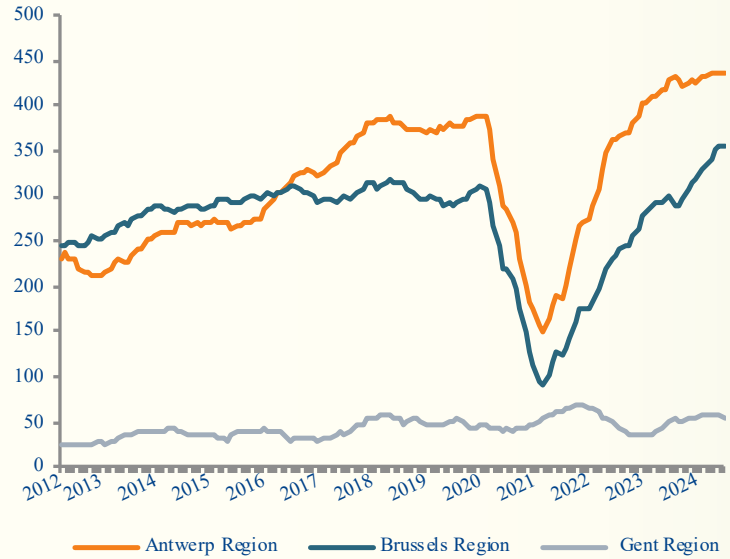
On the indicators.be website, the Federal Planning Bureau tracks the Belgian path towards a set of Sustainable Develop Goals for 2030 [6]. To make a European comparison, they rely on estimates from the European Commission's DG Move. As Figure 3 shows, COVID boosted the modal share of the passenger car in 2020 and 2021. Two years later, public transport has still not fully recovered: while trains are back on the rise, they are not yet at the same level as before the corona crisis. Other public transport companies are also struggling to attract passengers back. This while congestion on the main roads in the Flemish Region has reached new record heights since July 2023 (Figure 11).

Figure 10 Share of passenger transport by car



Source: www.indicators.be [6]

Figure 11 Congestion in kilometer-hours per working day

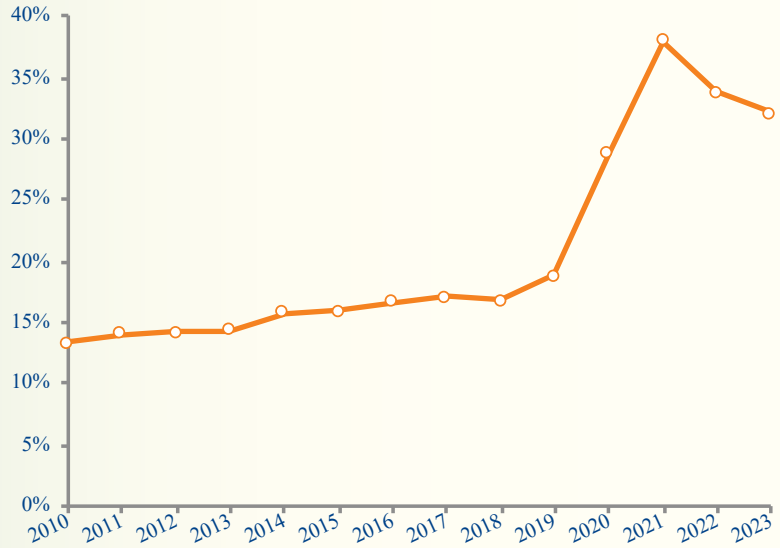


Source: Statistiek Vlaanderen https://www.vlaanderen.be/statistiek-vlaanderen/mobiliteit/filezwaarte

Telework plays an important role in passenger mobility. After the explosion of telework during COVID, the share of employees working from home declined since 2021 (Figure 12). Not only is the number of teleworkers decreasing, but also the number of days of telework per week (Figure 13).

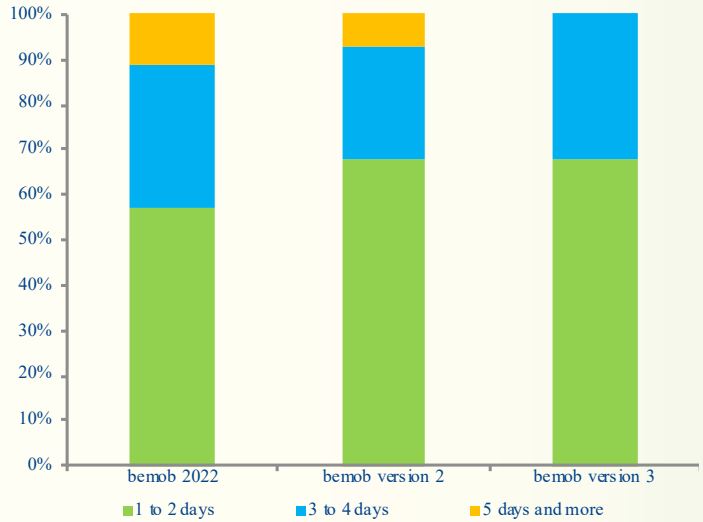
An initial survey conducted by the FPS Mobility and Transport during 2022 showed that 57% of homeworkers worked from home for 1 to 2 days. The follow-up survey showed that share to be 10 percentage points higher barely a year later. The most recent survey shows there were no more homeworkers working from home for 5 days or more.

Figure 12 Share of employees working from home



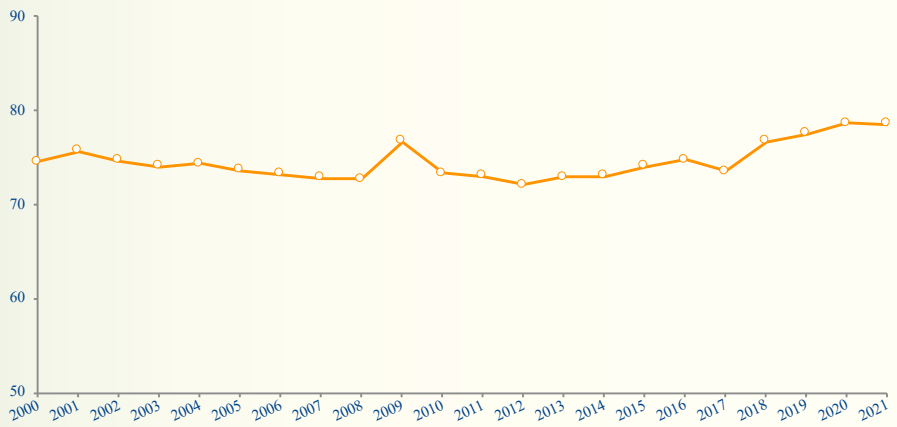
Source: statbel https://statbel.fgov.be/en/themes/work-training/labour-market/working-home

Figure 13 Number of days of telework per week according to 2022 (*bemob 2022*), 2023 (*bemob version 2*) and 2024 (*bemob version 3*) surveys



Source: FPS Mobility and Transport

Figure 14 Share of freight transport by road (%)



Source: Federal Planning Bureau [6]

Freight transport

As for passenger transport, the Federal Planning Bureau [6] tracks the evolution of the share of road transport in goods transport. In terms of ton-kilometers, road freight transport accounts for almost 80%. This share has continued to rise in recent years (Figure 14).

Freight transport suffered much less from the COVID crisis than passenger transport. However, freight transport has shrunk since the start of the war in Ukraine. Compared to 2021 (i.e. before the war), transport on Belgian inland waterways fell by 15% [Stabel]. Freight transport by Belgian rail, expressed in gross tonne-km, also suffered a blow of more than 13% [Opendata.infrabel]. The damage to road freight transport was smaller: the number of vehicle-kilometers by trucks on Belgian toll roads fell by less than 4% [Viapass].

3.1.1.8. Housing stock [1,11]

Belgium counted 4 630 028 buildings in January 2023. Since 1995, the number of buildings has increased by 16%. Over the same period, the number of dwellings increased by 30% (5 741 588 units). The Belgian housing stock remains old. The age of the buildings varies from one region to another. In Flanders, 34% of the buildings were built after 1981, compared to 22% in Wallonia and only 7% in the Brussels-Capital Region [Statbel accessed on 29/05/2024].

In 2020, 77.2% of households lived in a single-family house and 22.3% in a flat (source: EUROSTAT).

Private households spent on average 30.7% of their budget for housing in 2022 [Statbel accessed on 29/05/2024].

3.1.1.9. Industry

Although Belgium's economy has become mainly based on service sectors, its industrial sector continues to be a relatively important component of Belgium's economic activity (almost 19% of GDP). [1] Table 7 shows the progression of added value in the main branches of economic activity since 2015.

The sectors of industry that contribute most to greenhouse gas emissions are subdivided into three categories, according to the source of emissions:

- greenhouse gas emissions from energy combustion, mainly through the production of electricity and heat, but also from oil refining
- greenhouse gas emissions from industrial processes, mainly from the chemical industry (petrochemicals, but also production of nitric acid and ammonia), mineral products industry (including cement and lime production) and metallurgy.
- greenhouse gas emissions from energy transformation of the manufacturing industry distributed between the iron and steel industry, the chemical industry, food and beverage processing and cement plants.

Table 7 GDP – Gross added value by economic activity, estimation at current prices (in EUR millions, gross data) [1]

										Growth	
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2023/2015	2023/2022
Agriculture, forestry, fishery	2 860	2 703	2 960	2 774	3 027	3 129	3 259	3 549	4 525	58.2%	27.5%
Industry	62 671	63 277	65 457	65 338	69 562	67 542	73 808	84 836	79 736	27.2%	-6.0%
Construction	19 294	19 678	20 150	21 767	22 628	21 759	24 399	26 261	28 095	45.6%	7.0%
Services	288 477	298 374	308 467	320 321	331 949	321 245	351 757	382 617	413 425	43.3%	8.1%
Other components	43 400	46 053	48 016	49 850	51 330	46 860	54 838	56 950	58 918	35.8%	3.5%
GDP at market price	416 701	430 085	445 050	460 51	478 676	460 535	508 061	554 214	584 699	40.3%	5.5%

Source: Institut des comptes nationaux. NBB.Stat

3.1.1.10. Waste

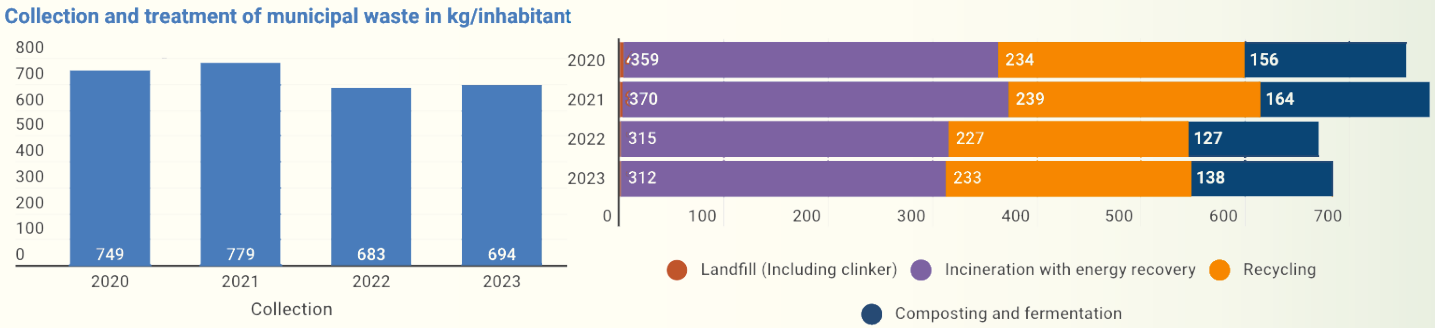
The average per capita production of municipal waste in Belgium will fall from 779 kg in 2021 to 683 kg in 2022[6], representing a reduction of 12.3%.

At national level, there will be 8 752 926 tonnes of municipal waste in 2021 and 7 915 113 tonnes in 2022. Year-on-year, this represents a fall of 9.6%.

In 2022, 46% of municipal waste was incinerated, 33% was recycled, 19% was used for composting and fermentation and 0.2% was landfilled.

[6] Between 2019 and 2020, there is a big break in the figures. The European Union has decided to better monitor the transition to a circular economy and recycling rates in the Member States. The definition of municipal waste has therefore been harmonised across all Member States. Municipal waste is now defined as waste from households and waste from other sources, such as retail, administration, education, health services, accommodation and food services, and other services and activities, which is similar in nature and composition to waste from households. Accordingly, municipal waste includes, among other things, waste from the maintenance of parks and gardens, such as leaves, grass clippings and tree prunings, as well as end-of-market waste and waste from street cleaning services, such as the contents of public bins and street sweepings, with the exception of materials such as sand, stone, mud or dust. For Belgium, this means that the source of municipal waste is much broader than in 2019 and before. The production (and treatment) of waste is therefore much greater than before.

Figure 15 Distribution of municipal waste treatment methods



Source: Belgium statistics based on surveys and administrative sources Municipal waste / Stabel

3.1.1.11. Agriculture and forestry [7]

Agriculture in Belgium, which is favoured by fertile soil and a temperate climate, specialises in market garden and horticultural crops, cereals, potatoes, sugar beets, stock farming and milk production. Due to the country's short coastline, fishing has relatively limited importance as an economic activity. Although farmland covers most of Belgium (44.4% of the territory), its surface area is shrinking and giving way to urbanized areas. Over the last 10 years, croplands and grasslands have been converted to settlements at rates of 36.3 and 45.8 kha/year, respectively, which is equivalent to 99 515 football fields in total (1 football field = 0.825 ha). The loss of croplands is largely offset by the conversion of grasslands to croplands, occurring at a rate of 101 kha/year. [9]

As in other industrialised countries, the share of the Belgian agricultural sector in gross value added has been eroded over the past decades (1.1% of GDP in 2023). Nevertheless, coupled with the food industry, the agricultural sector remains a key export market: agri-food accounted for 14% of Belgian exports in 2023. [10]

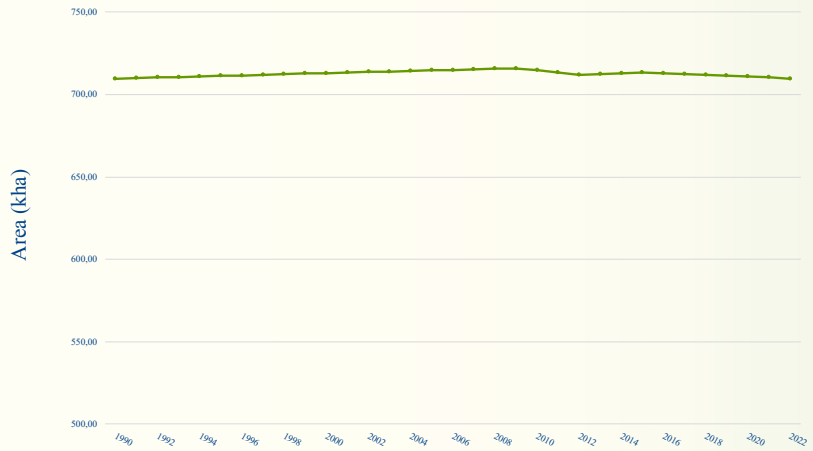
One of the characteristics of the Belgian agricultural sector is the structural decrease in the number of farms, leading to a concentration of land and means of production. The trend is set to continue in 2022, with the number of operations 2.3% lower than in 2021. The average area per farm tripled from 12.5 ha in 1980 to 38.7 ha in 2022. [7]

In 2022, 2 668 farms were under organic control. In relation to the total Belgian agriculture, this represents a little more than one in fifteen farms. In terms of area, the Useful Agricultural Area (UAA) under organic control corresponds to 7.9% of the Belgian UAA. This proportion is higher in the south of the country: 13% of the UAA in Wallonia is under organic control [11, 12, 13]. In 2022, the certified organic areas have increased by 1.0%. This admittedly positive trend confirms a slowdown in the expansion of organic crops. [11]

Despite a high population density, forests and other natural areas remain relatively stable (23.1% of the territory), just over 709 000 ha in 2022[7]. The evolution of the forest area in Belgium is shown in Figure 16.

[7] NB: the data on land use given above (3.1.1.3 and Figure 3) are not based on the same methodology as here. There are therefore some differences.

Figure 16 Evolution of Forest area in Belgium between 1990 and 2022 [9]



The Belgian forest area is divided between the country's three regions: 78.4% in Wallonia, 21.3% in the Flemish Region and 0.31% in the Brussels-Capital Region. In 150 years, forest cover has increased by 25%. [8]

53% of Belgium's forest area belongs to private owners. With an average surface area of 2.5 ha per owner and more than 100 000 owners, private forest is characterised by relatively high fragmentation and a wide diversity of owners. The remaining 47% form part of the public domain. These are state-owned forests belonging to the Regions, municipalities and provinces, public social welfare centres and church fabriques. [8]

In Belgium, the European Natura 2000 network covers about 221 000 ha in Wallonia, 166 000 ha in Flanders [14] and 2 300 ha in Brussels, making a total of about 389 300 ha or 12.7% of the national territory. Integral or managed reserves are scattered throughout the country. In the Walloon Region, these reserves cover around 10 000 ha. [8]

Among the numerous ecosystem services provided by our forests, they serve as Belgium's only significant carbon sink. In 2022, forests removed 1 988 kt of CO_2 equivalent, offsetting 22% of the emissions from the agricultural sector. Beyond the loss of fertile soils, the conversion of grassland to croplands and subsequently to settlements contributes to CO_2 emissions. [9]

Long considered as a significant sink of carbon, the harvested wood product pool is a source of emissions in Belgium since 2019. It seems essentially to be related to subcategory “wood panels” with a decline in production compared to the 1990s and currently leading to negative variations in carbon stocks. [9]

Of the 3 main services provided by forests (production, culture and regulation), regulation currently requires the most attention.

The composition and harvesting rates of forests vary by region. In Brussels, the forest stand volume is 610 000 m^3 with an annual growth of 15 000 m^3, and a harvest rate of 27%. Flanders has a stand volume of 40 902 000 m^3 with an annual growth of 1 220 000 m^3, and a harvest rate of 70%. Wallonia has the largest forest stand volume of 118 337 000 m^3, with an annual growth of 4 099 000 m^3, and a harvest rate of 102%. [16] This overexploitation of 2% in Wallonia is explained by the maturation of numerous stands planted in the 1970s, which led to a significant volume of harvesting. Additionally, forest managers, following the evolution of silvicultural practices, did not systematically replant spruce after harvesting the mature stands, particularly in areas where conditions were not optimal. [15]

Nationally, the forests are composed of 58% hardwood and 42% softwood. [16]

Regional forest management and health are areas of continuous development and concern. 65% of the wooded area is made up of five species: beech, oak, spruce, Douglas fir and ash, which is not very diversified and therefore increases their vulnerability to the various droughts of recent years (sensitivity to pathogens, fires, storms, etc.). [17]

In Flanders, forest management emphasizes sustainability and multifunctionality, with significant transformations towards mixed and native species forests. The structure has improved with more old trees and deadwood, enhancing biodiversity. [18]

Wallonia monitors forest health closely, with significant defoliation in hardwood (40% observed in 2021) and softwood (50% observed in 2021). This is due to a combination of climatic and biotic factors. The dieback phenomena observed in Walloon forests impact the vitality of forest stands and the functioning of forest ecosystems in general, potentially undermining the resilience of our forests in the current context of climate change. In addition to measures related to combating air pollution, various adapted silvicultural management measures have been taken to mitigate the dieback phenomena. In particular, the Forest Code promotes mixed-species and multi-aged forests to enhance resistance to climatic and biological stress, requiring appropriate species selection for artificial regeneration. Complementary guidelines encourage natural regeneration, use of local ecotypes, mixed and irregular stands, and retention of forest residues to prevent soil depletion. Specific management measures are recommended for addressing the ash dieback crisis. [19]

In the Brussels-Capital Region, its management aims to ensure ecological stability and a long-term balance in the distribution of forest age. In addition to ensuring the ability to regenerate, biodiversity and ecological and social aspects are considered. [9]

In Belgium, 47% of the total area of forests is certified either PEFC or FSC. [16]

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[14] Oppervlakte Natura 2000-gebied [Area of Natura 2000 site] - Instituut voor Natuur- en Bosonderzoek (vlaanderen.be)

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[16] Rapport Panorabois – Office économique wallon (Panorabois report - Walloon Economic Office) - 2021

[17] Des forêts en bonne santé sont-elles synonyme de population en bonne santé ? Les scientifiques se penchent sur la question [Are healthy forests synonymous with a healthy population ? Scientists examine the question]– RTBF – 22 March 2023

[18] Een blik op de kenmerken van bos in Vlaanderen – eerste resultaten van 2 opeenvolgende Vlaamse bosinventarisaties [A look at forest characteristics in Flanders - first results of 2 consecutive Flemish forest inventories] – Bos revue - Natuur en Bos - July 2023

[19] Fiche - Etats de santé des forêts - Etats de l'environnement wallon [State of health of the forests - State of the Walloon environment] – 15 February 2022

3.1.2 Institutional arrangements

3.1.2.1 Institutional arrangements for tracking progress

The EU's Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action ('Governance Regulation')[8] establishes a governance mechanism and specific arrangements to track the progress of the Union and its Member States towards the implementation and achievement of the EU's climate and energy targets and commitments under the UNFCCC and the Paris Agreement. These arrangements include the monitoring of GHG emissions and removals, the reporting of policies and measures, projections of GHG emissions and removals and progress on adaptation to climate change.

Under the Governance Regulation, the EU has established a Union Inventory System to ensure the timeliness, transparency, accuracy, consistency, comparability and completeness of the data reported by the EU and its Member States. This inventory system includes a quality assurance and quality control programme, procedures for setting emission estimates, and comprehensive reviews of national inventory data to enable the assessment of compliance towards climate goals.

Each EU Member State compiles its GHG inventory in accordance with the requirements of the Paris Agreement[9] and the relevant Intergovernmental Panel on Climate Change (IPCC) guidelines[10]. Inventory data on GHG emissions and removals, including information on methods, are submitted electronically using a reporting system managed by the European Environment Agency (EEA). The submitted data are subject to quality control procedures and feed into the compilation of the GHG inventory of the EU. Net GHG emissions, calculated from emissions and removals reported in the GHG inventory of the EU, are the key information used for tracking progress towards the EU NDC target of a least -55% net emission reduction by 2030 compared to 1990.

Given the scope of the EU NDC related to international aviation and navigation, a specific share of international aviation and navigation emissions as reported in the GHG inventory data is calculated based on the Joint Research Centre's Integrated Database of the European Energy System (JRC-IDEES)[11]. Details on the methodology applied to identify GHG emissions from international aviation and navigation in the scope of the EU NDC, which are added to the national totals from the EU GHG inventory, are given in the Annex 8.2 to this BTR.

Under the Governance Regulation each Member State must report to the Commission biennially on the status of implementation of its integrated national energy and climate plans (NECPs). This process allows the Commission to ensure that the EU and the Member States remain on track to achieve the climate-neutrality objective and progress on adaptation. Under the Governance Regulation, Member States further operate national systems for policies and measures and projections and submit and report standardised information, which is subject to quality and completeness checks. Based on the submitted data, the EEA compiles projections of GHG emissions and removals for the EU. The EU-wide information is summarised annually in the Climate Action Progress Report[12] by the European Commission and in the 'Trends and projections' report by the EEA.[13] Both the Union and the national systems are subject to continuous improvements.

> The national energy and climate plans (NECPs) were introduced by the Governance Regulation.
>
> For Member States, the NECP for 2021-2030 play a key role to enabling the tracking of progress towards the 2030 climate and energy targets. The update of the NECPs provides an opportunity for Member States to assess their progress, identify gaps and revise existing measures or plan new ones where needed.
>
> Member States were due to submit their final updated NECPs, taking account of the Commission's assessment and recommendations, by 30 June 2024.

[8] Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action, http://data.europa.eu/eli/reg/2018/1999/oj.

[9] Chapter II of the annex to decision 18/CMA.1, https://unfccc.int/documents/193408; and decision 5/CMA.3, https://unfccc.int/documents/460951.

[10] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, https://www.ipcc-nggip.iges.or.jp/public/2006gl/; and on a voluntary basis: 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, https://www.ipcc.ch/report/2019-refinement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/.

[11] European Commission, Joint Research Centre, Rózsai, M., Jaxa-Rozen, M., Salvucci, R., Sikora, P., Tattini, J. and Neuwahl, F., JRC-IDEES-2021: the Integrated Database of the European Energy System – Data update and technical documentation, Publications Office of the European Union, Luxembourg, 2024, https://publications.jrc.ec.europa.eu/repository/handle/JRC137809.

[12] Climate Action Progress Report 2024, https://climate.ec.europa.eu/document/download/d0671350-37f2-4bc4-88e8-088d0508fb03_en?filename=COM_2024_498_F1_REPORT_FROM_COMMISSION_EN_V4_P1_3729454.PDF

[13] Trends and Projections in Europe 2024, https://www.eea.europa.eu/en/analysis/publications/trends-and-projections-in-europe-2024 https://www.eea.europa.eu/en/newsroom/news/eea-trends-and-projections

As mentioned above, Belgium as a Member State has a national system for policies and measures and projections, which explains the structures and procedures put in place in this context.

Most of the Belgian reports are available on the following page of the National Climate Commission website: Reports | National Climate Commission (cnc-nkc.be)

Belgium has adopted the practice of sharing its commitments internally between the three Belgian regions and the federal government. Negotiations on the Burden Sharing agreement for 2021-2030 are still ongoing, but a first partial political agreement has already been concluded[14]. For the previous period, the agreement provided for progress reports to monitor the implementation of the agreement by all parties. A similar mechanism is likely to be included in the future agreement.

Belgium submitted its draft updated NECP in November 2023. The final version is still pending.

[14] This agreement relates to the distribution of the 2021 and 2022 revenues from the auctioning of the ETS system, the dissolution of the "climate responsibility mechanism" and the sharing of the amounts relating thereto, the guarantee of a minimum Belgian objective in terms of renewable energies and international climate finance for the period 2021-2024.

3.1.2.2 Institutional arrangements for implementation of the NDC

The EU and its Member States have set up a comprehensive system for the implementation of the EU climate change mitigation targets. The European Climate Law[15] sets the goal of climate neutrality by 2050 and the intermediate target of reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. These targets cover emissions and removals that are regulated in the Union law.

To ensure that the EU and its Member States achieve their target, the 2030 Climate and Energy Framework was put in place. The main policies of this framework are the EU Emissions Trading System (EU ETS)[16], which caps GHG emissions in energy, industry, aviation and maritime transport; the LULUCF Regulation which includes national net removal targets for the LULUCF sector; and the Effort Sharing Regulation (ESR) which establishes national reduction targets for GHG emissions not covered by the EU-ETS or the LULUCF Regulation i.e. domestic transport (excluding aviation), buildings, agriculture, small industry and waste. The implementation of the ESR is supported by additional sectoral policies and measures (details can be found in this BTR in the chapter on mitigation policies and measures). The legislative acts under the 2030 Climate and Energy Framework require the European Commission and the EU Member States to set up the institutional arrangements for implementing the specific policies and measures.

[15] Regulation (EU) 2021/1119 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law'), http://data.europa.eu/eli/reg/2021/1119/oj.

[16] This refers to the ETS1, i.e, the Emission Trading System for stationary sources (Chapter III of the ETS Directive) and for aviation and maritime transport (chapter II of the ETS Directive). Note that the 'Emissions trading system for buildings, road transport and additional sectors' (ETS2), added in 2023 as Chapter IVa of the ETS Directive, forms an instrument under the Effort Sharing Regulation (ESR).

The revised EU ETS Directive increases the level of ambition in the existing system from 43% to 62% emissions reductions by 2030, compared to 2005 levels and extend the system to also apply to international maritime transport. A separate carbon pricing system will apply to fuel combustion in road transport and buildings and small-emitting sectors (ETS2) with a 42% emission reduction target compared to 2005 across the sectors covered. The amended Effort Sharing Regulation (ESR) increased, for the sectors that it covers, the EU-level GHG emission reduction target from 29% to 40% by 2030, compared to 2005, which translates in updated 2030 targets for each Member State. The new LULUCF Regulation sets an overall EU-level objective of 310 Mt CO_2 equivalent of net removals in the LULUCF sector in 2030.

The ESR sets national targets for the reduction of GHG emissions in the Member States by 2030. Member States are also subject to gradually decreasing annual emission limits for each year from 2021 to 2030. The annual progress towards the national targets under the Effort Sharing Legislation is assessed by comparing GHG emission levels from the sectors covered by the ESR with the relevant annual emission allocations under the legislation (AEAs). To achieve compliance under the ESR, Member States are permitted to use flexibility options to a certain extent.

Under Article 9(2) of the ESR, any debit (i.e., excess emissions) under the LULUCF Regulation in the period 2021 to 2025 is automatically deducted from Member States' AEAs under the ESR first compliance period.

Progress in the implementation of these policies and measures is monitored under the Governance Regulation. Relevant information which is reported regularly and archived at the EEA include GHG inventories, approximated GHG inventories for the

previous year, information on policies and measures, projections, and progress towards the implementation of integrated National Energy and Climate Plans (NECP). This information helps the EU and its Member States to correct their course if progress towards the targets of the 2030 Climate and Energy Framework is behind schedule. As an example, the European Commission assesses the drafts of new or updated NECPs and provides recommendations for improved planning and implementation. In addition, the reported information is subject to quality checks, and the GHG inventories reported by EU Member States are subject to comprehensive reviews in 2025, 2027 and 2032.[17]

All EU legislation, including the legislation under the 2030 Climate and Energy Framework, is subject to a stakeholder engagement process. So-called 'better regulation tools' ensure that policy is based on evidence and the best available practice[18]. During the preparation of legislative proposals, the European Commission invites citizens, businesses and stakeholder organisations to provide their views on the subject of the new legislation. These comments are documented in a dedicated portal[19], and the European Commission reports on how it takes these comments into account in the development of the legislative proposals. Furthermore, the Governance Regulation sets requirements for Member States to ensure that the public is given early and effective opportunities to participate in the preparation of the NECPs.

Belgium has a dedicated NECP website: https://www.nationalenergyclimateplan.be/en. It contains the various versions of the plan, as well as the results of public enquiries, regional consultations and the various recommendations made.

As the BTR brings together a number of initiatives that have already been the subject of consultation, it was not itself the subject of wide consultation, but rather of a round table discussion on 9 September 2024 with members of the Federal Council for Sustainable Development, made up of various stakeholders. Their recommendations and comments[20] have been incorporated as far as possible into this BTR.

In the future, regional advisory boards will also be involved in this type of round table.

[17] Consolidated text (2023) of Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action, https://eur-lex.europa.eu/eli/reg/2018/1999/2023-11-20.

[18] Decision-making process, https://ec.europa.eu/info/strategy/decision-making-process/how- decisions-are-made_en

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3.2. Description of the Nationally Determined Contribution

Under their updated NDC[21] the EU and its Member States, acting jointly, are committed to a legally binding target of a domestic reduction of net greenhouse gas emissions by at least 55% compared to 1990 by 2030. The term 'domestic' means without the use of international credits.

The NDC consists of a single-year target, and the target type is 'economy-wide absolute emission reduction'. The scope of the NDC covers the 27 Member States of the EU.

The 17 October 2023 updated NDC scope is supplemented by additional information to clarify the precise amount of international aviation and maritime emissions which are covered under the EU NDC. Details on the EU NDC can be found in Table EU 1 and in the annex 8.2.

[21] The update of the nationally determined contribution of the European Union and its Member States, https://unfccc.int/sites/default/files/NDC/2023-10/ES-2023-10-17%20EU%20submission%20NDC%20update.pdf

Table EU 1 Description of the NDC of the EU

Information	Description
Target and description	Economy-wide net domestic reduction of at least 55% in greenhouse gas emissions by 2030 compared to 1990. The term 'domestic' means without the use of international credits.
Target type	Economy-wide absolute emission reduction.
Target year	2030 (single-year target)
Base year	1990
Base year value	Net greenhouse gas emissions level in 1990: 4 699 405 kt CO_2eq.
Implementation period	2021-2030
Geographical scope	EU Member States (Belgium, Bulgaria, Czechia, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden) including EU outermost regions (Guadeloupe, French Guiana, Martinique, Mayotte, Reunion, Saint Martin (France), Canary Islands (Spain), Azores and Madeira (Portugal)).
Sectors	Sectors as contained in Annex I to decision 5/CMA.3: Energy, Industrial processes and product use, Agriculture, Land Use, Land Use Change and Forestry (LULUCF), Waste. International Aviation: Emissions from civil aviation activities as set out for 2030 in Annex I to the EU ETS Directive are included only in respect of CO_2 emissions from flights subject to effective carbon pricing through the EU ETS. With respect to the geographical scope of the NDC these comprise emissions in 2024-26 from flights between the EU Members States and departing flights to Norway, Iceland, Switzerland and the United Kingdom. International maritime Navigation: waterborne maritime navigation is included in respect of CO_2, methane (NH_4) and nitrous oxide (N_2O) emissions from maritime transport voyages between the EU Members States.
Gases	Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF6), nitrogen trifluoride (NF_3)
LULUCF categories and pools	The included LULUCF categories and pools are as defined in decision 5/CMA.3.
Intention to use cooperative approaches	The EU's at least 55% net reduction target by 2030 is to be achieved through domestic measures only, without contribution from international credits. The EU will account and report for cooperation with other Parties in a manner consistent with the guidance adopted by CMA1 and any further guidance agreed by the CMA.
Any updates or clarifications of previously reported information, as applicable*d*	The information on the NDC scope contains clarifications/further details compared to the information provided in the updated NDC of the EU.

Note: This table is identical to table 'Description of a Party's nationally determined contribution under Article 4 of the Paris Agreement, including updates,' which has been submitted electronically together with this BTR. This table is also annexed to this BTR.

Source: Updated NDC of the EU. The update of the nationally determined contribution of the European Union and its Member States, https://unfccc.int/sites/default/files/NDC/2023-10/ES-2023-10-17%20EU%20submission%20NDC%20update.pdf.

3.3. Indicator, definitions, methodologies and progress

3.3.1 Indicator

For the tracking of progress towards implementing and achieving the NDC of the EU, an indicator is used which has the same unit and metric as the NDC base year and target values. The chosen indicator is 'annual total net GHG emissions of the EU consistent with the scope of the NDC in CO_2eq'. Table EU 2 provides more information on this indicator.

Table EU 2 Indicator for tracking progress

Information	Description
Selected indicator	Annual total net GHG emissions consistent with the scope of the NDC in CO_2eq.
Reference level and base year	The reference level is total net GHG emissions of the EU in the base year (1990). The reference level value for the EU is 4 699 405 kt CO_2eq.
Updates	This is the first time the reference level is reported, hence there are no updates. The value of the reference level may be updated in the future due to methodological improvements to the EU GHG inventory and to the determination of international aviation and navigation emissions in the NDC scope
Relation to the NDC	The indicator is defined in the same unit and metric as the target of the NDC. Hence it can be used directly for tracking progress in implementing and achieving the NDC target.
Definitions	Definition of the indicator 'annual total net GHG emissions in CO_2eq': Total net GHG emissions correspond to the annual total of emissions and removals reported in CO_2 equivalents in the latest GHG inventory of the EU. The totals comprise all sectors and gases listed in the table entitled 'Reporting format for the description of a Party's nationally determined contribution under Article 4 of the Paris Agreement, including updates'. Indirect CO_2 emissions are included from those Member States that report these emissions.

Note: The information in this table is identical to the information in Common Tabular Format (CTF) tables 1 ('Description of selected indicators') and 2 ('Definitions needed to understand the NDC'), which were submitted electronically together with this BTR.

Source: The reference level is based on the Annual European Union GHG inventory 1990-2022.

3.3.2 Methodologies and accounting approach

The EU use the following accounting approach for tracking progress towards the joint EU NDC: annual GHG data from the national GHG inventory of the EU, complemented for international aviation and navigation with estimations from the Joint Research Centre's Integrated Database of the European Energy System[22]. The total net GHG emissions are provided in the scope of the EU NDC and are compared to the economy-wide absolute emission reduction target as defined in the NDC. The EU will account for its cooperation with other Parties in a manner consistent with guidance adopted by the CMA.

As far as emissions and removals from the LULUCF sector are concerned, net emissions are used for tracking progress towards the 2030 target of the NDC based on all reported emissions and removals.

Details on methodologies and accounting approaches consistent with the accounting guidance[23] under the Paris Agreement can be found in CTF table 3 ('Methodologies and accounting approaches'), which was submitted electronically together with this BTR.

3.3.3 Structured summary – status of progress

An important purpose of the BTR is to demonstrate where the EU and its Member States stand in implementing their NDC, and which progress they have made towards achieving it. The most recent information on GHG emissions and removals in the scope of the NDC constitutes the key information for tracking this progress. Table EU 3 summarises the current status of progress.

Based on the GHG inventory data and data on international aviation and navigation for 2022, the EU and its Member States reduced net GHG emissions by 31.8% compared to 1990. The EU and its Member States made progress towards implementing and achieving their NDC. The legal and institutional framework is in place to make further progress in the years ahead and to achieve the NDC target by 2030.

In CTF tables 1, 2 and 4, two additional indicators were entered. They are not directly linked to the EU NDC as such. Nevertheless, they reflect specific objectives for Belgium within the European framework. To avoid confusion with the EU NDC, these indicators are not discussed in this section but in the PAMs section (see 3.4.1) and in the projections section (see 3.6.5.2 and 3.6.5.3).

Table EU 3 Summary of progress towards implementing and achieving the NDC

	Unit	Base year value	Values in the implementation period			Target level	Target year	Progress made towards the NDC
			2021	2022	2030			
Indicator: Total net GHG emissions consistent with the scope of the EU NDC	kt CO_2eq	4 699 405	3 272 650	3 205 223	NA	(at least 55% below base year level)	2030	The most recent level of the indicator is 31.8% below the base year level.

NA: Not Applicable.

Note that an annual emissions balance consistent with chapter III.B (Application of corresponding adjustment) will be provided in a subsequent BTR upon finalisation of relevant further guidance by the CMA, based on the annual information reported under Article 6.2.

Note: More detailed information can be found in CTF table 4 ('Structured summary: Tracking progress made in implementing and achieving the NDC under Article 4 of the Paris Agreement'), which has been submitted electronically together with this BTR.

Source: The indicator values are based on the Annual European Union GHG inventory 1990-2022.

[22] European Commission, Joint Research Centre, Rózsai, M., Jaxa-Rozen, M., Salvucci, R., Sikora, P., Tattini, J. and Neuwahl, F., JRC-IDEES-2021: the Integrated Database of the European Energy System – Data update and technical documentation, Publications Office of the European Union, Luxembourg, 2024, https://publications.jrc.ec.europa.eu/repository/handle/JRC137809.

[23] Decision 4/CMA.1, Further guidance in relation to the mitigation section of decision 1/CP21, https://unfccc.int/documents/193407.

3.4. Mitigation policies and measures

3.4.1. Information on PAMs

3.4.1.1. Introduction

It is important to recall how policies are implemented at the national level.

Within Belgium's federal system, responsibilities and policy-making powers are shared between the Federal State and the three Regions (the Walloon, Flemish and Brussels-Capital Regions). Climate change policies are therefore designed and implemented by the federal and regional governments, which have set up their own priorities and objectives within the scope of their powers.

Regions have major responsibilities in areas such as the rational use of energy, the promotion of renewable energy sources, public transport, transport infrastructure, urban and rural planning, agriculture, and waste management.

The Federal state is responsible for large parts of taxation policy. It is also responsible for product policies (standards, fuel quality, labelling and performance standards for household or industrial electrical goods…). It is responsible for ensuring the security of the country's energy supply and for nuclear energy. It also supervises Belgium's territorial waters, which implies that it is also responsible for the development of offshore wind farms.

3.4.1.2. Summary of main PAMs

The information required by the guidelines in paragraphs 80 to 85 is included in the CTF NDC table 5 in annex of the BTR. This table is intended to be a summary of the main policies and measures, based on the guidelines. Due to lack of time and late availability of the online tool, the PAMs were not classified by sector. When looking at the expected GHG emission reductions of these main policies and measures in 2025 (where estimates are available), those in the energy sector (consumption and supply) represent approximately half of total estimated emission reductions, the industrial processes PAMs approximately 1/5, PAMs in the transport sector a bit less than 1/5, PAMS in the buildings sector around 3% and finally agriculture and waste PAMs around 2%. Within the framework of the European reporting (Annex IX of the NECP progress report), a much more extensive list of around 250 PAMs is also available. Additional information can also be found there, such as the most recent progress of each of them.

To assess the latest progress in climate policy in Belgium, one can refer to the provisional version of the National Energy Climate Plan as required by the European Union under Regulation on the governance of the energy union and climate action (EU) 2018/1999 (https://energy.ec.europa.eu/topics/energy-strategy/energy-union_en#regulation-on-the-governance-of-the-energy-union-and-climate-action). The provisional NECP is available on https://www.nationalenergy-climateplan.be/en, or https://commission.europa.eu/publications/belgium-draft-updated-necp-2021-2030_en. This provisional version of the Belgian NECP has been analyzed by the European Commission available on https://commission.europa.eu/publications/commission-recommendation-assessment-swd-and-fact-sheet-draft-updated-national-energy-and-climate-22_en. The finalization of the NECP is a priority, taking into account that Belgium has not respected the deadline of 30th June 2024. It is important to note that federal and regional elections took place in June 2024. The new governments will have to decide on its final version with the aim of fulfilling its obligation in due course and to provide a stable framework for investments and further efforts.

3.4.1.3. National indicators to track progress

As mentioned in section 3.1.2.2, within the EU policy framework, a national target is attributed to Belgium in the ESR sector and also in the LULUCF sector.

– Effort Sharing Regulation (ESR) target

The current situation is described in CTF-NDC table 4.2 where annual ESR emissions are considered as a national indicator and in section 3.6.5.2. Particular attention is therefore paid to these sectors which are very challenging. In order to continue to respect the annual trajectory in the coming years, additional efforts are required. The implementation of ETS2 from 2027 onwards should help accelerate emissions reductions.

– LULUCF target

The current situation is described in CTF-NDC table 4.3 where annual LULUCF emissions are considered as a national indicator and in section 3.6.5.3.

Belgium complies with the no-debit rule for the first compliance period of the LULUCF Regulations and will need to continue its efforts to enhance natural sinks to reach the 2030 target. To this end, various policies and measures are underway in the regions to protect and increase carbon stocks, notably to boost the resilience of forests, replant in non-forest area and restore and protect wetlands and peatlands. Several initiatives are also planned to strengthen the attractiveness of investments in the agricultural sectors, with a view to increasing the potential of carbon storage in croplands and grasslands. Flanders aims to set up a regional vision and framework for carbon farming. The Walloon region support farmers to maintain and plant biodiversity-friendly elements such as hedges and trees through the eco-

schemes under the CAP. Finally, Belgium frames the management of land artificialization, by promoting the reduction of land take and land cover in existing artificial soils and encouraging clearing and sustainable management of artificial soils.

3.4.1.4. Transversal principles

Belgium integrates transversal principles throughout its climate policy so as to ensure climate change and the transition do not exacerbate existing inequalities.

Just transition is a priority for Belgium.

Throughout 2022 and 2023 a broad societal dialogue on Just Transition was held in Belgium. A Scientific High Committee for a Just Transition was established in 2022 and it published a special report on how to organize and introduce a just transition in Belgium. A Citizen's Agora was assembled as well to put citizens at the heart of the deliberations. Particular attention was paid to the most vulnerable, including people living in precarious conditions or with disabilities with the intention to highlight their realities.

Just transition was also one of the transversal priorities during the Belgian Presidency of the Council of the EU as well as a priority in the Environment formation. During the Presidency a broad stakeholder conference for a Just Transition was organised bringing together representatives from EU Member States, the Commission, civil society organisations, social partners, environmental NGO's, academics and anti-poverty organisations. Finally, Council Conclusions were adopted containing several paragraphs on ensuring a just transition. Belgium is currently developing a Social Climate Plan expected in June 2025 that will mitigate the social impact of the new European Emission Trading System for buildings and road transport for vulnerable households, transport users and micro-enterprises thereby alleviating energy and transport poverty.

Not only nationally, but also internationally does the just transition need to be implemented as per the COP26 Declaration on supporting the Conditions for a Just Transition Internally, which Belgium is a signatory of.

As per the draft update of the National Energy and Climate Plan (2021-2030), Belgium takes into consideration the aspect of existing gender inequalities that could be exacerbated by climate change as well as responses to climate change. The Plan delves into water- and energy poverty and how they, in particular the latter, are the result of economic, structural and technical causes and require a holistic approach. Due to these causes, women tend to be disproportionately impacted as well as vulnerable groups. Belgium will commit to enhancing support in the context of energy poverty. The Plan also tackles the matter of including women in the green transition, in particular by encouraging their participation in the renewable energy sector, and how this can further gender equality.

3.4.2. Methodologies/assumptions to estimate GHG emission reductions or removals

As already mentioned in section 3.1.2.1, Belgium has a national system for its PAMs and Projections.

The assessments of the impacts of (groups of) individual policies and measures are carried out at the level of each entity of the country (federal government and three regional governments). For the elaboration of the Belgian GHG inventory and Belgian GHG projections, a distinction must be made between the measures implemented by the federal government and the regional governments.

Belgium's GHG emission inventory consists of the sum of three regional inventories (Flanders, Brussels and Wallonia) that together represent the Belgian territory. Therefore, there is no purely federal GHG inventory. Similarly, emission projections submitted in the context of the EU Governance Regulation are the result of a combination of three individual regional emission projections. Because climate and energy policies of the federal government act on the territorial emissions of the three regions, the expected GHG impact from policies decided by the Federal Government is to be reflected in the regional inventories, and therefore also in the emission projections.

Regional assessments are made by comparing inventory trends and models with existing and additional measurements. Where such estimates are possible, they often concern groups of measurements.

Federal GHG impact assessments are elaborated by contrasting a baseline scenario without policy with an emission scenario that represents a specific policy (or group of policies). They generally distinguish between estimated territorial ETS and non-ETS emission impact. Since 2009, multiple GHG impact evaluations of federal climate policies have been elaborated[24]. These assessments have allowed the total cumulative emission impact resulting from federal climate policy to be derived over several years. This information was used, for example, in the context of the national *effort sharing* (or '*burden sharing*') of national 2013-2020 emission reduction targets under the EU Governance Regulation (between federal and regional authorities)[25].

Since 2022, GHG (and in the future also energy-related and socio-economic) impact evaluations of federal measures have been integrated into a federal climate policy '*synthesis report*' that is published

[24] Overview of GHG impact evaluations of federal climate policies: https://klimaat.be/klimaatbeleid/belgisch/federaal/klimaatgovernance section 'Impactanalyses'.

[25] See reports from October 2021 (French: https://climat.be/doc/rapport-art.16-nbs-2021-fr.pdf; Dutch: https://climat.be/doc/rapport-art.16-nbs-2021-nl.pdf)

each year in the context of a newly established federal climate governance cycle[26] (Ministerial Decision of October 2021[27] and more recently the law of 15 January 2024[28]).

It is technically impossible to transpose these effects to the regional scale. These methodologies also do not allow the effects of federal and regional measures to be summed.

The provisional version of the PNEC includes the latest assessments of the effects of PAMs.

3.4.3. PAMs no longer in place compared with previous report

As this is the first BTR, there's no need to compare it with an earlier version.

3.4.4. Actions, policies and measures that influence emissions from international transport

Greenhouse gas emissions from so-called international bunkers – fuel deliveries to the international maritime and aviation sector – are not covered by the ESR climate target for Member States for the period 2021-2030. The demand for these two sectors is driven by international rather than local factors (e.g. strong globalisation of trade, tourism) and competition within these sectors is also very international. For these reasons, the reduction of greenhouse gases in these sectors should preferably be organised at global level.

Action is also important for these two sectors. In 2018, international aviation and maritime transport each accounted for around 16 % of total transport greenhouse gas emissions in the EU, and it is expected that this share will increase further due to a growing demand for international transport of both people and goods. In recent years, the IMO and ICAO have taken important decisions and measures to reduce greenhouse gas emissions from the bunker sectors.

Since 2012, intra-EEA (European Economic Area) flights have been covered by the European emissions trading scheme for CO_2, with the cap on CO_2 emissions in 2013-2020 being limited to 90% of the 2004-2006 level. With the revision of the EU Directive ETS in 2023 increasing free allocations to aviation will be phased out by 2026 and the strengthened linear reduction factor will also be applied to aviation. Additionally, ICAO's CORSIA is implemented through the EU ETS Directive and this will be applied to international flights departing from or arriving at airports within the European Economic Area (EEA). For flights within the EEA, only the EU ETS will continue to apply. If CORSIA will not be strengthened to be aligned with the Paris Agreement or the participation of third countries in it is insufficient, the scope of the EU ETS might however be extended as of 2027.

Since January 2024, the EU ETS has been fully extended to cover CO_2 (and as from 2026 also CH_4 and N_2O) emissions from all large ships entering EU ports covering 50% of emissions from voyages starting or ending outside of the EU and 100% of emissions that occur between two EU ports and when ships are within EU ports. Emissions from maritime transport are included in the overall ETS cap (and hence subject to the same linear reduction factor).

Measures have also been taken at Flemish level, such as the promotion of energy-efficient ships and alternative fuels (e.g. the supply of LNG to ships). The Port of Antwerp is also taking measures in the form of a reduction in tonnage rights for ships with a favourable Environmental Ship Index (ESI), which takes into account, inter alia, CO_2 emissions. In addition, much effort is being made to provide quay power to ships moored in the port (e.g. Port of Antwerp).

[26] Federal climate governance cycle webpage on climate.be (Dutch / French)
[27] Council of ministers 10/2021 (Dutch / French)
[28] Law on the governance of federal climate policy of 15 January 2024 (Dutch / French)

3.5. Summary of greenhouse gas emissions and removals

3.5.1. Introduction

This chapter provides key information about the Belgian greenhouse gas (GHG) inventory.

Belgium, as a party to the United Nations Framework Convention on Climate Change (UNFCCC) and to the Paris Agreement, reports annually on GHG inventories for the years from 1990 to the current calendar year (t) minus two (t-2), for emissions and removals within its territory. The GHG inventory data presented in this chapter of the Biennial Transparency Report (BTR) is consistent with the GHG inventory of Belgium submitted in its 2024 National Inventory Report.

Further details are given in the National Inventory Document, which is submitted as a stand-alone document.

The key recent developments in GHG emissions in Belgium can be summarised as follows:

Total net greenhouse gas emissions (including land use, land-use change and forestry (LULUCF), without international bunkers) were 103.16 million tonnes of carbon dioxide equivalents (CO_2eq) in 2022. Total net GHG emissions decreased by 27.8% from 1990 to 2022. In absolute terms, the biggest reductions in emissions were achieved in "Energy industries" (down by 11.2 million tonnes of CO_2 equivalent) just followed by combustions in industry (down by 11.0 million tonnes of CO_2 equivalent) between 1990 and 2022.

In 2022, total net GHG emissions in Belgium (including LULUCF, without international bunkers) fell by 6.7 million tonnes, or 6.1%, compared to 2021.

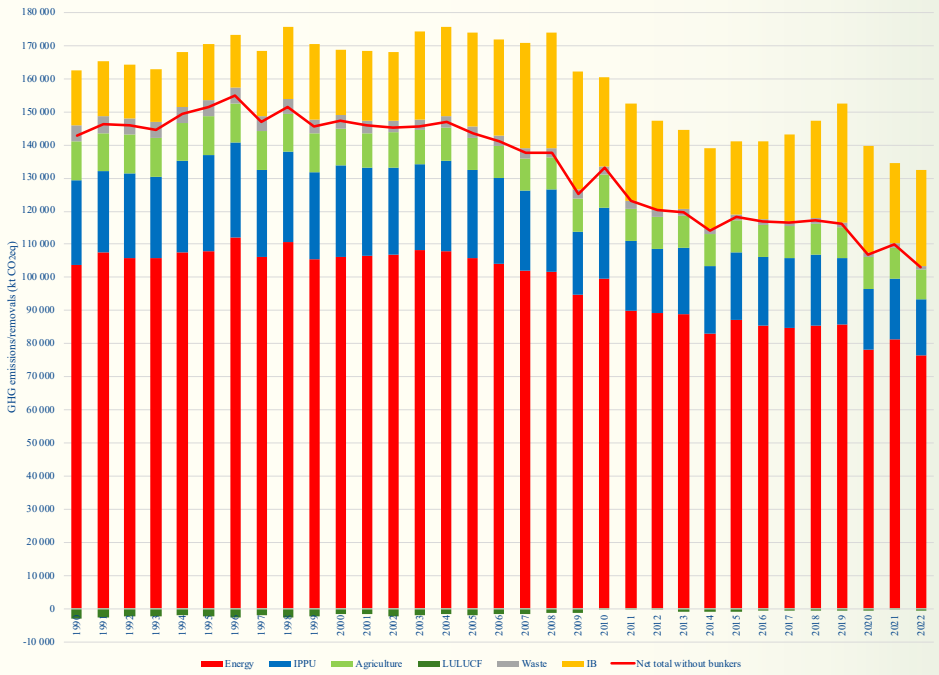
3.5.2. Summary of GHG emission trends

This section provides a brief description of the trends in GHG emissions. See also CTF NDC table 6 of the reporting tables in annex.

3.5.2.1. Trends in total GHG emissions

In 2022, total net GHG emissions in Belgium, including LULUCF, were 27.8% (a drop of 39.7 million tonnes CO_2 equivalents) below 1990 levels. Emissions decreased by 6.1% (6.7 million tonnes CO_2 equivalents) between 2021 and 2022. Emissions from international aviation and navigation are excluded from national totals reported in the GHG inventory. The trends at sector level and in each sector's share of total Belgium GHG emissions is shown in Figure 17.

Figure 17 GHG emissions/removals per sector, 1990 to 2022



Note: All GHG inventory information presented in this report is based on the November 2024 version of the UNFCCC Common Reporting Table (CRT) tool. Further updates and corrections in the CRT tool may result in changes to the final GHG inventory data. IPPU = Industrial processes and product use. IB = International Bunkers

Source: Belgian GHG inventory 1990-2022

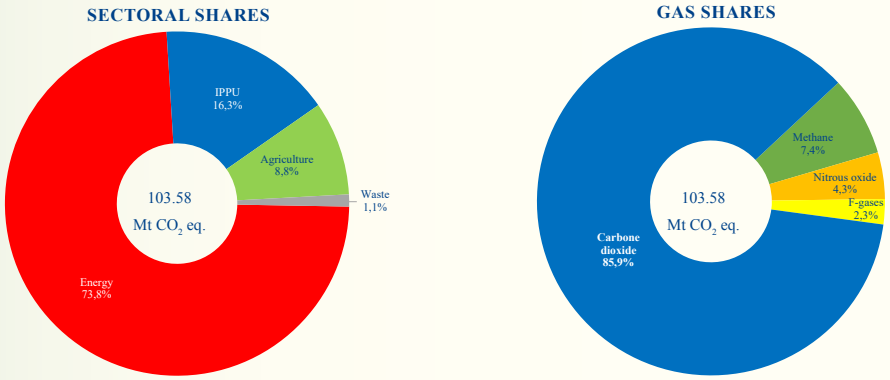
3.5.2.2. GHG emissions without LULUCF per sector and by gas in 2022

The Energy sector (including transport, energy industries and space heating) is the most important sector in the total GHG emissions in 2022.

The major greenhouse gas in Belgium is carbon dioxide (CO_2), which accounted for 85.9% of total GHG emissions in 2022. Methane (CH_4) accounts for 7.4%, nitrous oxide (N_2O) for 4.3%, and fluorinated gases for 2.3%.

The share of each main sector and of each gas of the total Belgian emissions (excluding LULUCF) in 2022 is shown in Figure 18.

Figure 18 Share of total GHG emissions (excluding LULUCF and international bunkers) per sector and by gas in 2022



Note: Indirect CO_2 emissions are excluded.
IPPU = Industrial processes and product use
F-gases = Fluorinated gases

Source: Belgian GHG inventory 1990-2022

3.6. Projections of greenhouse gas emissions and removals

3.6.1. Introduction

The greenhouse gas emission projections were elaborated in the course of 2022 based on the most recent information available on the macro-economic context and policy implementation. As these projections were developed in 2022, they could not yet take into account the expected impact of the energy crisis. For the reference year 2019, unadjusted emission data from the inventory submission in 2023 (dated 15/03/2023) taking into account the 2006 IPCC Guidelines for National Greenhouse Gas Inventories are presented in this report and the reporting templates. Projection scenarios are not yet available for the Flemish region for the period 2035-2045. For these years, the WEM and WAM scenarios were set equal to 2030. For 2050, the WAM projection scenario was aligned with the Flemish Climate Strategy 2050.

Except for electricity production, the reported projections are the sum of the bottom-up projections of the three regions (Flanders, Wallonia, Brussels-Capital) which are calibrated on the regional energy balances. The bottom-up approach starts from the demand side of the different sectors (industry, domestic, tertiary, transport…) and results in sectoral energy projections. Within this approach, relations between energy consumption, activity levels and energy prices are assessed at a sectoral level. The electricity production is modelled at national level.

Indirect greenhouse gas emissions are not reported. There is no consistent set of projections available as not all modelling assumptions for indirect greenhouse gas emissions are aligned between the regions. More information on the national system set in place for the preparation of the projections can be found in the report 'Reporting on national system for policies and measures and projections under Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action'[29].

3.6.2. General projection Assumptions

The following general assumptions are used in the calculations of regional bottom-up emission projections (unless otherwise indicated).

All implemented and adopted (EU, federal, regional) policies and measures, considered until the end of 2022, have been taken into account in the 'with existing measures' (WEM) scenario. Planned

[29] https://reportnet.europa.eu/public/dataflow/111

policies and measures or targets have been integrated in a scenario with additional measures (WAM). A scenario 'without measures' (WOM) is not reported because of difficulties in constructing such a scenario given Belgium's long history of climate policy. Belgium has no plans to develop a WOM scenario in the near future.

3.6.2.1. The section below summarises the general assumptions included in the WEM and WAM scenario. Emission factors

Emission factors reported in the 'Belgium's Greenhouse Gas Inventory (1990-2020) National Inventory Report'[30] have been used for the calculation of the projections.

More specifically, the emission factors for the energy related CO_2 projections (CRF Cat 1A Fuel Combustion Activities) are presented in Table 8. The emission factors for coke, petroleum coke, coke oven gas, refinery gas and blast furnace gas are adjusted values based on inquiries with the sector, in contrary to the other factors which are IPCC default values. In the Brussels-Capital Region, waste emission factors are estimated based on measurements in the incinerator.

[30] https://unfccc.int/sites/default/files/resource/bel-2022-nir-23may22.zip

3.6.2.2. Global Warming Potential

CO_2 equivalent emissions and projected emissions 2025-2050 are calculated using the Global Warming Potential (GWP) values specified in the UNFCCC reporting guidelines on annual inventories according the fifth assessment report of IPCC - AR5 (Table 9).

3.6.2.3. Climate assumptions

The regional and national projections for the residential and tertiary sector are calculated assuming that the number of degree-days for the period 2020-2050 is equivalent to the average degree-days of the 2012-2021 period. This average is equal to 1 761 degree-days (reference 15/15) and characterised a mild climate.

3.6.2.4. Demographic evolution

The demographic projections presented in CTF-NDC Table 11 are based on the prospects by the Federal Planning Bureau[31]. They were calculated per age, gender and district.

[31] https://www.plan.be/databases/data-35-fr-perspectives_de_population_2021_2070

Table 8 Emission factors used for the energy related CO_2 emission projections

Fuel	Emission factor (kton CO_2/PJ)		
	Flanders	Wallonia	Brussels
Hard coal	94.6	98.3	94.6
Cokes	107.0	104.5	
Brown coal, lignite		101.2	
Other solids (waste, ...)	variable	variable	Variable
Natural gas	56.4	56.1	56.1 56.5*
Cokes oven gas	38.0 - 40.0		
Blast furnace gas	250.0 - 265.0		
Refinery gas	55.1 - 56.5		
Heavy fuel oil	77.4	77.4	77.4
Petroleum cokes	97.5	97.5	
Light fuel oil, gas oil	74.1	74.1	74.1
Gasoline	70.0	69.3	
LPG	63.1	63.1	63.1
Other petroleum products	73.3	73.3	

*Only for CRF sector 1A4.

Table 9 Global warming potentials (excluding F-gases)

Greenhouse Gas	GWP
CO_2	1
CH_4	28
N_2O	265

3.6.3. Projections by sector

3.6.3.1. CCUS

Flanders

The Flemish region holds the largest integrated fuel and chemical cluster in Europe and is hence responsible for important emissions of concentrated CO_2 on a relatively limited surface. In general, these are the result of ethylene and hydrogen production or other chemical processes, the refining of mineral oil, steelmaking, waste incineration and natural gas plants in the electricity sector, which are all or might be covered by the EU Emissions Trading Scheme.

The Flemish region is hence a suitable location to establish new collaborations and innovative integrated systems that allow the capture of up to tens of millions of tons of CO_2 per year, their compression, cleaning and liquification if needed, and their transport, either via pipelines or ship with the aim of their permanent geological storage and/or their usage back into useful products (such as recycled carbon fuels).

As also mentioned in paragraph 7.1.5.2. of the updated Flemish Energy and Climate plan 2021-2030[32], the Flemish region is – amongst other initiatives both at the Flemish and European level – currently creating the necessary legal framework to allow for large-scale projects in the Flemish region to be implemented by 2026 and beyond. One of the very important projects is the Kairos@C[33] project in the Antwerp port.

[32] https://www.vlaanderen.be/veka/energie-en-klimaatbeleid/vlaams-energie-en-klimaatplan-vekp-2021-2030

[33] https://kairosatc.eu/

Table 10 CCUS projections in Flanders (Mton CO_2)

2030	2050	Sector
3.0	**3.0**	Chemical (CRF category 2)
2.0	**2.0**	Iron and steel (CRF category 2)
-	**3.0**	Electricity production (CRF category 1)
-	**1.0**	Waste incineration (CRF category 1)
-	**2.0**	Refineries (CRF category 1)
5.0	**11.0**	**Total**

Whereas this comes with several uncertainties, it is not unrealistic that the amounts of CO_2 that will be captured will be as mentioned in Table 10.

Whether and how much of these amounts of CO_2 will be transported for permanent geological storage and/or used back into useful products, is difficult to predict. It is therefore also difficult to predict whether these amounts will all result in net CO_2 reductions in the Flemish (and Belgian) greenhouse gas inventory, as this will also depend (in the case of CCU) on where and in which sectors recycled carbon fuels will be consumed.

Wallonia

In Wallonia, CO_2 capture is envisaged in the WAM scenario after 2030 for the industry and energy sector. Results are based on the modelling of technologies (rather than on concrete projects) and the economic choice of the model.

3.6.3.2. The power sector (electricity production) (CRF category 1A1a and autoproducers in other CRF categories)

Projections for 2030[34] in the power sector are modelled at national level by the Federal Planning Bureau with the Crystal Super Grid model of the company Artelys. The model is a "unit commitment optimal dispatch" model. "Unit commitment" refers to the process that determines which units are activated at which time and are then able to produce electricity. As for the 'economic dispatch', it relates to the actual production of the various plants successively activated according to the cost-efficiency criterion.

The model inputs used are:

- European power sector data (e.g., capacities, availabilities, power demand…) from TYNDP 2020 study developed by ENTSOE[35]. The scenario used is the "National Trends" which is based on the objectives of the PNEC 2019.
- Updated yearly projected electricity generation according to the Belgian entities (i.e., RES, CHP, Nuclear, Waste, Derived Gases). Production curves come from climate database from ENTSOE.
- Updated yearly projected electricity demand according to the Belgian entities. Unitary hourly load curves come from climate database from ENTSOE.

The model outputs used in the projections are:

- Electricity generation from gas and oil power plants.
- Imports and exports of electricity.

The results in CTF-NDC Table 11 regarding Electricity demand and supply for Belgium show an increase of the electricity consumption between 2019 and 2030 with

[34] Projections in 2025 consists of interpolation between base year 2019 and projected year 2030.

[35] https://2020.entsos-tyndp-scenarios.eu/#download

6% in the WEM scenario and with 13% in the WAM scenario (i.e. respectively 0.6% and 1.2% per year on average).

The trans-boundary electricity trading in 2030 is endogenous and modelled across all EU countries. The evolution of net imports in Belgium depends thus on the interconnection capacities, power demand and power generation fleet of each EU country. Net imports in 2025 are not modelled and are estimated to meet power demand in 2025.

The WEM and WAM scenarios integrate the phase-out of nuclear energy in Belgium. On 31st January 2003, the Federal Government decided the progressive phase-out of the production of electricity using nuclear fission energy by limiting the operating lives of existing nuclear power plants to 40 years and prohibited the construction of new nuclear power plants. In July 2012, the Federal Government confirmed this timetable except for one nuclear unit, Tihange 1, whose operation lifetime was extended by 10 more years. This decision was confirmed in a law (18th December 2013). On 18th June 2015, another extension was approved (for the Doel 1 and Doel 2 units) through an amendment of the law of 31st January 2003. In March 2022, the Federal Government decided to extend Doel 4 and Tihange 3 for 10 additional years. WEM and WAM scenarios consider this 10 years extension.

The timetable for the nuclear power phase-out between 2022 and 2035 mentioned in Table 11 has been taken into account in the WEM and WAM scenarios.

An increase in the offshore wind capacity after 2020 has been assumed in the WEM and WAM scenario (CTF-NDC Table 11).

The calculation of the CH_4 and N_2O emissions of the electricity production sector is performed applying the CH_4 and N_2O emission factors on the final energy carriers. Wood and other biomass burning is only taken into account for the projections of CH_4 emissions.

For the CO_2 emission projections originating from waste incineration each region applies its own methodology as specified in the National Inventory Report. The CO_2 emissions from waste incineration with energy recuperation are reported in the energy sector as 'other fuels' for the non-organic part and as 'biomass' for the organic part. The emissions from 1 industrial waste incinerator in the Flemish region (auto-generator) are allocated to CRF category 1A4a. CO_2 emissions originating from flaring activities in the chemical industry are allocated to the waste sector (CRF category 5C).

Table 11 Nuclear phase out

Nuclear unit	Capacity (MW)	Closing date WEM	Closing date WAM
Doel 1	433	15th February 2025	15th February 2025
Doel 2	433	1st December 2025	1st December 2025
Doel 3	1 006	1st October 2022	1st October 2022
Doel 4	1 039	1st July 2025 / 1st December 2036*	1st January 2036*
Tihange 1	962	1st October 2025	1st October 2025
Tihange 2	1 008	1st February 2023	1st February 2023
Tihange 3	1 046	1st September 2025 / 1st December 2036*	1st January 2036*

* Exact date not yet known.

Table 12 Renewable electricity Flanders in WEM and WAM scenario (TWh)

		WEM		WAM	
	2019	2025	2030	2025	2030
Solar	3.0	5.2	6.1	5.9	8.2
Wind onshore	2.8	4.2	4.5	4.3	5.7
Hydro	0.01	0.01	0.01	0.01	0.01
Biomass	2.4	1.6	1.3	1.6	1.3
Biogas	0.7	0.8	0.8	0.8	0.8
Total	**8.9**	**11.8**	**12.8**	**12.6**	**16.0**

Flanders

The WEM and WAM projections with regard to electricity production from renewable sources, as mentioned in the draft update of the Flemish Energy and Climate Plan 2021-2030[36], haven been taken into account.

Wallonia

The impact of support for green electricity production ("green certificate") is taken into account for the WEM scenario. Several measures (financing mechanisms, removal of administrative and legal obstacles…) increase electricity renewable energy targets in the WAM scenario around 14 TWh in 2030, in accordance with targets of the Air Climate Energy Plan for 2030.

Waste incineration remains stable in WEM and WAM scenario.

In the case of gas combined heat and power production system (CHP), the estimation considers "envelopes" from green certificate and after, technology choice is based on the result of the optimisation after the definition of a realistic potential of deployment.

Brussels-Capital Region

• WEM SCENARIO •

Regarding electricity and heat production, the estimations are based on historic evolution of the waste incinerator according to the regional energy balance; this is also the case for the waste water handling installations. In the case of the CHP, the estimation considers the average operating hours and the average annual evolution of the installed power between 2011 and 2021. The WEM scenario considers that biomass CHP will phase out in 2025. "Green certificates" will not be granted after 2030 meaning the end of the CHP production at the year 2040.

Concerning heat pumps, solar and photovoltaic panels' production projections, the WEM scenario assumes that the projected evolution follows the historic trend from energy balances. Finally, the scenario considers that the turbojet will work until 2038.

• WAM SCENARIO •

Comparing to the WEM scenario, the WAM scenario considers a reduction of 30% of incinerated waste in 2030. Part of the organic waste will go to a small anaerobic digestion plant starting in 2026. Regarding gas CHP, the WAM scenario assumes that the "green Certificates" will come to an end in 2025 thus CHP installations will be out in 2035. For photovoltaic panels, the WAM scenario includes the additional production of 5GWh installed in social housing and an annual growth of 8% until 2030.

3.6.3.3. The (energy) conversion sector

3.6.3.3.1. Refineries
(CRF categories 1A1a, 1A1b, 1B2c, 1B2a4)

Flanders

Refining is an activity that only takes place in the Flemish region. The WEM and WAM emission projections assume that the capacity of the refineries in Belgium will not increase after 2019. As described in the Belgian National Inventory Report CO_2 emissions of the refineries are allocated to the sectors:

- 1A1a for the involved combined heat-power installations of the refineries;
- 1B2c for the flaring emissions;
- 1A1b for the total emissions excluding the emissions of the combined heat-power installations and excluding the emissions from flaring activities.

The N_2O and CH_4 emission projections from refining activities are estimated by applying emission factors to the final energy carriers. The CH_4 emissions have a diffuse character and include the flaring emission projections of the refineries for the Flemish region.

All CH_4 emissions of this sector (except the emissions of the combined heat-power installations which are allocated to the sector 1A1a) are allocated in category 1B2a4 and all N_2O-emissions (except the emissions of the combined heat-power installations which are allocated to the sector 1A1a) are allocated in category 1A1b. The emissions of CH_4 reported in the category 1B2a4 also contain the flaring activities of refineries.

3.6.3.3.2. Coke production
(CRF category 1A1c)

Flanders

In Flanders the WAM and WAM scenario assumes one coke production plant in steel industry operating at maximum capacity in the period 2019-2050 and equipped with a desulphurisation unit.

Wallonia

In Wallonia, the last coke factory was closed in 2014 and it is not expected that a new plant will be built.

3.6.3.3.3. Oil transport
(CRF category 1B2a3)

Flanders

Fugitive emissions of CO_2 and CH_4 from oil transport are assumed to remain constant at the 2019 level.

3.6.3.3.4. Gas transmission and distribution
(CRF category 1B2b)

Flanders

Projections of fugitive CH_4 emissions from the distribution of natural gas in Flanders are calculated based on assumptions on the evolution of the natural gas network and the gradual replacement of pig iron pipes by PE, PVC or steel. The expansion of the natural gas network in Flanders is estimated taking into account the increase

[36] https://www.vlaanderen.be/veka/energie-en-klimaatbeleid/vlaams-energie-en-klimaatplan-vekp-2021-2030

of the number of households and the number of houses in residential areas with the possibility to connect to the natural gas distribution grid.

Wallonia

Calculation of CH_4 emissions from the distribution of natural gas in Wallonia is based on the assumption that the network expands lightly each year. The emissions are supposed to stay constant as pig iron pipes and asbestos cement pipes will continue to be replaced, all new distribution pipes being made of steel or PE/PVC.

Brussels-Capital Region

Fugitive emissions considered in Brussels-Capital Region are due to the distribution of natural gas; the emissions remain constant since the network will not be extended.

3.6.3.4. The industrial sector

3.6.3.4.1. Energetic CO_2 emission in the industrial sector (CRF category 1A2)

Projections of energy use in the industry sector are based on assumptions of activities and also the energy intensity (amount of energy used per unit of activity).

Flanders

The energy consumption and CO_2 emissions in the industrial sector in the WEM have been modelled taking into account the expected energy efficiency improvement, based on current energy agreements, and activity projections. Increased energy efficiency and additional fuel shift assumptions have been considered in the WAM scenario.

The industrial off-road emissions are calculated by using the OFFREM-model with emission factors of the IPCC 2006 guidelines (CO_2 and CH_4) and EMEP/EEA guidebook (N_2O). Off-road emissions of the industrial sectors are allocated (incl. construction industry) in category 1A2gvii.

Wallonia

The evolution of economic activity is taken into account via requests for energy services specific to each industrial sub-sector[37] (either via an assumption of stability compared to 2018 or via an assumption of evolution equal to the average of the years 2014-2018). Investment projects and equipment closures that have taken place or have been announced have been considered.

All major industries are involved in 'second generation' branch agreements whereby they are committed to improve their energy/CO_2 efficiency by 2023. Technology choice is based on the result of the optimisation, challenged and brought into line with monitored voluntary agreements results for the WEM scenario.

Brussels-Capital Region

• WEM AND WAM SCENARIOS •

The projections are calculated on the basis of energy intensity. Industry sector in Brussels-Capital Region faced an important decrease from the year 2000. Between 2008 and 2021, it has stabilized, representing approximately 3% of final energy consumption in the region. The perspectives of a future expansion are very low. The projections assume that the gross added value will progress according to the middle term projections 2022-2027[38]; from 2028 until 2040 this value remains constant.

The 8th December 2016 a decree has been approved concerning energy audits obligations[39]. This decree is included in the WEM scenario. The objective is to diminish total energy consumption of the biggest industrial companies located in the region, so companies consuming more than 28 GWh per year in primary energy must do an energy audit.

3.6.3.4.2.Process emissions of CO_2 (CRF category 2A, 2B, 2C)

Flanders

Main non-energetic uses of fuels in Flanders:

- natural gas for ammonia production (carbon converted to CO_2 emissions);
- natural gas for processes where the carbon is fixed in the end-products;
- natural gas for the production of hydrogen and ethylene oxide;
- naphtha and LPG in crackers and in other processes (carbon fixed in end-products);
- heavy fuel oil for production of carbon black; use of coal-tar in one company.

Because it concerns non-energetic use of fuel it is assumed that climate policy will not have an effect on the use of the fuels mentioned above. In addition, there are also several processes with chemical reactions, in which carbonaceous products, generally not considered as fuels, are oxidised to CO_2. Such process emissions occur in the chemical industry (production of ethylene oxide, acryl acid, cyclohexanon, synthetic soda), in refineries, in the sector of non-metallic minerals, and during flaring and the desulphurisation of flue gasses.

As from the inventory submission in 2015 some emission categories have been re-allocated to CRF category 2 according to the IPCC 2006 guidelines:

- The emissions from the solid fuels (cokes gas, blast furnace gas, cokes

[37] The industrial sector is divided into 20 subsectors : milk, sugar, transformed potatoes, other food industry, cement, lime, hollow glass, flat glass, bricks, ceramics, other non-metallic minerals, ammonia, other chemicals, wood industry, pulp and paper, iron and steel, non-ferrous metals, non-energy consumption (chemicals and others) and other industries.

[38] https://www.plan.be/databases/database_det.php?lang=fr&ID=27

[39] Arrêté du Gouvernement de la Région de Bruxelles-Capitale relatif à l'audit énergétique des grandes entreprises et à l'audit énergétique du permis d'environnement approuvé en troisième lecture le 8 décembre 2016.

grid and anthracite) have been re-allocated from the category 1A2a in previous submissions to the category 2C1a for the only big integrated steel plant in Flanders.
– The emissions from the production of ethylene are included in category 2B8b since the inventory submission in 2015. Until the inventory submission in 2014 these emissions were allocated to the category 1A2c (other fuels). These emissions cover the recovered fuels in the steamcracking units in the petrochemical industry and other recovered fuels from the chemical industry.

The current inventory allocation method has been used for this projection report.

Projections of CO_2 process emissions are linked to activity assumptions which are mainly based on the results of the EU Reference Scenario 2020[40] for Belgium.

As mentioned in chapter CCUS 3.6.3.1, CCUS is taken into account for process emissions in the chemical sector and the iron and steel sector.

Wallonia

Main non-energetic uses of fuels in Wallonia:

– coal in the iron and steel industry and selected applications of engineering (metallic works);
– petroleum products in several sectors, notably in the chemical industry;
– natural gas for ammonia production (carbon converted to CO_2 emissions).

Emissions from processes considered in Wallonia are the following:

– CO_2 produced by the decomposition of limestone in cement and lime productions;
– CO_2 produced by the decomposition of methane to produce ammonia (and considered separately from CO_2 emitted by the actual combustion of methane).

Projections of CO_2 process emissions are linked to growth rates of activity and have therefore been kept constant in WEM scenario.

The emissions are decreasing in the WAM scenario after 2030, thanks to new technologies (hydrogen, carbon capture…).

3.6.3.4.3. CH_4 and N_2O emissions in the industrial sector (CRF category 2)

The CH_4 and N_2O emission projections for the industrial sector are made using the emission inventory methodology reported in the National Inventory Report.

CH_4 emissions in the industrial sector originate mainly from the iron and steel sector in Flanders (sinter production). The same activity growth trend as mentioned in section 3.6.3.4.1 above are assumed. The emission levels are directly linked with this same growth trend.

The N_2O emission originates from caprolactam (Flanders) and nitric acid (Flanders, Wallonia) production.

N_2O emission projections of caprolactam production are based on information from the concerned company regarding activity data and implementation of reduction measures. In the WEM scenario the application of an end-of-pipe technique has been considered. Additional reduction measures which still require further research have been taken into account in the WAM scenario.

N_2O emission projections of nitric acid production in Flanders is assumed to remain constant at the 2019 level. In Wallonia, N_2O emission projections of nitric acid projections are based on information from the concerned company regarding activity data and implementation of reduction measures. Reduction measures were implemented in 2011, resulting in a large decrease of N_2O emissions. The emissions have been considered the same in the WEM and the WAM scenario.

3.6.3.4.4. Non-energy products from fuels and solvent use (CRF category 2D)

Flanders

The emissions of non-energy products from fuels and solvent use are considered constant at the 2019 level for the entire projection period. This category includes:

– The CO_2 emissions from the use of lubricants (CRF category 2D1);
– The CO_2 emissions from the use of paraffin wax (CRF category 2D2);
– The CO_2 emissions from the urea used as a catalyst (CRF category 2D3).

Wallonia

The emissions of non-energy products from fuels and solvent have remained stable for 10 years around 35-40 kt CO_2. Those emissions are kept constant and equal to 35.16 kt CO_2 for the entire projection period for both WEM and WAM scenario.

Brussels-Capital Region

The use of non-energy products is kept constant for the entire period.

3.6.3.4.5. The 'Other product manufacture and use' Sector (CRF category 2G)

Only the use of N_2O as anaesthetic and aerosol cans is included in this category.

Flanders

N_2O emissions from this use in Flanders are kept constant at 2019 emission levels. Due to the lack of information about the evolution of consumption, the last historic value has been considered constant for the entire projection period.

Wallonia

N_2O emissions from this use in Wallonia are kept constant at 2018 emission levels. Due to the lack of information about the evolution of consumption, the last historic value has been considered constant

[40] https://energy.ec.europa.eu/data-and-analysis/energy-modelling/eu-reference-scenario-2020_en

for the entire projection period for both WEM and WAM scenario.

Brussels-Capital region

For Brussels-Capital Region, the information on anaesthetic use is based on the regional sales of anaesthetic. Due to the lack of information about the evolution of anaesthetic consumption, the last historic value has been considered constant for the entire projection period.

Emissions due to the use of aerosol cans are also estimated in the Brussels-Capital Region inventory considering a constant consumption per inhabitant. The emission projections of aerosol cans are based on population data from the Federal Planning Bureau (see section 3.6.2.4).

3.6.3.4.6. F-gas emissions (CRF category 2)

• WEM SCENARIO •

The F-gas emission projections are drawn up from the model developed by ECONOTEC Consultants and VITO in the context of a study commissioned by the Federal Department of the Environment on behalf of the National Climate Commission[41].

The following assumption on the share of refrigerants that will be used in heat pump equipment is used in the WEM scenario. R407C and R410A which have been used predominantly in the past will be replaced by R32 and non-HFC alternatives, such as R290 and HFOs. While the share of R32 will decrease, in 2050, 30% (equipment up to 7 kW) and 25% (equipment larger than 7 kW) of new installations will still use R32.

• WAM SCENARIO •

For the calculation of F-gas projections in the heat pump sector the sale of heat pumps is considered the same as in the WEM scenario's (and in line with the EU energy and climate ambitions). The difference between both scenario's result from assumptions on the share of refrigerants that will be used in heat pump equipment. In the WAM scenario however, driven by the proposal for the amended F-gas regulation, this transition will be much quicker and only few equipment will be placed on the market with R32 in 2030. Therefore in the WAM-scenario the projections F-gas emissions are smaller than in the WEM-scenario.

The F-gas emissions from heat pumps are also not the biggest category of emissions of F-gases due to their usage as refrigerants. Industrial and commercial refrigeration have been and are responsible for larger emissions of F-gases. A steep reduction in the usage and emissions in these categories has been observed in the last years and will continue in this decade. Due to EU-legislation this reduction will be more pronounced in the WAM-scenario This also explains the predicted decline of F-gas emissions.

[41] https://www.cnc-nkc.be/sites/default/files/report/file/final_report_2022_public_-_projections.pdf

In **Wallonia**, the WAM scenario considers a decrease of the emissions by 2030 compared to 2005.

In the **Flemish region,** the WAM scenario takes into account additional measures that are included in the draft update of the Flemish Energy and Climate Plan for the period 2021-2030 and that aims at reducing the F-gas emissions to 0.6 Mton CO_2-eq in 2030 for the Flemish Region. The following additional measures are considered:

- Strengthening of the economic support instruments, particularly the Ecologiepremie+ subsidies (possible extension beyond 2020 and to other technologies);
- Support for new or existing training centres with adequate equipment;
- Fostering of a Green Deal with the retail sector, to reduce its use of F-gases to practically nil and its emissions to a minimum in 2030.

3.6.3.5. The residential sector (CRF category 1A4b)

The climate regulations and measures considered for the WEM and WAM projections are presented in more detail in the PAMs reporting. The assumed evolution of the population and the number of households is discussed in section 3.6.2.4. Estimates are made on the number of new dwellings. Distinction is made between new and existing houses.

Flanders

Heating and equipment

- New dwellings (WEM and WAM scenario):

As of 2021 it is assumed that the heat demand of all new single-family dwellings and apartments respect an E-level of 30 following the implementation of the EC directive on energy performance of buildings.

- Existing dwellings:

For existing dwellings, projected fuel consumption in the WEM scenario is determined by:

- The average fuel consumption in an existing dwelling in 2019 and the evolution of the number of dwellings;
- The impact of renewable energy policies (solar boilers and heat pumps), autonomous boiler efficiency improvements and also thermal insulation measures based on the current subsidy system.

The main additional measures included in the WAM scenario are listed below:

- Accelerated renewal of heating systems;
- Prohibition on new gas connections in new residential complexes;
- Optimization of settings of existing heating systems;
- Demolition subsidy;
- Reduction in VAT for renovations;

- Renovation obligation;
- Reform of subsidy system;
- Prohibition of new heating oil boilers.

Fuel mix

The projected fuel mix of existing dwellings starts from the current distribution of energy carriers and takes into account the expected yearly fuel switch (installation switch from fuel oil to natural gas heating systems) and the number of heat pump installations. An increased number of heat pump installations has been assumed in the WAM scenario based upon the WAM-scenario for renewable energy. The fuel mix for new dwellings depends on the E-level pathway.

Equipment

It is considered that 80% of the historic electricity was used for electrical appliances and lighting. The remaining 20% of the consumption is used for electric heating and sanitary hot water preparation. The evolution of the power consumption of electrical appliances and lighting has been simulated taking into account the results of the EU Reference scenario 2020.

Off-road

The off-road emissions of the residential sector are calculated by using the OFFREM-model with emission factors of the IPCC 2006 guidelines (CO_2 and CH_4) and EMEP/EEA guidebook (N_2O). Off-road emissions of the residential sectors are allocated in category 1.A.4.b.ii (Off-road vehicles and other machinery).

Wallonia

• WEM SCENARIO •

Space heating and hot water

For new dwellings, the heat demand takes into account the current EPB regulation in Wallonia with the following requirements from 2021 : Ew = 45; Espec = 85 kWh/m²/year (where Ew is the "primary energy consumption level" and Espec is the "specific primary energy consumption level").

For existing dwellings, 20 different categories of existing buildings are taken into account. For each category, the surfaces and net needs are described. Retrofitting options (roof, wall, floor and window) are also differentiated according to the 20 categories of buildings defined above. A decrease of specific energy consumption of existing housing is calculated based on energy savings per type of renovation and a number of annual renovations coherent with the results from energy grant system.

Concerning the fuel mix, a set of technologies is described in the model through standard parameters (efficiency, lifetime…) which can evolve (improved performance…). Installation switch from fuel oil to natural gas heating systems[42] and share of renewable energy (mainly biomass and heat pumps) slightly increases in the fuel mix (thanks to EPB requirements for new houses and energy grant system).

Other uses

The demand for other energy services for the residential sector including lighting, cooking, refrigeration and freezing, cloth washing and drying, dish washing, and other electricity services follows the evolution of the number of households.

For electric equipment, new technologies are described according to the best available technologies.

• WAM SCENARIO •

The WAM scenario for residential sector includes different measures:

– For all buildings, more heat is produced by renewable energy (biomass, heat pumps…), in accordance with targets of the Air Climate Energy Plan for 2030. The gradual withdrawal of oil-fired installations is modelled in accordance with the planned regulatory measure.
– For existing buildings, the targets of the "Long term Renovation Strategy"[43] and its intermediate objectives are taken into account. It will reduce the environmental impact of existing buildings. This strategy defines different objectives for energy efficiency of the envelope and the equipment of the existing buildings.

This scenario will require the implementation of new measures or the improvement/widening of some measures taking place in the WEM scenario.

Brussels-Capital Region

• WEM SCENARIO •

The residential emission projections consider the historic trends between 2001 and 2019 on energy consumption, household size, and population. The projections also reflect the application of the Brussels-Capital Region Government's Decree[44] regarding Energy Performance of Buildings. This decree considers that all new buildings will be nearly passive (15kWh/m².yr) and heavy renovated buildings will consume 30kWh/m².yr.

The measures taken into account in the WEM scenario are related with the energy management and technical installations in buildings. The technical reception of a new boiler installation is one of these measures. In fact, when a new boiler is installed, the entire heating system must be controlled by a certified technician; this action allows 25% reduction from heating consumption. Boiler replacement rate was estimated from the data provided by the Thermal

[42] Taking into account some limits linked to gas infrastructure, barriers to system change, … Only 20% of oil installations at the end of their life are replaced by an alternative system.

[43] https://energie.wallonie.be/fr/strategie-de-renovation.html?IDC=9580

[44] 21 décembre 2007.- Arrêté du Gouvernement de la Région de Bruxelles – Capitale déterminant des exigences en matière de performance énergétique des bâtiments et du climat intérieur des bâtiments tel que modifié par l'arrêté du 5 mai 2011.

Technique Belgian Association (ATTB, French acronym) and it was deduced from the boilers replaced with energy grants.

The third measure is also related to the heating installations. The mandatory control is applied for boilers that are part of a heating system with a nominal power higher than 20kW that uses non-renewable fuel (gasoil and natural gas), and whose heat transfer fluid is water. An annual control is established for oil boilers and natural gas boilers should have a control every two years since 2019. This control generates energy gains around 1% for gas boilers and 2% for oil ones. This measure lasts the whole projected period but the measures reaches only 10% of the total target.

The phasing out of fossil fuels such as coal and gasoil is considered in the WEM scenario. Starting from 2021, it will not be allowed to install any equipment using coal as fuel. Whilst this will be the case for gasoil installations from 2025.

Another measure considered in the WEM scenario is the energy grant system. The energy gains are estimated considering the average gain of 2009 to 2020 for building's isolation, double glazing implementation, heating regulation systems and boilers replacement. The energy gain is considered to last 20 years. This gain is multiplied by the annual budget; the WEM scenario considers the budget proposed by the Government from 2021 (31.2M€) to 2024 (47.5M€). According to the grant system report concerning the year 2018, residential sector benefits of 91% from total budget, this percentage was used to estimate the energy reduction of this sector and is kept constant.

Finally, Brussels-Capital Region promoted from 2007 to 2013 the "Exemplary Buildings Project" (BatEx). The objective of the project was to promote ecological construction and passive buildings. The project allowed the construction and renovation of approximately 214.000 m^2 in the residential sector. The energy gain is estimated to last 20 years. The impact of the Exemplary Buildings Project will come to end in 2033.

• WAM SCENARIO •

The WAM scenario considers the improvement or the widening of some measures taking place in the WEM scenario for the residential and tertiary sector. This is the case for the boiler's control, in the WAM scenario, the effectiveness of the measure increases to 25%. This increase of effectiveness also applies to the technical reception of a new heating boiler.

Finally, the strategy for reducing the environmental impact of existing buildings, known as "Renolution" is considered in this scenario. The assumptions consider the acceleration of the renovation in old buildings and the phasing out of coal, oil, CHP in 2040 and the phasing out of gas in the longer term in order to achieve the objectives stated in the strategy.

3.6.3.6. The tertiary sector (CRF category 1A4a)

Flanders

• WEM SCENARIO •

A model adapted to the specifics of the tertiary sector is used for the tertiary energy projections. This model allows us to have adapted assumptions for each subsector. The following subsectors are defined: healthcare, trade, offices, education, restaurants, hotels, bars, government and others.

The evolution of the energy demand is based on the evolution of general activity in each specific subsector or, if not available, the projected GDP growth.

A business as usual scenario is defined for investments in energy-efficiency based upon the current amount of subsidies that are given. Regarding additional heat pumps the WEM-scenario for renewable energy is adopted.

• WAM SCENARIO •

For the WAM scenario a gradual increase of the investments in energy efficiency is modelled. It is assumed that the implementation of the Flemish renovation obligation will lead to a significant increase in the renovation activity and thus resulting in increased investments in energy-efficiency measures. It is assumed that the renovation activity will steadily increase because of the time given to implement the obligation. In addition, an obligation for all buildings, regardless if transferred or not, to reach a certain energy performance level by 2030 is implemented which will further boost energy demand reductions.

The additional amount of heat pumps installed and the fuel switch realised is based upon the WAM-scenario for renewable energy. Thus, the WAM scenario includes:

– the implementation of additional energy saving measures as described in the PAMs reporting;
– the impact of renewable energy policies.

Wallonia

• WEM SCENARIO •

Different energy services (heating, hot water, cooling, and other services including cooking, private and public lighting, refrigeration, and other electrical devices) and technologies are defined for 7 subsectors (education, health, culture and sports, shops, private offices, public offices, datacentres).

The evolution of the demands is linked to employment growth.

Some renovations fuel switching are assumed, according to the results from support policies (UREBA…).

For electric equipment, new technologies are described according to the best available technologies.

• WAM SCENARIO •

WAM scenario for tertiary sector includes different measures:

– For all buildings, more heat will be produced by renewable energy (biomass, heat pumps…), in accordance with targets of Air Climate Energy Plan for 2030.
– For existing buildings, the targets of the "Long term Renovation Strategy"[45] and its intermediate objectives are taken into account. It will reduce the environmental impact of existing buildings. This strategy defines different objectives for energy efficiency of the envelope and the equipment of the existing buildings.

This scenario will require the implementation of new measures or the improvement/widening of some measures taking place in the WEM scenario.

Brussels-Capital Region

• WEM SCENARIO •

The main consideration for establishing projections is the expansion of building surface due to the increase of employment as well as the information available in the regional energy balance. The increase of teleworking in future years is also taken into account.

The implementation of the Brussels Energy Performance of Buildings Decree[46] is reflected in the projections. This measure is applied for office and education buildings; it starts in 2018. All new buildings are considered nearly passive (15kWh/m².yr) and all the heavy renovated buildings must reach a very low energy level (45kWh/m².yr).

The first measure focuses on the big energy consumers. It contemplates the requirement of an energy audit in order to obtain the renewal of the environmental permit for establishments exceeding 3500 m²[47]. The energy audit allows a reduction between 7.3% to 7.88% of final energy consumption.

The decree concerning energetic audits has been approved the 8th December 2016[48]. According to this framework, the big companies, defined by the number of employees and its energy consumption, must do an energy audit starting on 2018, this means on average 18 additional audits per year. In addition, the target is enlarged for commercial establishments, starting from 2018; commercial establishments with a surface over 1500 m² must do an energy audit.

In addition, there is the mandatory implementation of the local action and energy management plans (PLAGE, French acronym) in private buildings which surface exceeds 100 000 m² and public buildings with an area bigger than 50 000 m². The objectives of the PLAGE are to implement energy management measures, handle energy invoices, increase users comfort, improve air quality and reduce GHG emissions. This action starts on 2019. The first phase lasts 6 years and the subsequently phases have a duration of 4 years. The objective of the PLAGE is to obtain a reduction on final energy consumption of 10% per phase.

The impacts of the NRClick and the subsequent RenoClick programs are also part of the WEM scenario. These programs oriented for the brussels public services propose a complete renovation program. It covers deep renovation but also energy efficiency projects or PV installation.

Three measures already described in the residential sector scenario (see section 3.6.3.5) are also applied in the tertiary sector. The first one is the technical control of heating systems which has the same hypothesis than the residential sector. The second one is the implementation of the energy grant system; the only difference is the proportion of the budget assigned to this sector; according to the grant system report concerning the year 2018, tertiary sector uses 9% of total budget and it is kept constant between 2019 and 2040. Finally, the BatEx project that promoted the energy and environmental performance, the profitability and reproducibility of the technologies, and the architectural quality and urban integration of buildings was also applied in the tertiary sector. In fact, approximately 396.000 m² were constructed and renovated under this project between 2007 and 2013. The energy reduction obtained thanks to the construction characteristics is assumed to remain for 20 years. The impact of the Exemplary Buildings Project will come to end in 2033.

• WAM SCENARIO •

As mention before, the boiler's control effectiveness is increased to 25% in the WAM scenario.

Moreover, the strategy for reducing the environmental impact of existing buildings, known as "Renolution" is considered in this scenario. The assumptions consider the achievement of the neutrality in public buildings in 2040 considering the increase of the renovation rate and the phasing out of fossil fuels.

3.6.3.7. The agricultural sector (CRF category 1A4c and 3)

Greenhouse gas emissions in the agricultural sector mainly consist of CH_4 and

[45] https://energie.wallonie.be/fr/strategie-de-renovation.html?IDC=9580. For tertiary building: energy efficient and carbon neutral building for heating, production of domestic hot water, cooling and lighting in 2040.

[46] 21 décembre 2007.- Arrêté du Gouvernement de la Région de Bruxelles – Capitale déterminant des exigences en matière de performance énergétique des bâtiments et du climat intérieur des bâtiments tel que modifié par l'arrêté du 5 mai 2011.

[47] 30 janvier 2012.- Arrêté du Gouvernement de la Région de Bruxelles-Capitale relatif à un audit énergétique pour les établissements gros consommateurs d'énergie.

[48] Arrêté du Gouvernement de la Région de Bruxelles-Capitale relatif à l'audit énergétique des grandes entreprises et à l'audit énergétique du permis d'environnement approuvé en troisième lecture le 8 décembre 2016.

N_2O emissions originating from animal husbandry and emissions from agricultural soils.

The livestock numbers mentioned in CTF-NDC Table 11 were used in the projections.

Flanders

In 2019 the energy consumption in the agricultural sector mainly originates from greenhouse heating systems (63%), non-stationary sources (fisheries, tractors...) (12%) and the warming of stables (25%).

Off-road emission projections are calculated using the OFFREM-model with emission factors of the IPCC 2006 guidelines (CO_2 and CH_4) and EMEP/EEA guidebook (N_2O). Emission projections of sea-fishery are calculated with the EMMOSS model. Both models are also used for the greenhouse gas inventory.

The WEM projections for the greenhouse horticulture take into account an extension of current subsidies[49] for energy efficiency and renewable energy measures. In the WAM scenario increase in the budget for the subsidy system in the period 2023-2030 has been taken into account.

The CH_4 and N_2O emission projections take all policy measures, listed in the PAMs reporting, into account and assumptions on the evolution of the animal herd. The main policy measures that were included in the projections are briefly summarised below:

- Flemish covenant on enteric emissions in combination with the eco scheme feed management for methane reduction from the CAP strategic plan.
- The target of reducing the pig population by 30% by 2030 (to be met in part by a buy-back scheme) compared to 2015.
- Small-scale digestion applied to 30% of total dairy cattle, i.e. 50% of dairy cattle in barns with manure pit (60% of the dairy herd). This corresponds to 500 small-scale digesters on dairy farms in 2030.
- Small-scale digestion applied at 25% of the number of pigs in stalls with manure pit (100% of the pig population) taking into account the reduction of the pig population by 30%. This corresponds to 130 small-scale digesters on pig farms.
- Soil emissions are reduced, among others, through the new manure action plan MAP 7 which is still in draft stage. A more concrete calculation of soil emissions will be elaborated in the final update of the Flemish energy and climate plan 2021-2030. Implementation of the measures in the CAP strategic plan will lead to further reduced nitrogen fertilization.

[49] https://lv.vlaanderen.be/subsidies/vlif-steun-voor-de-land-en-tuinbouw

Wallonia

Energy related emissions in the agricultural sector in the Walloon Region, including the emissions from the gasoil of tractors and other mobile equipment, are limited (320 $ktCO_2e$ for the whole period).

CH_4 and N_2O emission projections take into account the recent evolutions of activity data:

- livestock: a global decrease for cattle and an increase for all the other animal categories in the WEM scenario; a further decrease of non-dairy cattle and a decrease in pigs and poultry for the WAM scenario.
- fertilizer use: a reduction of mineral fertilisers (further decrease in WAM) and an increase for the organic fertilisers.

For some parameters, the mean values of last years are maintained up to 2050, in absence of any other information (e.g. milk yield, crop residues...).

The calculations follow the methodology of GHG inventories, detailed in the National Inventory Report of the 2023 submission.

Brussels-Capital Region

Greenhouse gas emissions in the agricultural sector mainly consist of CH_4 and N_2O emissions originated from animal husbandry (enteric fermentation and manure management) and direct and indirect emissions from managed soils. The CH_4 and N_2O emissions of the agricultural sector are very low in Brussels-Capital Region. The stabilisation of the sector is assumed since further expansion is not possible; thus the values remain constant.

Table 13 Overview of the assumed energetic shares of biofuels in transport fuels in the WEM and WAM scenarios (% Net Calorific Value)

		2025	2030
WEM	Bioethanol	8.95	8.95
	Biodiesel	8.95	8.95
WAM	bioethanol	10	10.45
	Biodiesel	10	10.45

3.6.3.8. The transport sector (CRF category 1A3)

Biofuels

The share of biofuels in transport fuels is one of the important factors determining the emission levels. The shares of biofuels used in the regional road transport models are harmonized on the basis of this federal PAM described in the 2019 National Energy Climate Plan. Table 13 provides an overview of the assumed blends of biodiesel in diesel and bioethanol in gasoline in the WEM and WAM scenarios until 2030. These are kept constant after 2030.

Apart from the harmonized shares of biofuels in road transport, the rest of the transport sector modelling occurs through specific regional models. These are described below.

Flanders

The transport sector includes road transport, railway transport, inland shipping, maritime shipping and air transport. Different models were used for the various transport modes. The models calculate the use of energy and the emissions starting from the transport flows (volumes). For road traffic, railway traffic and inland shipping a specialised traffic model was used to calculate the transport flows, the Flemish multimodal model.

Road transport

The calculation of atmospheric pollutants, emissions and energy consumption for road transport is based on projection studies performed by VITO for the Flemish government using the Fastrace model[50]. Only motorized traffic (excl. pedestrians and cyclists) is included in the projections.

The GHG projections take 2019 as base year. The confirmed policies and measures are taken into account in the WEM scenario. These include the national and regional planned improvements of the public transport network, the redesign of some urban areas to promote soft transport modes (walking, cycling), and the implementation of trucks freight transport pricing. No new Flemish measures are assumed in the WEM scenario after 2019. Starting from the base year 2019, the expected evolution of mobility and transport demand in Flanders in the WEM scenario was used to calculate the number of vehicle kilometers per vehicle type and fuel type for the period 2019-2030 and 2050. The total Flemish fleet composition was modelled for the period 2019-2030 and 2050 starting from the fleet in 2019 and considering the composition of new vehicles and survival rates of the vehicles over the same period.

Additional measures to reduce the number of vehicle kilometers and aiming at a significant shift to electric, plug in hybrid or charge sustaining hybrid vehicles, have been taken into account in the WAM scenario. Additional measures are expected to reduce the number of vehicle kilometers compared with the WEM scenario. The Flemish Clean Power for Transport Plan 2020[51] and Vision 2030 will lead to a shift towards cleaner vehicles. This includes a target of 100% zero emission vehicles (new sales) in 2029 both for cars and light duty vehicles.

Rail transport

Emissions of rail transport only include the emissions originating from diesel trains, while energy figures include energy use by electric trains as well. The applied growth in transported volumes determines train-kilometers, which in turn determine the evolution of the emissions. The shares of diesel and electric traction are considered constant over the projected period.

Inland Waterways and Short-sea Shipping

Emissions of inland waterways and short-sea shipping are based on the evolution of the transported volumes which determine the evolution of the emissions.

Off-road emissions

Emission of off-road activities in harbours, airports and transhipment companies are allocated to CRF category 1A3e. The emissions projections are calculated with the country-specific OFFREM-model with emission factors of the IPCC 2006 guidelines (CO_2 and CH_4) and EMEP/EEA guidebook (N_2O).

Pipeline transport

Emissions originating from the compression activities in the sector 'storage and transport of natural gas' are reported in CRF category 1A3e. These emissions are assumed to remain constant at the 2019 level.

Wallonia

Road transport

The projections of the overall mobility are calculated using the principle of mobility demand.

- Projections of the Federal Planning Bureau[52] are used for WEM scenario (demand is assumed to increase, with little modal shift).
- FAST program is considered for WAM scenario: the FAST vision is an ambitious plan focused on mobility adopted by the Walloon government. It foresees a major modal shift towards rail transport and a reduction in the general demand for transport. For passenger cars, demand decreases under the impulsion of a decreasing modal share of cars (from 83% in 2017 to 63% in 2030), a rise in the car occupancy rate (from 1.3 in 2017 to 1.5 in 2030) and a reduction of 5% of the global demand for passenger transport. This scenario will require the implementation of new measures

[50] https://vito.be/en/product/fastrace-traffic-emission-model

[51] https://www.vlaanderen.be/milieuvriendelijke-voertuigen/beleid (in dutch)

[52] For more information see: https://www.plan.be/publications/publication-2240-fr-perspectives_de_la_demande_de_transport_en_belgique_a_l_horizon_2040

or the improvement/widening of some measures taking place in the WEM scenario. Total demand for freight transport is kept constant for the whole period and the modal share by road is 77% in 2030 (84% in 2016).

In the WEM scenario, conventional vehicles remain the main technologies operating. In the WAM scenario, electric and hybrid vehicles rise in 2030. Hydrogen vehicles also appear after 2030.

Rail transport

In WEM scenario, we assume an increase of the emissions due to the increase of transport by rail.

In WAM scenario, despite a constant demand, the modal share for rail in the whole passenger transport rises until 16% in 2030 (9% in 2017). For freight transport, the modal share of train rises until 13% of the total freight transport in 2030 (9% in 2016).

Navigation

In WEM scenario, the demand increases for inland vessel transport of goods.

In WAM scenario, for navigation, the modal share for freight transport rises until 10% of the total tonnes.km in 2030 (7% in 2016).

Aviation

In WEM and WAM scenarios, demand for aviation is assumed to be related to the increase in population.

Brussels-Capital Region

• WEM SCENARIO •

Projections of transport emissions consider road and off-road transport, railways, inland navigation, and natural gas transport. Road transport emissions represent 93% of the total (direct) GHG emissions of transport (2020). The main hypotheses used for the projections are described in the following paragraphs.

Road transport

Projections of road transport emissions are calculated using a bottom-up approach (*fuel used* basis). The correction to *fuel sold* is applied as final step.

The model used starts from the last known vehicles fleet circulating on the Brussels road network, available from the emissions inventories. The projections of the evolution of the vehicles fleet are based on historical survival curves, combined with other constraints like LEZ exclusions. The mobility demand scenarios comes from the Good Move project of Brussels-Mobility (scenarios No Move [WEM scenario] and Good Move [WAM scenario]). New vehicles are added to the fleet if the existing fleet, combined with annual mileages, does not reach the total mobility demand.

The policies and measures taken into account for the simulations refer to WEM scenario. For road transport, the WEM scenario notably considers the implementation of a Low Emission Zone (LEZ), at the regional level, which implies that the vehicles that do not respect the established thresholds (based on fuel and EURO standards) are banned. Moreover, the government of the Brussels-Capital Region has decided to implement a progressive phasing-out for fossil fuels-based thermic motors in the Region. Diesel light vehicles will be banned from 2030 on, and gasoline and GPL light vehicles from 2035 on.

At the current stage, this measure has a significant influence on some pollutants affecting local air quality, but a rather limited impact on GHGs emissions and climate change.

Rail transport

For railways, the evolution of liquid fuel (gasoil) consumption is derived from the evolution of freight transport demand at the Belgian level. The starting point of the projections (2019) comes from the regional energy balance. The GHG emissions increase by about 310 t CO_2 eq. between 2020 and 2030. Passengers transport (trains, metro and tramways) is driven by electricity; the increase on electricity consumption projected between 2020 and 2030 is 15%.

Navigation

For inland navigation, the evolution of liquid fuel (gasoil) consumption is derived from the evolution of freight transport demand at the Belgian level. The starting point of the projections comes from the regional energy balance. Projections show an increase of GHG emissions. In 2020, emissions from inland navigation were 1.82 kt CO_2-eq, and in 2030 they will be 2.38 kt CO_2-eq.

Natural gas transport

The emissions originating from natural gas transport are kept constant and equal to the emissions of year 2020 for the entire projection period since there are no available projections for this sector.

Off-road emissions

The projections of off-road emissions for all sectors and vehicles categories are calculated with the OFFREM model. This model has been developed for the 3 Regions in Belgium on the basis of a detailed bottom-up approach.

• WAM SCENARIO •

Road transport

The "Good Move" Plan[53] is the regional mobility plan. Developed through a dynamic and participatory process, Good Move defines the Region's mobility objectives and actions at the 2030 horizon. It focuses on six frames and is based on the implementation of fifty measures. According to preliminary estimates, the Good Move plan could contribute to a 21% reduction of vehicle-kilometers of light vehicles in the Brussels-Capital Region from 2018 to 2030. The priority objectives of Good Move regarding energy and climate are to reduce the use and ownership of cars, increase the modal shift, and green the fleet.

[53] https://goodmove.brussels/fr/

3.6.3.9. The waste sector (CRF category 5)

Flanders

Projections of CH_4 emissions from the solid waste disposal on land in Flanders (CRF category 5A) are calculated taking into account a ban on organic waste dumping since 2000. CO_2 emissions from the solid waste disposal on land sites originate when recovered emissions are used or flared via installations with energy recuperation. These emissions are reported in the energy sector (CRF category 1A1a and 1A4a).

CH_4 and N_2O emissions from waste water handling in Flanders (CRF category 5D) are based on projections with respect to the evolution of population and of the number of people connected to waste water handling systems until 2050.

CO_2 emissions from municipal waste water treatment are set to zero in the projections because these emissions derive from biomass raw materials.

The waste incineration category includes incineration of municipal and industrial waste, incineration of hospital waste and the incineration of corpses. In Flanders, only the fraction of organic-synthetic waste is taken into consideration to estimate the CO_2 emissions originating from waste incineration. As mentioned in section 1.3.1 the projections of the waste incineration plants with energy recuperation are allocated to the energy sector.

CO_2 emissions from flaring in the chemical industry are allocated to the waste sector (CRF category 5C) and are assumed to remain constant at the 2021 level.

CH_4 emissions from composting in Flanders (CRF category 5B) are kept constant at current emission levels.

Wallonia

Projections of CH_4 emissions from the solid waste disposal on land in Wallonia take into account the implementation of the Order of the Walloon Government of March 18th, 2004 banning the dumping of municipal waste into landfills since January 1st, 2008, yielding a decline in degradable organic carbon (DOC) content (municipal waste being mainly organic).

Nevertheless, the amount of total waste disposed is considered constant and equal to the latest available data (average of the 5 latest years). The methodology used for calculation is the one described in the last 2006 IPCC guidelines and in the National Inventory Report of the 2023 submission. The recovery rate of landfill gas is assumed to remain constant and equal to the average of the 5 latest years. CO_2 emissions from the solid waste disposal on land sites come from the use of recovered emissions are used or flared via installations with energy recuperation. These emissions are reported in the energy sector.

CH_4 and N_2O emissions of wastewater handling in Wallonia are kept constant at current emission levels. CO_2 emissions from municipal wastewater treatment are not included in the projections because the carbon derives from biomass raw materials.

The waste incineration category includes incineration of municipal solid waste, incineration of hospital waste and flaring in the chemical industry. The CO_2 emission projections originating from hospital waste incineration are integrated in the waste incineration sector. The emission projections of the municipal waste incineration plants (with energy recuperation) are allocated to the energy sector.

CH_4 and N_2O emissions from composting in Wallonia are kept constant at current emission levels.

The figures reported under WEM and WAM scenario are the same.

Brussels-Capital Region

Waste sector takes into account the emissions from water treatment plants, composting installations, and waste incinerators. For the waste water handling emissions, only the N_2O emissions are considered in the projections since the biogas produced is used in a CHP installation. Projections are based on the population evolution (see section 3.6.2.4). The compost centre started in 2002 and the emissions from composting process are kept constant for the projected period. The waste incinerator of Neder-Over-Heembeek is not included in the waste sector due to the energy recovery process; this installation is included in the energy sector.

3.6.3.10. The land-use and land-use change and forestry sector (CRF category 4)

The approach for the LULUCF WEM projections consists of extrapolating the recent trends of land use changes towards 2050 on the basis of the most recently integrated data of the Land Use Change Matrix in the LULUCF emission inventory. Both CO_2 and N_2O emissions are taken into account. A technical correction of the Forest Reference Level will be prepared before the final accounting for 2021-2025, as significant updates were applied in the GHG inventory. Hence, the accounting exercise made at Belgian level should be considered provisional.

Flemish Region

In the WEM scenario, the trend is adjusted for specific land use and land use change categories, based on the following hypotheses:

- There is zero net deforestation from 2021 onwards;
- There will be 4.000 ha of additional forest by 2024, and 10.000 ha by 2030, as compared to the forest area present in 2019.

The WAM scenario adds the following adjustments to the business-as-usual trend:

– The average net daily land take, i.e. conversion of land to settlements, is reduced to 3 ha per day by 2025 and to 0 ha per day by 2040;
– Carbon sequestration in agricultural land is promoted by application of certain techniques and crops, as included in the Common Agricultural Policy (CAP);
  • From 2023 onwards, 200.000 ha of cropland will have an annual increase of the soil carbon stock of 0.4%;
  • In the period 2023-2027, additional effective organic carbon (EOC) is supplied to cropland via adjusted annual cropping plans;
  • Additional buffer strips are installed, i.e. to protect against erosion, corresponding to an additional area of land converted from cropland to grassland.

Wallonia

The trend is adjusted for specific land use categories, based on these hypothesis:

– The land use change from grassland to cropland will stop from 2025 onwards, in line with the CAP;
– The trends in soil organic carbon will remain constant from 2030 onwards;
– In Wallonia, the conversions to settlements is gradually reduced up to 2050, based on the last decree regarding territorial development and artificialization of soils.

Brussels-Capital Region

LULUCF emissions are kept constant for the entire projected period in the Brussel-Capital Region.

3.6.3.11. International bunkers

Flemish Region

An increasing emission trend for international aviation and shipping has been adopted from the European reference scenario (for Belgium)[54]. In the WEM scenario, the trend is applied to the Flemish emissions up to the year 2030, after which the emissions are kept constant up to 2050. In the WAM scenario, the trend is applied to the emissions for the years 2025, 2030 and 2050. For the years 2035, 2040 and 2045, projections were set equal to 2030.

[54] https://energy.ec.europa.eu/data-and-analysis/energy-modelling/eu-reference-scenario-2020_en

Wallonia

International aviation emissions are based on the results of the TIMES model (where emissions are linked to population growth). There is no international shipping in Wallonia.

Brussels-Capital Region

There is no international aviation nor shipping in Brussels-Capital Region.

3.6.4. Aggregated projections

3.6.4.1. The 'with existing measures' greenhouse gas emission projections

The tables 14 and 15 and figures 19 and 20 summarise the compiled 'with existing measures' projections for the period 2005-2050.

Table 14 Greenhouse gas emissions by policy sector (WEM scenario) $MtCO_2$-eq.

	2005	2010	2015	2020	2022	2025	2030	2035	2040	2045	2050
Total excluding LULUCF	145.4	133.5	119.1	107.4	103.6	112.0	106.6	104.2	105.0	104.2	103.5
Total including LULUCF	143.7	133.2	118.4	107.0	103.2	111.3	105.5	103.0	103.9	103.1	102.3
EU ETS (in accordance with ETS scope 2013-2020)	66.5	54.8	44.7	41.5	39.7	44.0	42.7	42.1	43.2	43.3	42.9
ESR (in accordance with ETS scope 2013-2020)	78.9	78.7	74.4	65.9	63.9	68.0	63.9	62.1	61.8	60.9	60.6
LULUCF	-1.8	-0.3	-0.7	-0.4	-0.4	-0.7	-1.1	-1.1	-1.1	-1.1	-1.1

Table 15 Greenhouse gas emissions by IPCC sector (WEM scenario) $MtCO_2$-eq.

	2005	2010	2015	2020	2022	2025	2030	2035	2040	2045	2050
1 Energy	105.8	99.5	87.2	78.2	76.4	84.1	79.8	77.6	78.7	78.1	77.2
1A Fuel combustion	105.0	98.7	86.5	77.5	75.7	83.4	79.1	76.9	78.0	77.4	76.5
1A1 Energy industries	29.0	26.1	20.8	19.0	18.5	19.2	18.0	17.9	19.3	20.0	19.7
1A2 Manufacturing industries and construction	18.9	16.0	13.8	13.3	12.6	*14.9*	*14.8*	*14.0*	*13.7*	*12.7*	*12.2*
1A3 Transport	26.7	26.7	26.9	21.7	24.2	*25.5*	*23.2*	*22.2*	*22.1*	*21.7*	*21.5*
1A4 Other sectors	30.1	29.7	24.8	23.4	20.4	*23.7*	*23.0*	*22.6*	*22.8*	*22.9*	*23.1*
1A5 Other	0.2	0.1	0.1	0.1	0.1	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
1B Fugitive emissions from fuels	0.8	0.8	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7
2 Industrial processes	26.5	21.7	20.4	18.4	16.9	17.6	16.8	16.8	16.7	16.7	16.9
3 Agriculture	9.9	9.7	9.7	9.5	9.1	9.3	9.1	8.9	8.7	8.6	8.5
4 Lulucf	-1.8	-0.3	-0.7	-0.4	-0.4	-0.7	-1.1	-1.1	-1.1	-1.1	-1.1
5 Waste	3.2	2.6	1.7	1.3	1.2	1.1	0.9	0.9	0.9	0.9	0.9

Memo items (not included in Total)

International bunkers	29.0	29.3	23.4	24.2	30.0	39.5	39.1	39.1	39.2	39.2	39.2
IB.Aviation	3.6	4.2	4.4	3.6	5.3	4.9	5.0	5.0	5.0	5.0	5.0
IB.Navigation	25.4	25.1	19.0	20.6	24.7	34.5	34.2	34.2	34.2	34.2	34.2
CO_2 emissions from biomass	5.4	11.5	12.0	12.5	12.4	12.0	12.0	12.9	12.4	13.2	12.9
CO_2 captured	NO	NO	NO	NO	NO	0.0	0.0	0.0	0.0	0.0	0.0

Figure 19 Greenhouse gas emissions by IPCC sector (WEM scenario) $MtCO_2$-eq.

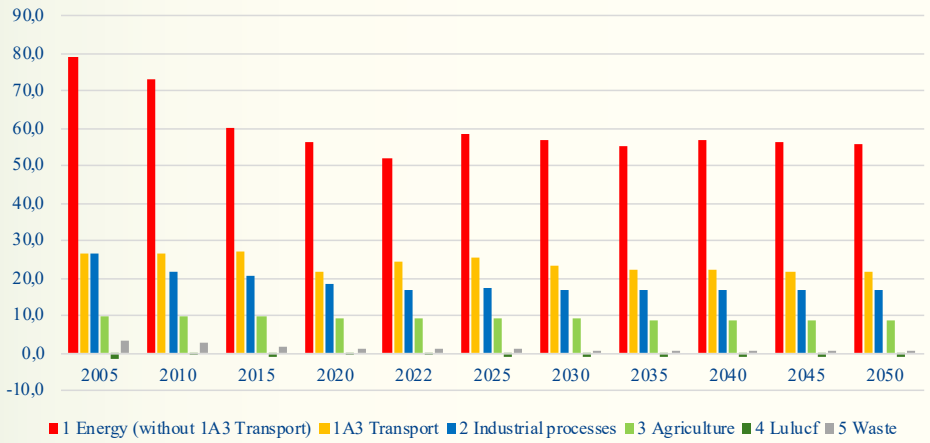
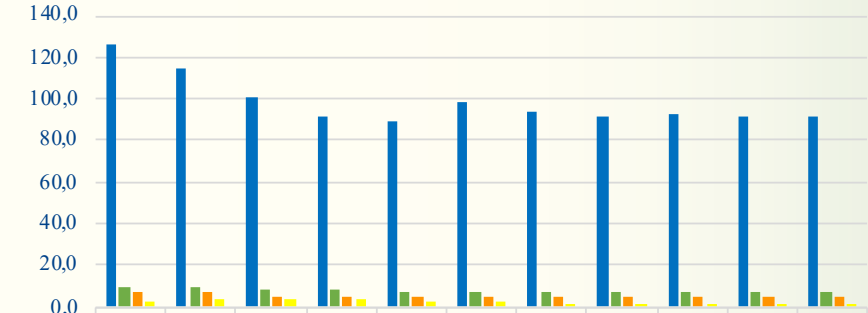


Figure 20 Greenhouse gas emissions by gas, excluding LULUCF (WEM scenario) $MtCO_2$ eq.



	2005	2010	2015	2020	2022	2025	2030	2035	2040	2045	2050
CO_2	125,6	114,5	101,3	91,2	89,0	98,0	93,8	91,5	92,7	92,0	91,4
CH_4	9,6	9,1	8,5	8,0	7,7	7,5	7,0	6,9	6,8	6,7	6,7
N_2O	7,5	6,7	5,3	4,8	4,5	4,6	4,5	4,5	4,4	4,4	4,4
F-gases	2,6	3,2	4,0	3,4	2,4	2,0	1,2	1,2	1,1	1,1	1,1

3.6.4.2. The 'with additional measures' greenhouse gas emission projections

The effect of the additional measures included in the WAM scenario results in the emission projections described in the tables 16 and 17 and figures 21 and 22.

Table 16 Greenhouse gas emissions by policy sector (WAM scenario) $MtCO_2$-eq.

	2005	2010	2015	2020	2022	2025	2030	2035	2040	2405	2050
Total excluding LULUCF	145.4	133.5	119.1	107.4	103.6	105.9	83.3	74.8	72.4	70.7	40.6
Total including LULUCF	143.7	133.2	118.4	107.0	103.2	105.0	82.0	73.5	71.0	69.4	39.3
EU ETS (in accordance with ETS scope 2013-2020)	66.5	54.8	44.7	41.5	39.7	43.1	36.5	30.3	31.4	31.5	26.9
ESR (in accordance with ETS scope 2013-2020)	78.9	78.7	74.4	65.9	63.9	62.7	46.8	44.5	40.9	39.2	13.6
LULUCF	-1.8	-0.3	-0.7	-0.4	-0.4	-0.9	-1.3	-1.3	-1.3	-1.3	-1.3

Table 17 Greenhouse gas emissions by IPCC sector (WAM scenario) $MtCO_2$-eq.

	2005	2010	2015	2020	2022	2025	2030	2035	2040	2045	2050
1 Energy	105.8	99.5	87.2	78.2	76.4	79.0	63.9	59.2	57.2	55.7	27.2
1A Fuel combustion	105.0	98.7	86.5	77.5	75.7	78.3	63.2	58.6	56.6	55.0	26.5
1A1 Energy industries	29.0	26.1	20.8	19.0	18.5	*19.1*	*17.3*	17.3	19.1	19.2	13.7
1A2 Manufacturing industries and construction	18.9	16.0	13.8	13.3	12.6	*13.8*	*13.0*	*9.8*	*9.5*	*9.5*	*8.0*
1A3 Transport	26.7	26.7	26.9	21.7	24.2	*23.5*	*16.6*	*15.6*	*14.4*	*13.1*	*0.6*
1A4 Other sectors	30.1	29.7	24.8	23.4	20.4	*21.8*	*16.3*	*15.8*	*13.5*	*13.1*	*4.1*
1A5 Other	0.2	0.1	0.1	0.1	0.1	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.0*
1B Fugitive emissions from fuels	0.8	0.8	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7
2 Industrial processes	26.5	21.7	20.4	18.4	16.9	17.2	11.1	7.2	6.8	6.7	6.3
3 Agriculture	9.9	9.7	9.7	9.5	9.1	8.7	7.5	7.5	7.5	7.5	6.4
4 Lulucf	-1.8	-0.3	-0.7	-0.4	-0.4	-0.9	-1.3	-1.3	-1.3	-1.3	-1.3
5 Waste	3.2	2.6	1.7	1.3	1.2	1.1	0.9	0.9	0.9	0.9	0.7

Memo items (not included in Total)

International bunkers	29.0	29.3	23.4	24.2	30.0	39.5	39.1	39.1	39.2	39.2	43.8
IB.Aviation	3.6	4.2	4.4	3.6	5.3	4.9	5.0	5.0	5.0	5.0	5.0
IB.Navigation	25.4	25.1	19.0	20.6	24.7	34.5	34.2	34.2	34.2	34.2	38.8
CO_2 emissions from biomass	5.4	11.5	12.0	12.5	12.4	13.5	14.5	16.1	18.3	19.5	16.7
CO_2 captured	NO	NO	NO	NO	NO	0.0	5.0	10.5	10.7	10.9	17.7

Figure 21 Greenhouse gas emissions by IPCC sector (WAM scenario) $MtCO_2$-eq.

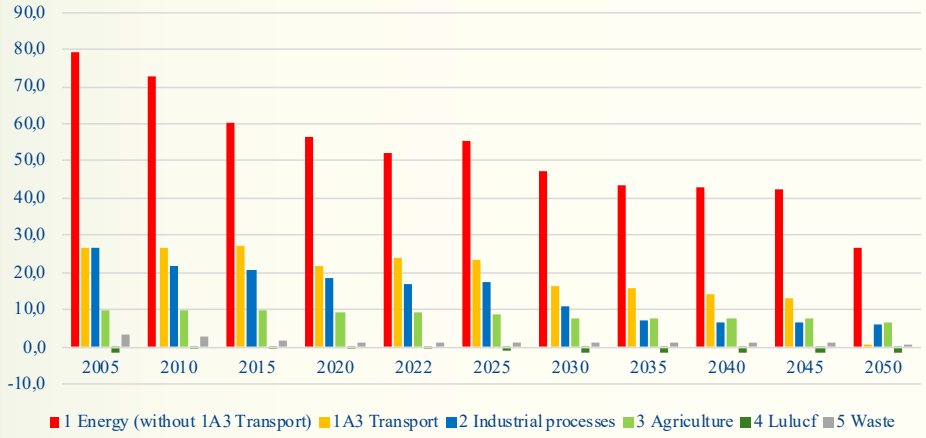
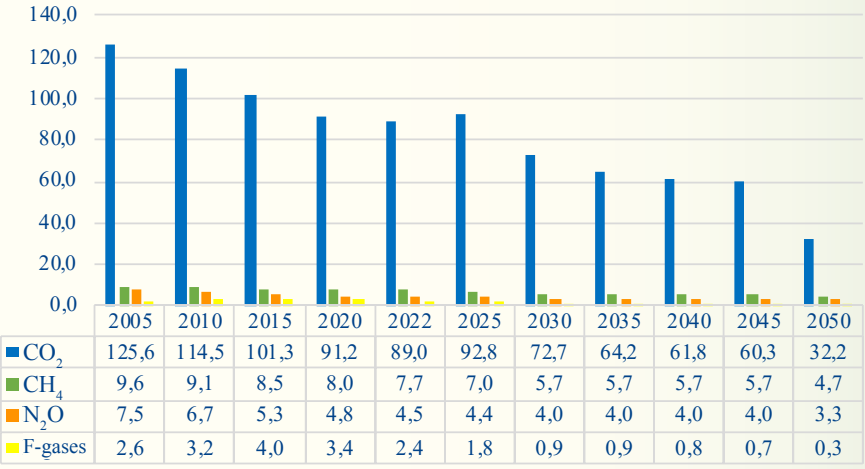


Figure 22 Greenhouse gas emissions by gas, excluding LULUCF (WAM scenario) $MtCO_2$ eq.



	2005	2010	2015	2020	2022	2025	2030	2035	2040	2045	2050
CO_2	125,6	114,5	101,3	91,2	89,0	92,8	72,7	64,2	61,8	60,3	32,2
CH_4	9,6	9,1	8,5	8,0	7,7	7,0	5,7	5,7	5,7	5,7	4,7
N_2O	7,5	6,7	5,3	4,8	4,5	4,4	4,0	4,0	4,0	4,0	3,3
F-gases	2,6	3,2	4,0	3,4	2,4	1,8	0,9	0,9	0,8	0,7	0,3

3.6.4.3. Results of the sensitivity analysis

Two parameters were varied in a sensitivity analysis (see Table 18): the number of heating days and the net imports of electricity. This leads to four scenario's:

1) warm scenario (low number of heating days as recorded in 2014),

2) cold scenario (high number of heating days as recorded in 2013),

3) lower electricity import (-25% compared to base scenario) and

4) lower electricity import (-75% compared to base scenario). For the four scenario's, the total WEM and WAM emissions were calculated (see Table 18).

Varying the number of heating days affects the residential and tertiary sector (CRF category 1A4b and 1A4a). The number of heating days were adjusted in the regional models, after which the results were summed.

Varying the net import of electricity affects the power sector (CRF category 1A1a). The different electricity import scenarios were accounted for within the Crystal Super Grid power model.

Table 18 Parameter values used for the sensitivity analyses

Scenario	Number of heating days (2025-2050)	Net electricity import WEM [TWh]						Net electricity import WAM [TWh]					
		2025	2030	2035	2040	2045	2050	2025	2030	2035	2040	2045	2050
Base scenario	1 761	16.7	17.7	7.5	16.1	14.9	13.9	9.7	14.0	4.3	5.1	5.7	18.0
1: Warm scenario	1 441	16.7	17.7	7.5	16.1	14.9	13.9	9.7	14.0	4.3	5.1	5.7	18.0
2: Cold scenario	2 145	16.7	17.7	7.5	16.1	14.9	13.9	9.7	14.0	4.3	5.1	5.7	18.0
3: Low electricity import (-25%)	1 761	12.5	13.3	5.6	12.1	11.1	10.5	7.2	10.5	3.2	3.8	4.3	13.5
4: Low electricity import (-75%)	1 761	4.2	4.4	1.9	4.0	3.7	3.5	2.4	3.5	1.1	1.3	1.4	4.5

Table 19 Greenhouse gas emissions excluding LULUCF for the different scenario's of the sensitivity analysis, $MtCO_2$-eq.

Scenario	Total excl. LULUCF - WEM						Total excl. LULUCF – WAM					
	2025	2030	2035	2040	2045	2050	2025	2030	2035	2040	2045	2050
Base scenario	112.0	106.6	104.2	105.0	104.2	103.5	105.9	83.3	74.8	72.4	70.7	40.6
1: Warm scenario	109.1	103.8	96.5	91.7	90.7	90.5	103.1	81.3	64.9	45.1	42.5	38.6
2: Cold scenario	115.5	109.9	98.0	95.6	94.8	94.7	109.1	85.5	67.1	46.3	43.6	39.3
3: Low electricity import (-25%)	113.7	108.2	105.7	106.5	105.7	105.0	106.8	84.5	76.0	73.6	71.9	41.8
4: Low electricity import (-75%)	116.9	111.2	108.7	109.6	108.8	108.0	108.7	86.9	78.4	76.0	74.3	44.2

3.6.5. Conclusion

3.6.5.1. Overall emission levels

There is a clear decrease between 1996 and 2022 in the total greenhouse gas emissions in the inventory (Figure 23). The total emissions in the WEM scenario show a slight decrease in the period 2025-2050. The total emissions in the WAM scenario show an outspoken decrease in the period 2020-2050. These projections do not include emissions nor removals from LULUCF.

Uncertainties concerning exogenous variables such as economic growth, climate conditions and electricity imports exist and their level will influence the resulting greenhouse gas emissions.

Figure 23 GHG emissions (Mton CO_2-eq.)

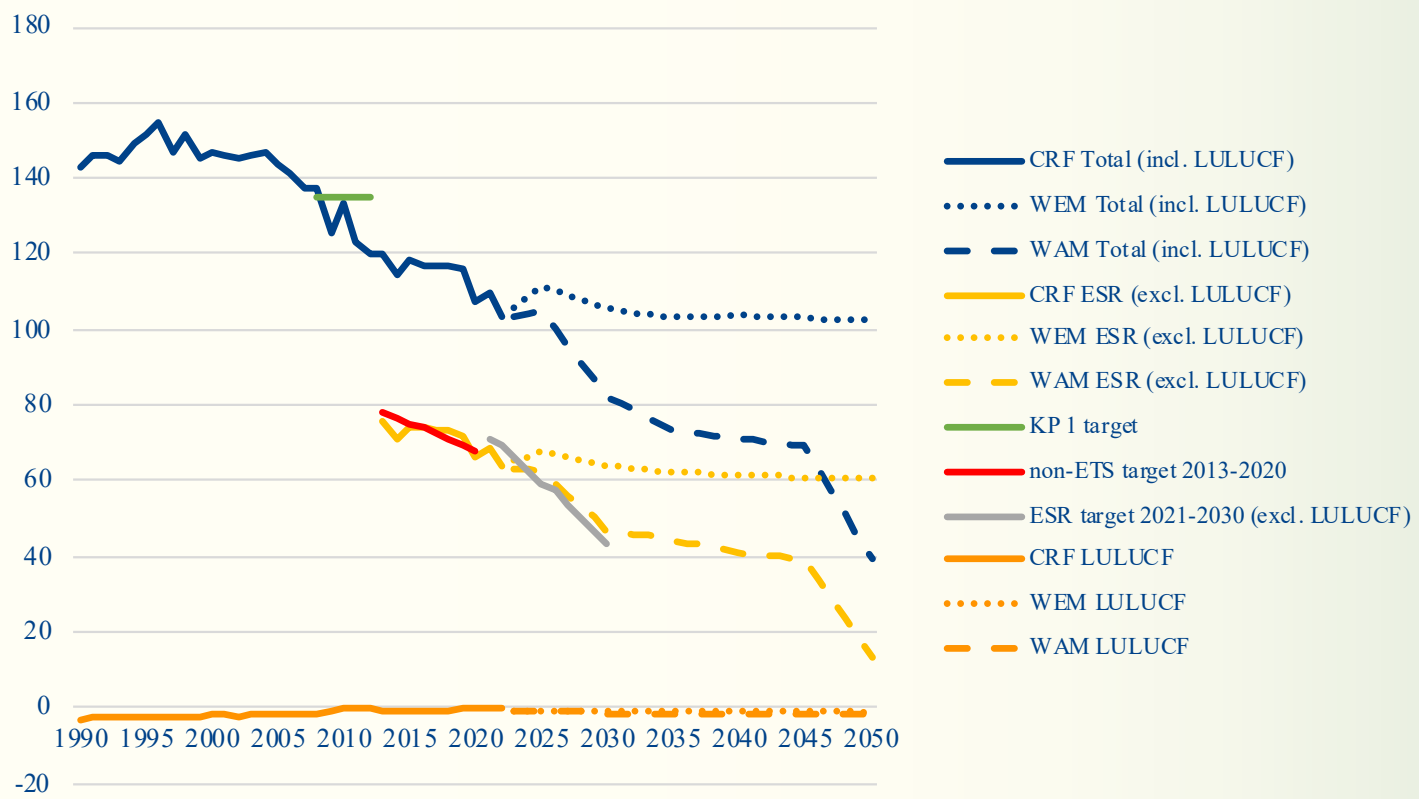
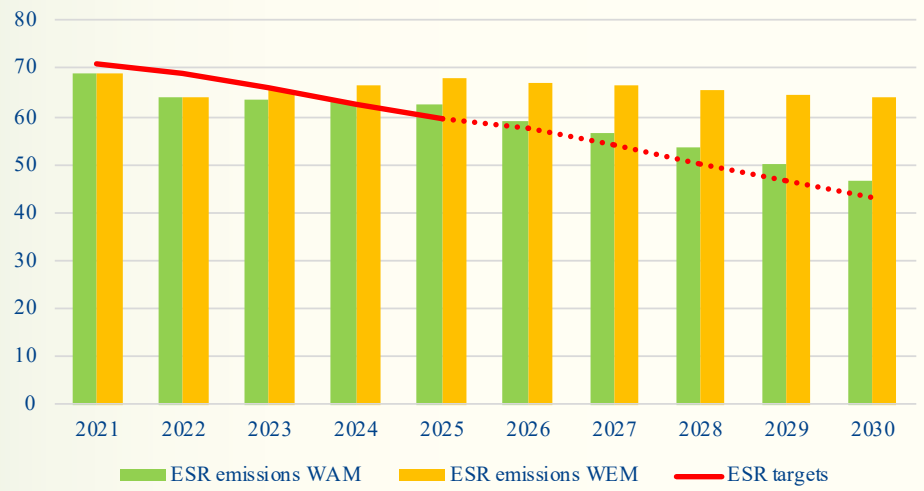


Figure 24 Comparison of WEM and WAM ESR projections with ESR target (2021-2030) (Mton CO_2-eq.)



Source ESR targets :2021-2022 and 2030 in line with Commission Implementing Decision (EU) 2020/2126, 2023-2025 in line with Commission Implementing Decision (EU) 2023/1319** and 2026-2029 (own calculation, preliminary estimate) in line with Regulation (EU) 2023/857****

* https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32020D2126

** https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023D1319

*** https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023R0857

3.6.5.2. Comparison with the Effort Sharing Regulation target (2021-2030)

The amended EU Effort Sharing Regulation[55], establishing binding annual greenhouse gas emission reductions by EU Member States from 2021 to 2030, includes a target of -47% in 2030 compared to 2005 for Belgium.

In Figure 24, the ESR emissions of the WEM scenario and the WAM scenario are compared with the ESR emission target. Interpolation was used to determine the emission projections in the years 2023-2024 and 2026-2029 of the WEM and WAM scenario. In the WEM scenario, the ESR targets are exceeded from 2024 onwards. On an annual basis, the shortfall increases to 21 Mton CO_2-eq in 2030. Cumulated over the period 2021-2030, a deficit of 80 Mton CO_2-eq is expected. In the WAM scenario, the ESR targets are exceeded from 2024 onwards. On an annual basis, the shortfall increases to 4 Mton CO_2-eq in 2030. Cumulatively over the period 2021-2030, a shortfall of 8 Mton CO_2-eq is expected.

3.6.5.3. Comparison with LULUCF target

The revised LULUCF Regulation (EU) No 839/2023 sets annual net emissions or net sequestration for two sub-periods, 2021-2025 and 2026-2030. Member states that record a surplus receive credits for this and can sell them to member states that record a deficit. Alternatively, those credits can be used – to a limited extent – to meet the Effort Sharing Regulation target. Conversely, any shortfall should be made up by buying LULUCF credits from Member States (or regions) that are in surplus or by using - without limitation - their own allowances from the ESR sectors.

The target applicable to all European member states for the 2021-2025 period is the so-called 'nodebit' rule. This means that for each Member State, the sum of all LULUCF activities (reforestation, deforestation, forest management, cropland and grassland management, harvested wood products, each calculated according to specific regulations) must be no net source of greenhouse gases over the entire 2021-2025 period, taking into account historical reference levels (accounting rules) and the flexibility provided. This does not mean that no activity category should cause any more emissions, but rather that carbon stocks as a whole should not decrease. Indeed, the possibility exists to use credits (carbon storage) from one activity category to offset a shortfall (carbon emissions) in another activity category.

With the revision of the LULUCF regulation, the 'nodebit' rule will disappear from 2026, and accounting rules will be simplified. For calculating the LULUCF offsetting, a net emissions/storage will be used in the 2026-2030 period, namely the sum of all LULUCF categories, as available in the inventory. The new 2030 target

[55] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023R0857

is expressed as additional storage to be realised versus the average storage in 2016-2018. For Belgium, this was set at -320 kt CO_2-eq additional storage by 2030, on top of the average storage (negative emissions) in the 2016-2018 period.

Based on the 2020 inventory included in the LULUCF Regulation, the average 2016-2018 storage for Belgium was 1032 kt CO_2-eq. However, in the 2024 inventory, the 2016-2018 figures have been corrected (Table 20), so the average for 2016-2018 according to the latest inventory is 598 kt CO_2-eq of storage. Belgium's 2030 target according to the latest inventory is therefore 598 + 320 = 918 kt CO_2-eq storage. Based on LULUCF projections in Table 20, this 2030 target would be met.

Table 20 Evolution of emissions/storage in the LULUCF sector (WAM scenario, Mton CO_2-eq)

2005	2010	2015	2016	2017	2018	2019	2020	2021	2022	2025	2030
-1.8	-0.3	-0.7	-0.7	-0.5	-0.6	-0.4	-0.4	-0.3	-0.4	-0.9	-1.3

3.7. Other information

According to paragraph 103 of the annex to decision 18/CMA.1, 'each Party may provide any other information relevant to tracking progress made in implementing and achieving its NDC under Article 4 of the Paris Agreement'. All relevant information can be found in sections 3.1 to 3.6, above. Hence, no additional information is provided here. ■

4. Climate change impacts and adaptation

4.1. National circumstances, institutional arrangements and legal frameworks

4.1.1. Biogeophysical characteristics relevant to adaptation actions

Belgium has three main geographical regions: Low-Belgium (up to 100 m above sea level), Middle-Belgium (100 till 200 m above sea level) and High-Belgium (200 till more than 500m above sea level). The area of Low-Belgium starts in the Western area with the coastline (66km long), beaches and sand dunes and the polders. Polders are areas of fertile land, close to or below sea level that have been reclaimed from the sea, from which they are protected by dikes or, further inland, by fields that have been drained with canals.

The Flemish lowland is situated between the polders and the rivers Leie and Scheldt. This is an area composed by sandy soils with some small hills. More to the East the area “de Kempen” is situated, a sandy area with mainly coniferous forests, meadows and mais fields.

The second geographical region, Middle-Belgium or the central plateau, lies further inland. This is a smooth, slowly rising area towards the rivers Samber and Maas, that has many fertile valleys and is irrigated by many waterways. Here one can also find rougher land, including caves and small gorges. The third geographical region, High-Belgium, is less populated and contains most forests. The first part (Southern of the rivers Samber and Maas) is the Condroz-plateau, a fertile and touristic area. South of the Condroz, the region of Fagne and Famenne is situated, an area that is very suitable for agriculture. More to the South are the Ardennes, a densely forested area, very rocky with deep valleys, that extends towards the Eifel in France and Germany.

Demographic situation relevant to adaptation actions

Belgium is a very densely populated country with more than 11.5 million inhabitants for 30 689 km². The Northern part (Flanders) is more highly populated then the Southern part (Walloon Region). The Belgian population has grown by 62 770 persons, or 0.54% between 2021 and 2022. This figure concerns the legal population on 1 January 2022. The largest part of the growth rate (90%) is due to the positive migration balance: more immigrations than emigrations.

19% of the Belgian population is 65 years old or older. Belgium has an aging

population. The population growth in the largest cities is rather pronounced with 1.86% in Brussels, 0.65% in Gent, 0.63% in Antwerpen and 0.24% in Charleroi. The population in the city of Luik remained stable. On 01/01/2021 the city of Antwerp counted 530 824 inhabitants, Gent 263 866 inhabitants, Charleroi 202 587 inhabitants and Liège 197 538 inhabitants. The city of Brussels has 185 316 inhabitants.

In total the Brussels-Capital Region counts 1 214 550 inhabitants, the Flemish Region 6 647 506 inhabitants and the Walloon Region 3 645 107 inhabitants.

The average population density in the Flemish Region was 487 inhabitants per km² in 2020. The population density is highest in and around the 'Flemish diamond', which is the central area between Ghent, Antwerp, Leuven and Brussels. Population density is also high in several coastal municipalities (Ostend, Bredene, Blankenberge and Bruges), in the south of West Flanders (Kortrijk and Roeselare) and in some central municipalities of the province of Limburg (Hasselt and Genk).

4.1.2. Economic and infrastructural situation relevant to adaptation actions

In Belgium, accounting for urban effects is particularly important given that the share of people living in cities and towns amounts to 87% (situation of 2015, putting the country among the top urbanized regions in Europe.) Considering mortality data for Belgium presented in Bustos Sierra et al. (2019a) by region, it emerges that Brussels has a higher excess mortality (when expressed as a percentage, not in absolute numbers) than the Flemish and Walloon Region. Also here, this has been attributed to the excess temperature increment occurring in Brussels, caused by the urban heat island phenomenon.

With regards to industry, Belgium had a strong presence of the metal (southern part of Belgium) and chemical/refinery industries (northern Belgium) in the country. The sector of services is the most important economic sector in Belgium with a share of almost 70% of the GDP. According to Statistics Belgium (2018) agricultural lands account for 44% (or 1 353 770 ha) of the land surface of Belgium. In 2018, the total amount of agricultural land consisted of 63% arable land, 35% permanent pastures and grassland and 2% permanent crops. Belgian agriculture is specialised in cereals, industrial crops, forage plants, vegetables and horticultural crops, potatoes, livestock, and milk production. Although agricultural land occupies the greater part of the territory (44%), the number of farms has continued to decrease in recent years, while the average farm size has increased. The share of agriculture in the Belgian economy continues its decline and is now less than 1% of GDP (De Ridder et al. 2020).

Belgium has a very dense network of infrastructure (roads, railways, waterways, ports and airports) and acts as an important transport hub in Western Europe (De Ridder et al. 2020[1]).

In 2021, 39 Flemish municipalities had a building density of 50% or more. The building density is the proportion of the total surface area that is built. The building density is highest in the Brussels-Capital Region. In 2021, 80.3% of the surface area of this region was built-up. With 15.5%, the Walloon Region had the lowest building density.

In all regions, the share of built-up area increased between 1990 and 2020. This increase was most pronounced in the Flemish Region.

Impact of urbanisation

Urbanisation of the landscape causes a change in the local wind climate and involves the use of materials that better capture the heat, such as concrete and asphalt. This leads, especially at night, to the creation of heat islands, characterized by the fact that the city cools off more slowly than the surrounding countryside. On average, this difference amounts to a few degrees, but also days with peaks of up to 7 to 8 °C and more are recorded. This so-called urban heat island (UHI) effect is further accentuated during heat waves under the influence of atmospheric conditions such as a cloudless sky and low wind speeds that often accompany heat waves. This leads to additional mortality, especially among the elderly and children. Furthermore, the urban heat island phenomenon also influences energy use (increase due, among other things, to the use of air conditioning), and promotes algae growth in surface water. In the winter, by contrast, the mortality in cities is lower due to reduced exposure to cold temperatures. Analyses by the RMI, KU Leuven and VITO show that the temperature increase in Uccle may, to some extent, also have been caused by the so-called heat island effect. Thus, a quarter of the annual average temperature increase in summer, recorded in Uccle between 1960 and 1999, is attributed to the intensification of the urban effect in the Brussels-Capital Region (RMI, 2015). The urban heat island effect can be translated into figures by means of the indicator 'heat wave degree days'. This indicator provides a composite picture of the total duration and the weight of heat waves in a year. The indicator is calculated for both an urban and a nearby rural location to highlight the urban effect. The indicator has been extended and validated by the VMM in 2018 https://www.vmm.be/publicaties/uitbreiding-en-validatie-indicator-hitte-eilandeffect. New modelmaps for Flanders show a doubling of the exposure to heat above the health thresholds by 2030.

[1] De Ridder et al. (2020), "Evaluation of the socio-economic impact of climate change in Belgium", Vito

4.1.3. Institutional arrangements and legal framework

As mentioned in section 3.1.1.1, national climate policy is coordinated by the National Climate Commission (NCC). Adaptation is monitored by one of its dedicated working groups, gathering representatives of the administrations of each entity. This group is responsible for preparing the various national plans and strategies, as well as all related European and UN reports. Their effective adoption is the responsibility of the NCC.

Adaptation in Belgium is mainstreamed at different levels: at the national level, within the National Adaptation Strategy and Plan, which contains actions that are complementary to those contained in the regional (Flanders, Wallonia, Brussels) and federal plans. Also, adaptation is mainstreamed at local level with the municipalities who have signed the Covenant of Mayors.

Most of the responsibilities regarding climate change adaptation are under the authority of the regional governments. Most of the adaptation measures are taken at the regional and local level.

In addition, Belgium actively participates in the working group Adaptation (WG6) of the EU Climate Change Committee established under the governance regulation, part of the EU Commission's efforts to enhance climate resilience and composed of Adaptation experts from all EU Member States with the support of the European Environment Agency. This framework focuses on mainstreaming adaptation into policies, fostering ecosystem-based approaches, and supporting vulnerable sectors, aligning with the European Green Deal. Belgium's involvement underscores its commitment to collective EU action against climate risks.

One of the working bases for establishing plans and strategies is based on the availability of climate scenarios which allow us to envisage what to expect.

Since the previous national communication, new climate scenarios are being built for the Belgian territory in the framework of the Belgian CORDEX.be II project which aims to combine regional downscaling expertise in Belgium[2]. The first project (CORDEX-BE I), funded by BELSPO (Belgian Science policy), started in 2015 and ended in September 2017. It brought together the different Belgian climate modelling groups from various regions in Belgium. This is also the case for CORDEX-II.be. As part of the list of federal adaptation measures, a Climate knowledge center has been founded which focusses on, among other things, coordinating the update of the high- resolution climate projections for Belgium (Cordex.be II). This work is carried out by the Royal metrological institute (RMI), KU Leuven, and Université de Liège. In addition they have already increased the accessibility of the climate projections data from Cordex.be I through the federal geodata portal of the IGN - Institut Géographique National[3].

The main aim of CORDEX.be II is to close the gap between regional climate model information and local impacts in order to provide climate services to support climate adaptation and mitigation. To achieve this ambition the project will simulate future climates in different scenarios and translate this information into local impacts. The local climate can be simulated using regional climate models (RCMs). Regional climate models downscale ("zoom in on") global climate model (GCMs) on a smaller domain (e.g. Belgium). RCMs increase the resolution of the climate simulations which results in a more detailed representation of the climate.[4]

[2] CORDEX.be II: Scenarios & Global Climate Model Selection

[3] Geo.be, le géoportail fédéral - IGN

[4] CORDEX.be II: Scenarios & Global Climate Model Selection

4.2. Impacts, risks and vulnerabilities

In 2018 the Flemish Environmental Agency (VMM) launched its Climate Portal https://klimaat.vmm.be/. This portal site provides data, figures and information on climate change and the effects and impact on people, environment, and society. These data are regularly updated.

In 2019 the site Adapt2climate was developed by the National Climate Commission as part of the implementation of the National Adaptation Plan. This national portal aims to make available existing information on climate change impacts, vulnerability assessments and adaptation in Belgium.

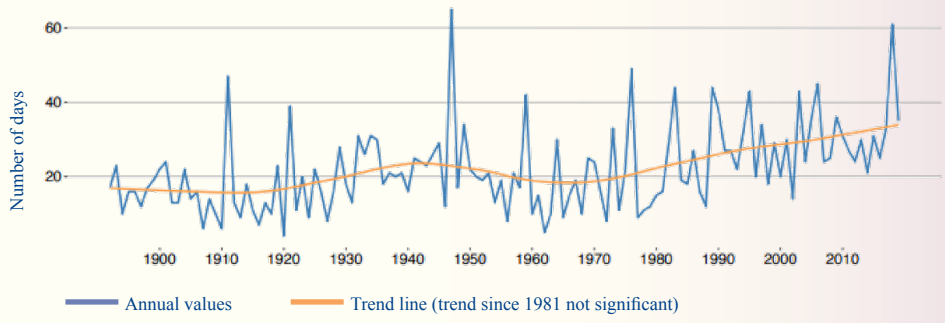
The Royal Meteorological Institute (RMI) published a new climate report in 2020 based on their climatological observations.

An overview of the main conclusions of both sites and report is provided below, supported by a few figures.

Belgium (Uccle) is now 2.4 °C warmer than in the pre-industrial period. The vulnerability of people and nature to climate change is determined not only by changing annual and seasonal averages, but also, and even more so, by changing extremes. Moreover, extreme temperatures also increase exposure to various harmful substances such as tropospheric ozone and particulate matter. When we look at the occurrence of the number of days with (extremely) high or low temperatures, a significant, linearly increasing trend is found only for the number of tropical days (Tmax ≥ 30 °C). For the measuring point in Uccle we count, per 14 years, one extra tropical day in a year. The equally increasing trend for the number of summer days (Tmax ≥ 25 °C) in a year is not statistically significant. The figures for the number of frost days (Tmin < 0 °C) and ice days (Tmax < 0 °C) indicate a downward trend, but this trend too does not appear to be significant. The most harmful climate effects in Europe are expected to come from the increased frequency and intensity of extreme events such as heat waves. In Belgium the number of heat waves shows great variability between years. A trend analysis produces a wavy pattern with an increase that has been sustained since the 1970s. In 2016, the number of heat waves was significantly higher than in the beginning of the 20th century. The frequency of heat waves has increased from on average one every three years to one per year. In addition to the number of heat waves, it is important to consider the length (number of days during heat waves in a year), the weight (the extent to which the temperature exceeds 25°C) and the intensity (ratio between weight and length) of the heat waves.

An analysis for the period 1833-2019 also reveals a wavy pattern for these three parameters, with an ascending trend line since the 1970. Figure 4 in section 3.1.1.4 shows us peaks of 7.0°C in 1879 and 11.9°C in 2014 and 2018. The 7 other warmest years are 2011 (11.6°C), 2007 and 2019 (11.5°C), 2006 (11.4°C), 1989, 2015 and 2017 (11.3°C). The 6 warmest years all occurred after 2005 and the 22 warmest years after 1988, so in the latest 31 years.

Figure 25 yearly number of days with maximum temperature of minimum 25°C (RMI)



4.2.1. Precipitation and flooding

The average annual precipitation in Belgium increases slowly but significantly. Winters become wetter, summers drier but with more frequent heavy rainfall and storms which increase the risk of flooding[5]. During the summer of 2021 many European countries, including Belgium, have been affected by severe flooding caused by very heavy rainfall. The speed and power of the water took a heavy human toll and caused a huge amount of socio-economic damage, mainly in the Walloon Region.

Climate change will lead to more frequent flooding in a broader area. The high-impact scenario shows an increase of the risk of flooding with a factor 5 to 10 by 2100. The floodable area, the flood depth and consequently the human and socio-economic damage will increase.

4.2.2. Drought and water shortage

Belgium is facing more and more problems due to more frequent and longer periods of drought. As we look at the meteorological drought (shift in the balance between precipitation and evaporation), the high impact scenario for Flanders shows that the summer precipitation can decrease from an average of 194 mm in the current climate to 157 mm (-19%) by 2050. Moreover, the potential evaporation can increase in the same period from 252 to 279 mm (+11%). This combination leads to an increase of precipitation deficit during summer. Also, the duration of drought periods (contiguous days without significant precipitation) will increase. Trend analysis by the RMI lead to the conclusion that there is a significant increase of this parameter during spring since 1981, with an average increase of +1.5 days per decennium (Figure 26).

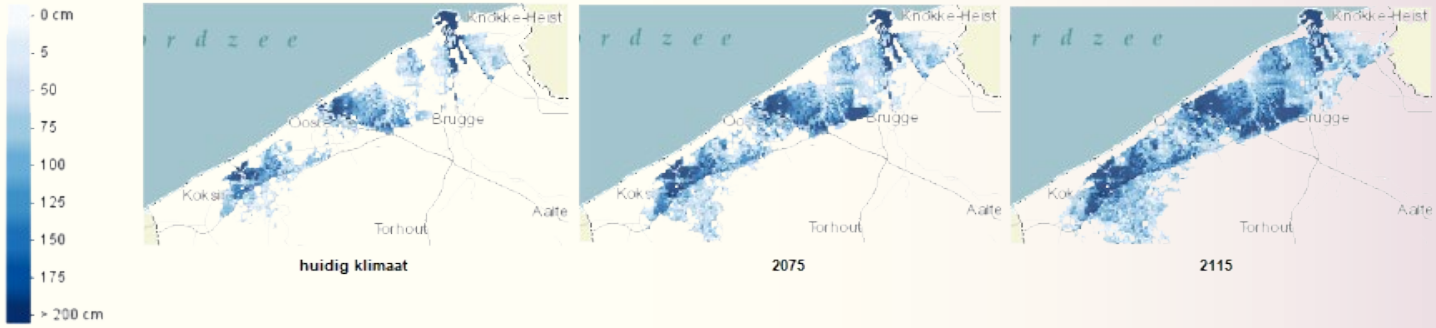
This trend can lead to problems in agricultural production, vulnerable ecosystems, rivers as well as shortage in water supplies in other sectors.

The impact in Flanders on the ground water level is extremely high due to the high soil sealing level, which prevents water to seep in the ground, increasing the risk of flooding and causing problems with replenishment of the groundwater table. Much of the rivers and streams have been straightened and canalized in the past and agricultural areas are drained by ditches, so the water flows away as fast as possible and doesn´t have a chance to seep in the ground. The high soil sealing rate, the lack of space for water and the fast drainage of water reinforce the problems of drought.

4.2.3. Sea Level

Due to the effects of climate change, the sea level is increasing. Peak water levels during storm surge are increasing, causing an incrementation of flood risk in the coastal area and coastal erosion. The annual average of the worldly sea level has increased in the past century with 1.7 mm/y and with 3.0 mm/y since the beginning of the ’90, causing a higher sea level in the North Sea of 20 cm since 1925. Sea level

Figure 27 Depth of water in 1000-year storm surge (VMM)



[5] See: https://opendata.meteo.be/ Historical climate data now available to researchers (RMI- Initiative from Belgian Climate Centre).

rise is a relatively slow process due to the fact that it reacts on the melting ice caps and glaciers and the warming of the seas. Because of that the increase of the sea level will continue long after the stabilisation of temperature on earth.

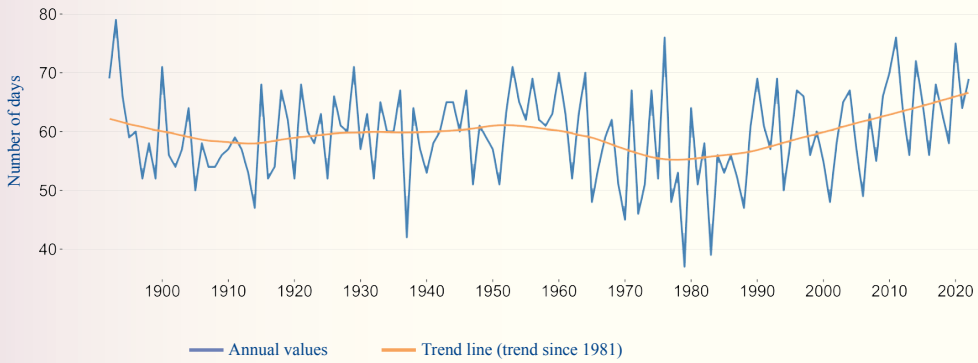
Climate scenario' s predict an increase of the storm surge level of 30 cm by 2050 within mid-scenario and with 80 cm by 2100. The global climate scenarios of the IPCC predict that the sea level rise will continue after 2100, causing an increase of 2 m or even more at the longer time.

A 1000-yearly storm surge can reach a water level of 7 mTAW (reference level for sea level measurements at the Belgian coast). But due to climate change and sea level rise, the 1000-yearly storm surge could rise up to 7.5 mTAW by 2075 and 8.0 mTAW by 2115.

4.2.4. Seawater temperature, salinity, wave height and wind speed at sea

In all the sub-areas of the North Sea (not only the Belgian part), the seawater temperature is rising. Moreover, a natural variability appears to occur with a period of seven to eight years. In the area closest to the Belgian coast, the increase is approximately 0.034 °C per year or 3.4 °C per century. No datasets are currently available that allow a long-term analysis of a climate influence on the salinity of our sea water. Regarding the wave height, the historical dataset in and near the Belgian part of the North Sea only suggests a natural variability with a period of approximately seven years. There is also a seasonal cycle: on average, there are higher waves in winter and lower waves in the summer months. A clear climate trend could not be demonstrated in the historical wave height and wind speed datasets.

Figure 26 Yearly number of days with less then 1mm precipitation during spring (RMI)



4.3. Adaptation priorities and barriers

One of the priorities at the Belgian level is a climate risk and vulnerability assessment further building on the results of the EUCRA (European Climate Risk Assessment) report, published by the European Environmental Agency (EEA) in 2024.

For the different regions in Belgium priorities lie in addressing the major effects of climate change like drought, flooding and heat islands in cities, implementing nature based solutions where possible.

In 2020 the study "Evaluation of the socio-economic impact of climate change in Belgium" commissioned by the National Climate Commission has been published. In addition to the sectoral impacts analysed in the study, this report shows that groups in society, which are already vulnerable, will often also be the most vulnerable to these climate-related impacts. This strongly reflects the importance of well-considered and fair adaptation measures.

4.4. Adaptation strategies, policies, plans, goals and actions

In 2010, Belgium adopted its National Adaptation Strategy. The strategy describes the main climate change impacts, the existing adaptation responses, a roadmap to a future National Adaptation Plan (NAP) and some policy guidelines for an adapted future.

The National Adaptation Plan (2017-2020) was adopted on 19 April 2017 by the National Climate Commission. In accordance with the decision of the National Climate Commission of 27 June 2013, this plan aims to: provide clear and concise information on adaptation policies and their implementation in Belgium; identify national measures to strengthen cooperation and develop synergies between different governments (federal, regional) on adaptation. It identifies specific adaptation measures that need to be taken at national level in order to strengthen cooperation and develop synergies between the different entities on adaptation. The Plan addresses 6 sectors and transversal issues: biodiversity, crisis management, energy, health, research and international cooperation.

The first mid-term evaluation (FR and NL) of this plan was completed in February 2019 and reflected an initial positive trend for adaptation. The subsequent final evaluation (FR and NL) in late 2020, focusing on the final implementation, indicated that the positive trend was sustained. In addition to the positive progress, remaining work items came into focus which may lay at the base of a possible follow-up. Based on the final evaluation, a new national adaptation plan is in process of development.

In 2021 a new mandate was provided by the National Climate Commission to update the National Adaptation Plan (2021-2030). The publication of the National Adaptation Plan has been postponed following the National Climate Commission's decision in April 2024 not to validate the draft National Adaptation Plan. It was also deemed opportune to review the upcoming national vulnerability and risk assessment led by Cerac (Centre for Climate Risk Analysis) and due in September 2025, which will underpin additional adaptation measures.

In 2022 the Flemish Government adopted a new Flemish Adaptation Plan 2030, with the aim to create a resilient Flanders against the effects of climate change in 2050 through the implementation of nature based solutions for a green, de-paved and water resilient Flanders. With the adaptation plan Flanders aims to work on climate change adaptation at the short and long term. Adaptation policy is part of the broader policy within the Flemish government and participation of different governmental levels as well as citizens, compagnies and organisations is crucial. As the most vulnerable groups in society experience the highest impact of climate change, social aspects are included in the implementation of adaptation measures. The Flemish adaptation plan is based on 6 strategies:

1. Flanders builds and connects green-blue infrastructure, always and everywhere
2. Water availability and water use
3. Space for water in order to realise water security and prevention of drought
4. Recovery and climate smart management of nature and forests
5. Climate adaptive health policy
6. Cooperation and coordination

In July 2020 the Flemish Government presented its Blue Deal against water scarcity and drought. The Blue Deal is based on 6 principles:

- Public administrations give the good example and provide the appropriate legislation
- Circular water use becomes the rule
- Agriculture and nature as part of the solution
- To sensibilize individuals and to stimulate de-pavement
- To increase the security of supplies

– Together we invest in innovation in order to create a smarter, more resilient and sustainable water system

A new Integrated Air-Climate-Energy Plan of the Brussels-Capital Region for the period 2023-2027 has been adopted on 27 April 2023. It includes detailed adaptation measures in several sectors with a focus on nature based solutions. Other thematic plans with adaptation measures are the regional water management plan adopted on 26 January 2017 for the period 2016-2021; which completely integrates the theme flood; a new water management plan has been adopted for the period 2022-2027 which addresses not only the theme flood but also the themes droughts and water scarcity and contains a specific chapter on adaptation; the new "forêt de Soignes" management plan for the period 2019-2043 (2019) and its Nature Plan (2016).

In January 2014, the Walloon government adopted its "Climate Decree" giving a legal framework to climate policy in Wallonia. The main implementation instrument is the "Air-Climate-Energy Plan" (PACE), which is a part of a dynamic process that provides for public participation upstream and an annual report to the Government and Parliament downstream, which allows it to be adapted. The first PACE, PACE 2016-2022, was adopted after a public consultation in 2016 and contains a section on adaptation. This section summarises the impacts & vulnerability assessments as well as detailed adaptation actions in several sectors and includes about 20 adaptation measures. PACE 2016-2022 is followed by the PACE 2030, which includes new policies and measures to achieve set out in the European Union's Energy Union framework for energy, climate and for air quality. Besides the sectoral actions, the financial and technical support to the local level (municipalities) is still present with dedicated budget and call to projects to create and develop green areas to adapt to impacts such as floods, droughts and heat waves in the Walloon municipalities.

After the severe floods of July 2021, the Walloon Government created a special commission to coordinate the studies and the work to rebuild in a sustainable way the areas devasted by the floods. A lot of resources have been released to provide an accompanying service to the victims. The work is still on course to better know how it happens and how to avoid this in the future and how to rebuild in a sustainable way.

Moreover, Wallonia has launched the Wallonia Recovery Plan (PRW), stemming from several complementary action programs. It guides the Walloon Government's actions in terms of jobs, the economy, the environment and the climate. With a budget of over €7 billion, it includes more than 300 projects designed to enable the Region to respond to current social, economic and environmental challenges, as well as to the impacts of various crises, such as the historic floods of July 2021. One year later, more than 85% of them have been launched, and some have already been finalized.

As a part of the PRW, a vulnerability assessment of the Walloon region is currently underway. Work began in August 2023 and it will run until the end of the first half of 2025. This diagnosis is a project of the Walloon Recovery Plan: PRW-317: Diagnosis of vulnerabilities to increase Walloon resilience through adaptation to climate change: scenarios, impacts, measures. The study has three main objectives: Update regional climate projections, assess vulnerabilities in various fields and make concrete adaptation proposals/recommendations and prioritize them, along with possible ways of financing them. Future impacts will be visualized on a dynamic cartographic portal developed as part of the study. The study will cover a total of 12 themes: biodiversity, ecosystem services, forests, water, soil, agriculture, tourism, health, socio-economics, cities, infrastructure and energy, and will link them together to propose a holistic approach to vulnerabilities.

4 calls for projects have been launched in 2021 with the aim of creating green spaces and greening the territory in the context of adapting to climate change. The ambitions are to create public green spaces that contribute to adaptation to climate change, that guarantee easy access to green space for all and by involving citizens and local players. In addition, one of the selection criteria was the sobriety and low maintenance costs of these new facilities. The first call for project, Creation of urban parks, was funded to the tune of more than 12M€ for 17 projects; the second one, green and blue urban network, was funded to the tune of close to 6.8M€ for 16 projects; the third, Green and blue network in rural areas, was funded to the tune of more than 6.5M€ for 22 projects and the last one, Greening a neighborhood, is ongoing.

On 28 October 2016, the federal government adopted the Federal Contribution to the National Adaptation Plan (available in FR and NL) which identifies federal adaptation actions in crisis management and transport, and additional transversal measures related to the integration of adaptation in different domains/policies and to sensitization. Measures included in this contribution were submitted to a public survey in 2014. The draft Federal Contribution to the National Adaptation Plan was submitted to the Federal Council for Sustainable Development and regional advisory bodies (CERBC, CESRBC, CWEDD, CESW, Minaraad and SERV) in December 2016. Their joint opinion on the draft plan was published in 13 February 2017. The Federal Contribution to the National Adaptation Plan was evaluated twice through an intermediate evaluation in 2019 and a final evaluation in 2021.

Building on the latter, at the end of 2021, the federal government started working on a coherent list of federal adaptation measures "Towards a Climate Resilient Society by 2050 - Federal Adaptation Measures 2023-2026". This list, published

in March 2023, consists of 28 measures spread across 8 sectors and is formulated in accordance to the new EU adaptation strategy of 2021, The European Climate Act and the EU Regulation 2018/1999 on the Governance of the Energy and Climate Action Union. The gender dimension has been integrated into this document, for example one measure focuses on multidisciplinary and holistic risk assessments as different demographic groups are affected differently by climate change impacts and in this context gender is an explicit part of the intersectional approach taken when assessing risks. The list of measures also recognizes the importance of a just resilience perspective. It requires that for each measure an assessment is made of the impact on precarious groups, in order to reduce or eliminate vulnerable situations. As part of the implementation of this list of measures and specifically linked to measure 28, a workshop will be organised together with the Combat Poverty Service to explore how vulnerable groups can best be assisted with regard to climate adaptation and how to communicate with them. A first evaluation of this plan is expected to be published before the end of 2024.

4.5. Progress on implementation of adaptation

The previous National Adaptation Plan was approved in 2017 with specific adaptation actions to be taken at the national level to improve cooperation and develop synergies between different entities (federal and regional). In March 2019, the mid-term evaluation of this plan was published for the period 2017-2018. The final evaluation of this plan was finalised at the end of 2020 and adopted by the National Commission on Climate Change in March 2021. Due to various reasons, the new National Adaptation Plan, with a 2030 time horizon, has not been adopted yet. However, the intention is to adopt this NAP as soon as possible, given its importance of identifying complementary measures to the regional and federal plans, as well as measures which promote vertical cooperation and information sharing between the regions and the federal entities. In any case, all measures taken will be based on the latest climate projections and corresponding risk analysis.

4.6. Monitoring and evaluation of adaptation actions and processes

The first Flemish Climate Policy Plan 2013- 2020, include a section on adaptation known as the Flemish Adaptation Plan (VAP). The primary goals are understanding the Flemish vulnerability to climate change and improving Flanders' ability to defend against the effects of climate change. The concurrent pursuit of these goals can be described as the "climate reflex". The 11 involved Flemish governmental departments maintain responsibility for the actions in their policy domain and they will bear the cost of these actions using their usual financial resources. In 2015 Flanders developed a first progress report 2013 – 2015 on climate change, including a section on adaptation. A second progress report 2016-2017 on climate change adaptation has been published in 2017. The Flemish Government is currently working on a set of indicators to measure the impact and outcome of adaptation action.

At the federal level two evaluations will take place: an interim evaluation (end 2024) and a final evaluation (end of 2026). Each measure will be subject to an evaluation by the departments responsible to determine to what extent their intended objectives have been achieved and if there are any shortcomings as well as the underlying reasons. On the basis of that evaluation, any shortcomings can be remedied, and measures can be added if necessary. Newly acquired knowledge regarding the effects of climate change and climate scenarios will be integrated into the implementation of existing measures and new measures may be added in reaction to new information/developments.

Brussels Environment published the first annual progress report on the air-climate-energy plan for the Brussels-Capital Region in April 2024. The next report will be published in April 2025.

4.7. Averting, minimizing and addressing loss and damage associated with climate change impacts

For the Brussel Region, the water management plan for the period 2022-2027 contains prevention and risk management measures linked to drought episodes and floods.

Since 2006, all Belgian fire insurance policies cover damage caused by natural disasters. Insurer data is available only for the most serious floods (more than 2000 damage reports in Belgium) and only indicate the number of reports per municipality.

At the Flemish level, the Flemish Adaptation Plan contains a strategy on an integrated approach for disaster risk management including early warning systems, emergency crisis management and clean-up and reconstruction strategies.

The Flemish government provides capacity building by supporting local governments through the climate adaptation tools; impact tool and plan tool of the Flemish Environmental Agency (VMM). These tools provide information on the impact of climate change at the municipal and district level and on possible adaptation measures to address these effects, including the costs and benefits.

At the federal level, there is a specific focus on facilitating internal knowledge building and providing technical and scientific support for integrating biodiversity into the management of the federal domains (land, infrastructure, and activities) of the Federal Buildings Agency (Régie des Bâtiments/Regie der Gebouwen), Ministry of Defence, Infrabel, and National Railway Company of Belgium (SNCB/NMBS). During this process, co-benefits in terms of climate adaptation are taken into account. Additionally, measures are being taken to protect and restore the marine environment, as well as to ensure early notification of the presence of invasive species and/or quarantine organisms in the agriculture, forestry, and ornamental horticulture sectors.

Furthermore, steps are being taken by the Center for Risk Assessment of Climate Change (CERAC) as they will analyse and assess all risk aspects (climate change impacts, vulnerability, and exposure) of climate change, and link this to all facets of climate policy (mitigation, adaptation, loss, and damage). Based on this, the coordinating body will formulate proposals for strengthening climate management in Belgium to increase the resilience of our country and society.

On the aspect of climate insurance, steps have been taken to improve the Belgian legislation on insurance for natural disasters of great magnitude in cooperation with the Belgian national bank, as well as the redefinition of the criteria by which the regions define risk zones.

4.8. Cooperation, good practices, experience and lessons learned

At the Belgian level cooperation between the regions and the federal level is facilitated by the national working group on adaptation, mandated by the National Climate Commission.

Belgian Climate Center: This organization aims to provide a nurturing environment where researchers, policymakers, businesses and the media can collaborate, and to allow each stakeholder to have access to the most relevant information. This ambition is realized through the facilitation of the production, translation, transfer and use of scientific knowledge and information for effective decision-making and adaptation as well as increased effectiveness of the adaptation strategies.

Cooperation and exchange of experiences and good practices at the EU level in the Working Group on Adaptation under DG Clima and the Eionet Network facilitated by the European environmental Agency (EEA). Good practices and experiences are also exchanged at the Mission portal of the EU Mission on adaptation to climate change and the yearly Mission Forum.

Another good practice are the trimestral meetings amongst the Benelux-members of the working group on adaptation, where adaptation-relevant issues are discussed for information exchange, synergies and potential cooperations. Just transition and just resilience are also among the topics being discussed and, in the future, more experts will be brought together to exchange on these topics.

4.9. Any other information

In 2025 a sectoral risk analysis will be launched by the Center for Risk Assessment of Climate Change (CERAC) to assess the impact of climate change on various sectors within Belgium. ■

5. Support provided and mobilized

Introduction

In 2021-2022, Belgium provided EUR 279 million of public support to developing country Parties (see CTF tables). The financial, technological and capacity-building support to developing country Parties mainly focused on:

- Adaptation (47%) and cross-cutting (43%) activities;
- The provision of bilateral and multilateral support in the form of grants;
- Contributions mainly directed towards Africa and Least Developed Countries (LDCs);
- Contributions to climate-specific multilateral funds (Green Climate Fund, Adaptation Fund, Least Developed Countries Fund, etc.) or specialised UN agencies;
- Contributions to bilateral projects mainly directed towards African partner countries and Least Developed Countries (64% of bilateral climate finance).

Belgium also supports the efforts of developing countries to implement low-emission, climate-resilient projects and pro-

Figure 28 Belgian climate finance: Trend 2013-2022

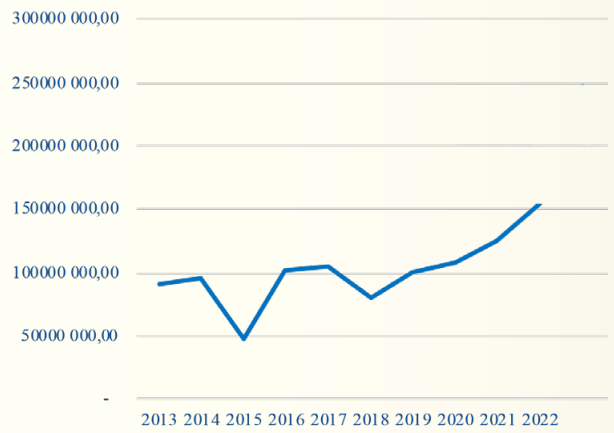
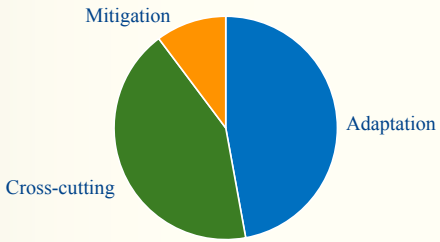
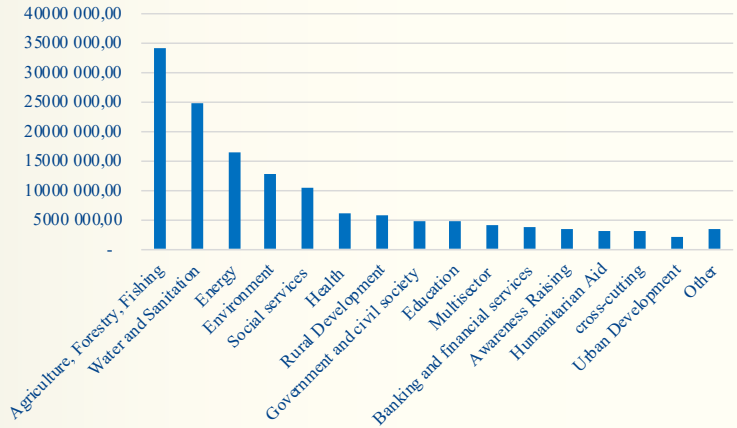


Figure 29 Belgian climate finance 2013-2022: type of support



grammes (i) by providing significant core funding to multilateral organisations and (ii) by mobilising, through public means, private investments for climate-related projects in developing countries. In this regard, Belgium mobilised EUR 56 million through public interventions to support developing country Parties (see CTF tables).

Figure 30 Belgian climate finance: bilateral support per sector in 2021-2022



5.1. National circumstances and institutional arrangements

Belgium is a federal state and, given this institutional context, the federal and regional governments play an active role in the development and implementation of climate change policies, including the provision and mobilisation of climate finance.

Following up of the cooperation agreement on the internal burden sharing for the period 2016-2020, the different governments reached an agreement on the burden sharing with regards to the provision of international climate finance. It was decided that each government would at least provide the contributions listed in table 21.

Systems and processes used to identify, track and report on support provided and mobilized through public interventions

Belgium uses the Rio markers to report to the Development Assistance Committee of the Organization for Economic Cooperation and Development (OECD-DAC) about the official development assistance that has been spent on activities to support the goals of the United Nations Conventions on biodiversity, climate change and desertification (respectively UNCBD, UNFCCC and UNCCD). These are policy markers that indicate donors' policy objectives in relation to each aid activity. To fulfil its reporting obligations to the UNFCCC, Belgium uses these markers to identify the relevant programmes and

Table 21

	2021	2022	2023	2024
Government of Flanders	15 500 000	16 500 000	17 500 000	18 500 000
Government of Wallonia	8 500 000	12 500 000	14 500 000	16 500 000
Government of the Brussels-Capital Region	2 750 000	2 750 000	3 000 000	3 000 000
Federal Government	100 000 000	100 000 000	100 000 000	100 000 000

projects in its portfolio. Each year, prior to reporting to the UNFCCC, the Rio Marker scoring is reviewed to ensure a correct qualification of projects.

The Directorate General for Development Cooperation and Humanitarian Aid (DGD), takes all Rio markers (climate, biodiversity and desertification) into consideration to be able to determine the coefficients used to estimate the amount of the project budget that can be considered climate finance. For instance, if a project is marked 2 for climate adaptation, as well as for biodiversity, only 50% of the budget would be considered climate finance. For projects that have one or more markers 1, the coefficients (in%) are determined on the basis of their subsector code, also avoiding double counting. To avoid double counting, the sum of coefficients for each project never exceeds 100%.

The regional governments also use the Rio markers. Accounting for "Rio marker 2" actions is simply 100% of the action budget. For accounting for the contributions of actions under Rio marker 1 a coefficient of 40% is used. To prevent double counting, a "Rio Marker 2" on both mitigation and adaptation does not result in climate reporting of 200% of the project budget, but counts as 100% of the project budget. The same principle is applied to a "Rio Marker 1" on both mitigation and adaptation, which results in a climate reporting of 40% of the project budget.

Each government also has a system in place to report more detailed information on its climate finance data in a transparent, easy-to-track manner through the following publicly available websites:

- Government of Flanders: www.fdfa.be/klimaat
- Government of Wallonia: http://www.awac.be/index.php/thematiques/politiques-actions/les-politiques-changement-clim/politique-wallonne/financement-climat-international
- Government of the Brussels-Capital Region: https://environnement.brussels/thematiques/air-climat/climat/financement-climatique-international
- Federal Government: www.openaid.be/en

The system of the Government of Flanders includes climate finance data from 4 different departments: Chancellery and Foreign Affairs; Environment and Spatial Development; Economy, Science & Innovation; Mobility and Public Works.

Challenges and limitations

Belgium recognizes the shortcomings of using the Rio Markers for quantification as the purpose of the Rio Markers is to indicate donors' policy objectives in relation to each aid activity, and not to lead to a quantification of support delivered. Unfortunately, there is no better international system available that will lead to more precise estimation, without posing an undue burden on Parties' reporting. To overcome this hurdle, Belgium reports in the most transparent manner (e.g. publicly available databases) on its climate finance and the methodology that has been used.

Information on experience and good practices in relation to public policy and regulatory frameworks to incentivize further private climate financing and investment

Belgium is fully engaged in the dialogue with international financial institutions, particularly the Multilateral Development Banks and their private sector arms, to enhance their role in providing and mobilizing climate finance. Providing adapted tools to facilitate access to climate finance to small and medium enterprises (SMEs) in Africa is also important, as well as enabling the development of sustainable value chains. BIO, the Belgian Investment Company for Developing Countries, also has a particular role to play in this. BIO's mission is to support a strong private sector in developing and emerging countries, to enable them to gain access to growth and sustainable development within the framework of the Sustainable Development Goals. Within its new climate and ecological sustainability strategy, BIO has set up three specific climate and nature priorities: (1) do no significant harm to long-term climate & ecological sustainability; (2) mainstream actions towards climate and ecological sustainability in its investments; and (3) increase climate and biodiversity finance ambition. These objectives make the alignment with the Paris agreement more concrete.

The updated strategy will be reflected in the new investment strategy 2024-2028 for each investment sector.

The management contract concluded between the Belgian government and BIO sets specific relevant targets:

- 20% of commitments made by BIO will be for investments that principally target mitigation and or adaptation.
- 20% of commitments made by BIO will be for investments that integrate climate change adaptation as a specific objective
- 10% of commitments made by BIO will be for investments that integrate measures for the conservation of biodiversity and sustainable management of natural resources as a specific objective, aligning BIO operations with the objectives of the Kunming Montréal Global Biodiversity Framework.

• Finexpo Renewable energy instrument

Finexpo can support any Belgian SME (small and medium-sized enterprises) active in renewable energy and willing to export this service to developing country through a grant (between 80.01% and 100% of the contract value up to a maximum of 700 000 euros), under certain conditions. This program therefore supports the exportation of projects that promote the use of renewable and ecological energy or offer an alternative to fossil fuels

and therefore contribute to a reduction of greenhouse gas emissions. Such support must be relevant for the developing country where it is exported. It is important to note that these grants are not reported as international climate finance, since there is no official finance flow from developed to developing country involved. However, these grants do mobilize private sector investments and are as such included in our comprehensive reporting in line with relevant EU regulation.

• Credendo Green Package

In November 2021 Belgium joined the Export Finance for Future (E3F), an initiative to align public export finance with climate goals.

The Credendo Green Package offers benefits to enterprises and banks that invest towards projects that contemplate climate change mitigation or adaptation, that are environmentally sustainable, or those that are delivering on the climate goals of the Paris Agreement, including green export activities. Benefits are available for the following Credendo product categories: export credit insurance, funded solutions, and financial guarantees. The projects selected as part of the Credendo Green Package have the most favorable conditions in every respect when it comes to incentives.

The main incentives include a lower threshold for the percentage of Belgian content for a transaction; a higher insured percentage (98%); an extension to domestic transactions when the supplied goods, technologies, services or projects show an export potential; a higher participation of Credendo in financial guarantees (up to 80%); an increase in resources for own financing of transactions and longer repayment periods, as well as an active positive communication on green projects.

Efforts taken to enhance comparability and accuracy of information reported on financial support provided and mobilized through public interventions, such as through use of international standards or harmonization with other countries, institutions and international systems

Belgium takes the importance of accurate and comparable reporting of data very seriously. The use of international standards and definitions, in line with the OECD Development Assistance Committee (DAC) is our main effort to ensure that we're reaching the highest level of monitoring and standards. These aspects are reflected in:

– Use of OECD DAC Rio Markers to identify climate-specific finance
– Define the underlying definitions in line with the OECD DAC definitions and standards (see table 22)

Specific national circumstances and institutional arrangements for the provision of technology development and transfer and capacity-building support

There are no specific national circumstances and institutional arrangements of the provision of technology development and transfer and capacity-building support. The same circumstances and arrangements as for the provision of financial support apply.

5.2. Underlying assumptions, definitions and methodologies

Table 22

	Assumptions, definitions and/or methodologies
Reporting year	Calendar years 2021-2022
Conversion between EUR and USD	For 2021: According to UN operational exchange rate on the 31st December 2021: 1USD = 0.881 EUR For 2022: According to UN operational exchange rate on the 31st December 2022: 1USD= 0.939 EUR
Committed	Belgium only reports commitments if these are based on a firm obligation such as a decree, or an agreement, expressed in writing and backed by the necessary funds, to provide specified assistance to a recipient country or a multilateral organisation.
Disbursed	Belgium only reports disbursements if payments have been made on the basis of an invoice or a payment request by a multilateral partner organisation or a non-governmental partner. Reporting of disbursements related to projects and programmes of the Belgian Technical Cooperation is based on actual expenses in the field.
Bilateral	Bilateral flows are provided directly by Belgium to another country.
Regional	Regional flows are provided to a specific region, consisted of different countries (e.g. sub-Saharan region).
Multi-bilateral	Bilateral flows channelled through multilateral agencies but earmarked for specific countries or regions
Multilateral	Multilateral flows are channelled through multilateral agencies.
ODA, incl. how BE has determined finance to be ODA	Grants or loans to countries and territories on the DAC list of ODA recipients and multilateral agencies that are undertaken by the official sector at concessional terms (i.e. with a grant element of at least 25%) and that have the promotion of the economic development and welfare of developing countries as their main objective.
OOF	Transactions by the official sector with countries on the DAC list of ODA recipients which do not meet the conditions for eligibility as ODA, either because they are not primarily aimed at development or because they have a grant element of less than 25%.
Other funding sources	n/a (no other funding sources than ODA and OOF are reported in the CTF)
Grant	Transfers made in cash, goods or services for which no repayment is required
Concessional loan, incl. how BE has determined finance to be concessional, including by using information such as grant equivalence, institution and/or instrument-based approaches	Transfers for which repayment is required, but with a concessionality level, which includes a measure of the “softness” of a credit reflecting the benefit to the borrower compared to a loan at market rate. technically, it is calculated as the difference between the nominal value of a tied aid credit and the present value of the debt service as of the date of disbursement, calculated at a discount rate applicable to the currency of the transaction and expressed as a percentage of the nominal value.

Non-concessional loan	BIO offers a wide range of direct medium- and long-term loans at both fixed and variable rates. Their term can vary between three and ten years, with a grace period of three years maximum. BIO operates according to a commercial logic inherent to its status and its development finance mission. BIO is careful to ensure the additionality of its investments to avoid entering into direct competition with the local established financial sector. BIO's role is to provide long-term financial products that are generally unavailable or inaccessible on the local markets. All projects must demonstrate long term financial viability and have a lasting impact on the development of the country in question, whether in terms of employment, the environment or economic and social growth. BIO also sets out to provide added value, in particular by contributing to good governance, by backing pioneering concepts and/or new initiatives or by attracting other investors. More information on the governance framework related to these investments can be found here: Governance | BIO
Equity	n/a (this financial instrument is not included in the CTF)
Guarantee	n/a (this financial instrument is not included in the CTF)
Insurance	n/a (this financial instrument is not included in the CTF)
Other financial instruments	n/a (this financial instrument is not included in the CTF)
Adaptation	Support directed towards the reduction of the vulnerability of human or natural systems to the current and expected impacts of climate change, including climate variability, by maintaining or increasing resilience, through increased ability to adapt to, or absorb, climate change stresses, shocks and variability and/or by helping reduce exposure to them. This encompasses a range of activities from information and knowledge generation, to capacity development, planning and the implementation of climate change adaptation actions.
Mitigation	Support contributing to the objective of stabilisation of greenhouse gas (GHG) concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system by promoting efforts to reduce or limit GHG emissions or to enhance GHG sequestration.
Cross-cutting	Support/activity that has both adaptation and mitigation components
Sector	Belgium uses the classification of sectors in line with the OECD DAC Creditor Reporting System (CRS). The focus is mainly on sectors where climate action has a high impact: energy; water and sanitation; environmental policy; biodiversity; education and research; agriculture.
Subsector	Belgium uses the classification of sub-sectors in line with the OECD DAC Creditor Reporting System (CRS)
Public finance	Provision of support by an official government in Belgium
Private finance	Flows at market terms financed out of private sector resources (i.e. changes in holdings of private long-term assets held by residents of the reporting country) and private grants (i.e. grants by non-governmental organisations and other private bodies, net of subsidies received from the official sector).

Methodologies on identifying climate-specific support

See above section 5.1. 'Systems and processes used to identify, track and report on support provided and mobilized through public interventions'.

Information on efforts taken to avoid double counting

Belgium undertakes the following efforts to avoid double counting:

- Belgium uses reporting systems that link the provided support with the national budget system. (from source reporting), so there is no double counting among multiple Parties involved in the provision of support.
- To avoid double counting among multiple Parties involved in the mobilisation of private finance through public interventions, Belgium increased efforts to report transparently on the amounts mobilised by its investments. For some programs co-financing was part of the requirements to introduce project proposals. For BIO invest the following definition was used to provide information on amounts mobilised: "Total of all financing from private sources provided in connection with a specific activity for which the DFI is providing financing."
- Regarding private finance assessed as mobilized through public interventions, Belgium first identifies a clear causal link between the public intervention and the mobilized private finance. Secondly, the point of measurement is the point of commitment of the private finance mobilized as a result of the public intervention (commitment in this context means that a contract related to the investment has been signed). Thirdly, only finance that directly follows from the public intervention is included in the CTFs.
- Regarding support attributed between multiple recipient countries, in cases where a project involves multiple recipient countries and where this information is reported on a country-by-country basis, it is important to note that Belgium reports in as a disaggregated way as possible. For some projects, this will mean that a project involving multiple recipient countries will be reported on a country-by-country basis, if a clear distinction is possible on which sources were sent to which country. For others, we only report on a project basis if such a distinction cannot be made or could lead to double-counting, meaning that support attributed between multiple recipient countries within one project will be reported as one project with the recipients clarified, for example as 'ECUADOR, PERU.

Effectively addressing the needs and priorities of developing country Parties for the implementation of the Paris Agreement

The Flemish International Climate Action Programme (FICAP) request a clear link between the project proposal and one of the national climate change plans or strategies (such as the National Determined Contribution, the National Adaptation Plan, etc.) in order to ensure that the project proposal addressed the needs and priorities identified by the government of the developing country/countries where the project will be implemented.

New and additional financial resources

Belgium provided 47.5 million EUR to the Global Environment Facility during the reporting period. 35 million EUR as part of this funding is reported as core funding in CTF Table 7a. Belgium increased its contribution to the 8th replenishment of the GEF significantly (from 60 million EUR in GEF-7 to 92.5 million EUR in GEF-8), in particular by providing 12.5 million EUR as specific climate finance, which is reported as such in CTF table 7a.

Belgium's contribution to the GEF is in accordance with its commitment to provide new and additional financial resources to meet the agreed full costs incurred by developing country Parties in complying with their obligations under Article 12, paragraph 1, of the Convention.

These are the new and additional financial resources that have been provided by Belgium pursuant to Article 4, paragraph 3, of the Convention.

Both the financial architecture as well the commitments by Parties have changed significantly since the Convention, especially with milestones such as the Copenhagen Accord, the Cancun Agreements and the Paris Agreement. While developed country Parties are required to continue the provision of financial resources to assist developing country Parties with respect to both mitigation and adaptation in line with the existing obligations under the Convention, these Parties are also requested, as part of a global effort, to take the lead in mobilizing climate finance from a wide variety of sources, instruments and channels, noting the significant role of public funds, through a variety of actions, including supporting country-driven strategies, and taking into account the needs and priorities of developing country Parties (Article 9, paragraphs 1 and 3, of the Paris Agreement).

As a result, financial support to climate action in developing countries does not only flow through the operating entities of the Financial Mechanism.

Over the years, there are also significant changes regarding the involvement of Belgium in international climate finance. While the federal government, through its Directorate Development Cooperation, remains the main donor, the Regional

governments are now also playing an active role, especially since the Copenhagen Accord (2009). There are also more ministries, departments or entities involved, besides Development Cooperation.

This development of greater involvement within Belgium, as well as the complexity of the climate finance architecture, makes it difficult to give a clear-cut description of "new and additional" financial resources as there is such a wide variety of sources. A dynamic and flexible concept of "new and additional" is required, even more so due the lack of an internationally agreed definition of this concept. For these reasons, Belgium puts a lot of emphasis on transparency of its use of reporting methodologies.

Belgium honours its commitments on international climate finance in the context of the Paris Agreement, including on the principle of new and additional. Belgium describes its financial support as new and additional, since it comprises:

- Provisions in line with Article 4, paragraph 3, of the Convention;
- Contributions which would not have existed without the financial commitments stemming from the Copenhagen Accord;
- Budget lines on top of the annual budget for bilateral development cooperation;
- Only the climate-specific or climate-relevant part of projects and programmes. Based on our methodology (see above), Belgium does not report the full amount of the projects/programmes if these are only partly relevant to climate action;
- Only climate-related projects in developing countries additional to the previous reporting period;
- Contributions from the revenues obtained from auctioning greenhouse gas emission allowances.

Progression from previous levels in the provision and mobilization of finance under the Paris Agreement

See figure 28.

Multilateral finance

(i) Whether the multilateral finance reported is based on the Party's inflow contribution to a multilateral institution and/or on the Party's share in the outflow of the multilateral institution;

The multilateral finance reported is based on Belgium's inflow contribution to the multilateral funds and institutions. Our share in the outflow of the multilateral institution is not included as a share of Belgian climate specific finance.

(ii) Whether and how multilateral finance has been reported as climate-specific and how the climate-specific share was calculated, including by, for example, using existing international standards;

With regards to multilateral finance, Belgium only reports its contribution to specific climate funds, such as the Green Climate Fund and Least Developed Countries fund. The provision of this climate specific funding is in addition to non-earmarked contributions to multilateral institutions and specialized UN agencies. Those contributions are not included as a share of Belgian climate specific finance.

(iii) Whether multilateral finance has been reported as core/general, with the understanding that the actual climate finance amount it would transfer into depends on the programming choices of the multilateral institutions;

As mentioned above, support to multilateral institutions and organisations that is not climate-specific, is reported as core/general contributions, exactly for the reason that it depends on the programming choices of the multilateral institutions to transfer these contributions to climate-specific goals.

(iv) Whether and how multilateral finance has been attributed to the reporting Party.

As we only report our inflows, it is clear that these contributions can be attributed to Belgium. As we only take into account the climate-specific share of multilateral finance, and not the core/general contributions, it is also clear that what is reported/attributed counts as climate-specific support.

Methodologies to identify if the support provided supported capacity-building and/or technology development and transfer objectives

All projects have – to various extents – objectives to support capacity-building and/or technology development and transfer as this is inherent to climate action projects. Belgium focuses in its reporting under CTFs 8 and 9 on those projects with a strong capacity-building and/or technology development and transfer objective. These projects are therefore identified on information received by the implementing agencies and the project documentation, so the identification of this support is on a project-per-project basis.

A description of the underlying assumptions, definitions and methodologies specifically used to provide information on technology development and transfer and capacity-building support

There are no specific assumptions, definitions and methodologies specifically used to provide information on technology development and transfer and capacity-building support. The information included are projects with a strong capacity-building and/or technology development and transfer objective, as identified by the project-level information of these projects.

5.3. Financial support provided and mobilized

5.3.1. Bilateral, regional and other channels

A few highlights provide a picture of how Belgium cooperates with is partners to tackle the impact of the global climate crisis.

With its partners in the UN family

For the past few years Belgium sought new opportunities with its partners countries to develop sound climate policies, help build capacity for adaptation and strengthen resilience of vulnerable communities and people.

In Uganda, Mozambique and Tanzania Belgium supports the Local Adaptive Living Mechanism of the United Nations Capital Development Fund, fostering locally led solutions for adaptation to communities; aiming to bring climate finance from the global to the local level.

Building on previous initiatives to build scientific capacity on climate change and biodiversity in the DR Congo, Belgium supports a multi-actor partnership led by UNESCO (United Nations Educational, Scientific and Cultural Organisation) to lift the Yangambi Biosphere reserve (BR) into a climate-biodiversity centre of excellence. The project has a strong scientific and capacity building component and aims to strengthen integrated conservation and development function of the BR allowing local people and communities to live in a sustainable way.

In the Palestinian Territories, Belgium supports UNDP's (United Nations Development Programme) efforts to improve natural resources management, reduce and manage waste and create green jobs. This Greening Gaza project is currently on hold and activities will be adapted as soon as possible once the situation in the field allows.

Given the vital role biodiversity and healthy ecosystems play to tackle climate change, Belgium supports Niger through UNDPs BIOFIN programme, to map resources for biodiversity and develop a sound financial plan to achieve the protection, conservation, and sustainable management of its natural capital.

The Centre-North, North and Sahel regions of Burkina Faso suffer recurrent shocks every year, which affect the food and nutrition security of millions of people living below the poverty line. To address

these constraints, Belgium supports a project with the Food and Agricultural Organisation (FAO) to set up village structures for capacity building in climate change adaptation and mitigation techniques, surface water management infrastructure, the rehabilitation of boulis, the development of low- lying lands for agricultural production and tree planting and biodiversity protection. The FAO applies a nexus approach: the project is carried out in fragile regions with a focus on vulnerable populations, with sustainable strengthening of local agri-food systems, and with a focus on conflict prevention and management. Participation of the grassroots community, especially women and young people, is essential.

In Burundi, Belgium through a partnership with the EU, Enabel and UNDP supports the government to improve the protection and sustainable management of the the Rusizi River basin ecosystem. This includes strengthening the involvement of local people in the conservation of Kibira and Rusizi National Parks, allowing them to benefit from ecosystem services, with a special focus on gender equality.

With Apefe

The Walloon Region developed project specifically dedicated to adaptation, mitigation or Loss and Damage through a partnership between AWAC and APEFE in countries such as Benin, Burundi, Burkina Faso, Rwanda and Senegal. It totalized 3.2 million EUR in 2023-2024 (0.5 million EUR in 2023 and 2.7 million EUR in 2024).

With Enabel

In the Sahel region, Enabel has started implementation of its portfolio "Climate in the Sahel", approved in 2021. With this large programme of 50 million EUR Enabel aims to reach 650 000 people in Mali, Burkina Faso, Niger and Senegal, contributing to the goals of the Great Green Wall Initiative. Forty thousand hectares of land will benefit from practices for conservation, restoration, and sustainable management. Local communities will be provided with tools to sustainably manage the natural resources in the intervention area, to address the direct and indirect drivers of desertification. At the regional level, cooperation, sharing of expertise, knowledge, and information will be strengthened. The aim is to develop better data collection for climate services at the regional level, in collaboration with national authorities, civil society and research institutions to make these services better suited for their end users.

In Mozambique Enabel's portfolio is also fully dedicated to climate action, including actions to strengthen disaster risk reduction systems.

The Walloon Region finances topping-up projects from the Enabel's portfolio climate in Sahel (PTCS) since 2022 (4.5 million in 2022-2024). For instance, the « Support for the development of a sustainable and inclusive wood-energy sector in Senegal and Burkina Faso, complementary to the Regional Climate Programme from Enabel to Sahel » and "Provision of solar equipment to analytical laboratories around the lake Tanganyika in addition to the integrated resource management project in Great Lakes Region / installation of photovoltaic solar panels ».

Through civil society

In 2022, new programs of the actors of civil society that Belgium supports, were approved. Many of these programs integrate specific climate action. A joint strategic framework was developed by 6 Belgian actors (BOS+, Join for Water, CE-BioS, WWF (World Wildlife Fund), VIA Don Bosco, Uni4COOP) and their partners to work together on social ecological resilience and improved wellbeing of people and communities in Ecuador, Peru, Benin, Burundi, DR Congo, Uganda, Rwanda, Tanzania, Cambodia and Vietnam. Four strategic goals were identified:

1. Improved rights, policies, and governance of ecosystems and natural resources
2. Improved awareness, knowledge, skills about sustainable ecosystems
3. Strengthened sustainable access to, management and use of ecosystem services
4. Ecosystems are conserved or restored for optimal functioning to improve social-ecological resilience and improved well-being

With the Belgian Investment Company for Developing Countries

The Belgian Investment Company for Developing Countries (BIO) provides loans and equity to foster private sector development in the global south. The Belgian government increased the capital of BIO with climate finance, to allow for BIO to play its role in helping countries leapfrog towards green and clean development of businesses. Within its new climate and ecological sustainability strategy, BIO has set up three specific climate and nature priorities: (1) do no significant harm to long-term climate & ecological sustainability; (2) mainstream actions towards climate and ecological sustainability in its investments; and (3) increase climate and biodiversity finance ambition.

In 2022, Brussels-Capital Region concluded a bilateral agreement with the Belgian development Agency Enabel, regarding the provision of EUR 4.1 million of funding by the Brussels-Capital Region to support activities contributing to climate change mitigation and adaptation in the partner countries of Belgian bilateral cooperation, for an execution period of 4 years (2023-2026). The three projects pursued through this agreement demonstrate

a primary focus on adaptation to climate change and resilient urban development.

The Flemish International Climate Action Programme

The Flemish International Climate Action Programme (FICAP) financed by the Government of Flanders and coordinated by the Department of Environment and Spatial Development in collaboration with G-STIC launched project calls in 2021 and 2022 to support developing countries in the fight against climate change, in line with the provisions of the Paris Agreement.

FICAP provides financial support for two types of projects: dissemination and/or capacity building projects, and demonstration projects. Dissemination projects focus on spreading and/or implementing the results of research and/or policy, while capacity building projects aim to enhance knowledge, skills, and/or resources. Projects may also combine dissemination and capacity building aspects. Demonstration projects focus on showcasing and/or scaling up market-ready innovative solutions.

Projects must be fully climate-accountable, meaning their primary objective should be to support climate actions in developing countries, aiming to mitigate the negative impacts of climate change on living and environmental conditions (adaptation) and/or reduce greenhouse gas emissions (mitigation) in those countries.

There also need to be a direct link to the climate policies and/or action of the developing country(ies) where the project is implemented. Projects focus on areas where climate-related solutions are expected to have maximum impact, preferable in the following sectors: agriculture, biodiversity, education & research, energy, environmental policy, water & sanitation and transport. Other sectors are not excluded if the project showcases significant climate—related impact.

In 2021, the Government of Flanders provided a grant of EUR 3.2 million to support 13 projects. In 2022, a grant of EUR 15.7 million was provided by the Government of Flanders to support 19 projects in total. These projects are included in CTFs and further information is available on Flanders International Climate Action Programme.

5.3.2. Multilateral channels

An overview of commitments made to multilateral funds and institutions:

- At COP26 in Glasgow in November 2021 the federal government pledged to contribute yearly 15 million EUR to the Least Developed Countries Fund (LDCF) in 2021-2024. This support is completed by the Walloon government, which contributed by (22.50 million EUR in2017-2024). Since its launch, the LDCF has financed over 310 projects and 53 enabling activities with approximately $1.7 billion in grants, directly benefiting over 50 million people and strengthening management of over 7 million hectares of land for climate resilience at the regional, national, and sub-national levels.
- At COP26 Belgium joined the Champions Group on Adaptation Finance.
- Belgium provided 40 million EUR to the Green Climate Fund in 2021-2022. The Walloon Region provided 2 million EUR in 2020-2024.
- The Adaptation Fund is supported through the Brussels Capital Government, the Government of Flanders, and Walloon Government (35.892 million EUR in 2015-2024).
- The Wallon Region provided 0.8 million EUR to the CCAC in 2017-2024 ;
- The Walloon Region provided 7 million EUR in 2017-2024 through earmarked programs;
- At COP26 in Glasgow, the Scottish and the Walloon Region (1 million EUR) announced a first pledge in favour of Loss and Damage. The recipient was the CVF&V20 Joint Multi Donor Fund Loss and Damage Funding Program which received from the Walloon Region 1 million EUR in 2022, 2 million EUR in 2023 and 1.1 million EUR in 2024.
- At COP28 in Dubai, the Walloon Region announced a pledge in the L&D Fund, whose operationalization has just been decided the first day of negotiation, November 30, 2023. The contribution of the Walloon Region to the Fund Restoring to Loss and Damage (FRLD) was 1 million EUR in 2024.
- A long-standing member of the NDC partnership, Belgium will, as of 2021, contribute 2 million EUR to the NDC partnership action fund, in addition to smaller projects for peer-to-peer support and sharing of expertise and experience. The NDC partnership supports countries to revise, enhance, and implement their NDCs, by providing expertise, knowledge sharing, capacity building and facilitating access to climate finance.
- Belgium supports capacity building for transparency (f.i to develop systems for GHG emissions monitoring), i.e., through UNDP's Climate Promise (1.25 million EUR annually) and the UNFCCC secretariat (750 K EUR annually).
- At COP26 Belgium also joined the Global Forest Finance Pledge (and Congo Basin Pledge), and amongst other contributions, supports the Central African Forest Initiative (3 million EUR/year).
- Dedicated support to UNEP's climate action (3 million EUR/year) will result in: access to finance and technology to help countries achieve the goals of the Paris Agreement;
- Decarbonization and resilience to drive global growth; greater transparency in line with the Paris Agreement to become the norm for States and territories.
- Belgium supports international agricultural research through a contribution

to the CGIAR's climate related work, helping farmers move towards sustainable food systems and agroecological practices and to build resilience and adapt to the impact of climate change on their livelihoods.

– Continuing this effort to align its support with the objectives of the Paris agreement, the federal government decided in 2022 to further increase the funds made available for multilateral climate finance. With these additional funds (12.5 million EUR each year in 2022-2024) Belgium was able to pledge 92.5 million EUR as a contribution to the 8th Replenishment of the Global Environment Facility, a significant increase from the previous contribution during the 7th Replenishment period (60 million EUR). This pledge was made, not only to help match the increasing need for climate finance, but also motivated by the key role the GEF has to play in the implementation of the soon to be adopted Global Biodiversity Framework.
– On average, the contribution to climate finance through multilateral partnerships was 35 M EUR in 2013-2020. Since then, it has increased to 71.4 million euros in 2022.

The Brussels-Capital Region is a historical contributor to the Adaptation Fund and has disbursed over EUR 10 million from 2013-2023. These successive contributions illustrate the fact that the Adaptation Fund is a key partner in the implementation of the Region's commitment to provide climate finance, in line with country needs, vision and priorities.

The Walloon Region was pioneer in the field of Loss and Damage, with a total amount of 6 million EUR in 2022-2024 (4.1 million EUR in CVF&V20 L&D Funding Program, 1 million EUR in FRLD and 0.9 million EUR in field project, ear marked and specifically dedicated to Loss and Damage, financed by AWAC and developed by APEFE in vulnerable communities).

5.4. Support for technology development and transfer provided

Examples of Technical Assistance investments supporting capacity building through BIO BDFS program:

– Technical Assistance Facility for Spark + Africa Fund, to support the fund investee with a range of advisory services, including training and capacity building to their positive climate impact outcomes.

  Commitment date = 2022. Amount = EUR 350 000 in subsidy (code 3)
  https://www.bio-invest.be/en/investments/spark-africa-fund-2

– Technical Assistance Facility for Alterfin, to support the fund investee with a range of advisory services, including the strengthening of their impact approach regarding sustainable agriculture.

  Commitment date = 2022. Amount = EUR 80 000 in subsidy (code 3)
  https://www.bio-invest.be/en/investments/alterfin-3

Examples of investments supporting technology development:

– Debt funding to Candi Solar, a company installing, owning and operating solar production plants and selling electricity to clients in India and South Africa.

  The investment is supporting the development of an innovative Power Purchase Agreement to serve SMEs that need clean, reliable and affordable energy.
  Commitment date = 2021. Amount = USD 5 000 000 loan (code 8)
  https://www.bio-invest.be/en/investments/candi-solar

– Equity funding to Omnivore Agritech & Climate Sustainability Fund III, a fund investing in innovative technological companies that deliver products and services having a disproportionate impact on the lives of farmers and rural communities in India.

  The fund focuses notably on companies enabling the agri-food sector (in particular smallholder farmers) developing climate-smart and resiliency food production practices in their operations or value-chains.
  Commitment date = 2022. Amount = USD 5 000 000 equity (code 8)
  https://www.bio-invest.be/en/investments/omnivore-agritech-climate-sustainability-fund-iii

– Debt funding to Inka's Berries, a company dedicated to the production and commercialisation of blueberries seedlings and of fresh blueberries for export.

  The investment is supporting climate adaptation technology development such as advanced water management, climate smart practices regarding use of fertilisers and pesticides and variety selection to ensure better adaptation to heat and water stresses in a region hit by El-Nino phenomenon.
  Commitment date = 2022. Amount = USD 15 000 000 loan (code 8)
  https://www.bio-invest.be/en/investments/inkas-berries

The Brussels-Capital Region is backing a technology transfer project in Rwanda through a bilateral agreement with its implementing partner, the Belgian development agency Enabel. The project focuses on constructing bridges using stone arches, a method that reduces GHG emissions by 70% compared to equivalent concrete bridges. Previously, this technique was not used in Rwanda, and the project seeks to spread its adoption throughout the region.

Examples of support provided for technology development and transfer by the Government of **Flanders**:

– "Sustainable, reliable, and affordable energy through smart hydropower" coordinated by ByNubian (partners: Hydrobox and Etu-Smart Grids): a 1 500-kilowatt (1.5 MW) hydroelectric power plant is being developed to provide clean, reliable, and affordable energy to the populations of the cities of Akula and Dongo-Kuma in the Sud-Ubangi province (DRC). To ensure efficient distribution of energy, a smart electricity grid is being established, delivering electricity directly to end-users according to the ABC model. In this model, so-called A-customers (Miluna Plantation, industrial zone, and the cities of Dongo-Kuma and Akula) use between 40% and 60% of the available electricity, ensuring the economic viability of the project. The remaining electricity is distributed to hundreds of small businesses (such as local schools and hospitals) and thousands of households.

  The smart electricity grid will stimulate the economic development of the region and will reach 5 000 households, 175 businesses, 4 hospitals, and 20 schools. The network aims for a 95% uptime and to avoid 10 684 tons of CO_2 emissions per year.
– "Platform for managing risks associated with extreme rainfall" coordinated by HydroScan (partner: VITO). A flood risk management platform is being implemented as a decision support system for both urban and rural areas. This platform will integrate various sources of relevant data for flood management and early warning. In this platform developed by HydroScan, innovative tools are being implemented to predict floods and their economic impact. Vietnamese partners are being trained in the use of this platform, enhancing their understanding of events during extreme situations. This enables proactive interventions so people can be better prepared and take measures to mitigate damage and even save lives. The platform is established based on HydroScan's Flood4Cast Real-time Alerter, a flood prediction software, and will be integrated with a new X-band rainfall radar. The flood maps with varying probabilities of occurrence are generated using an integrated flood model in Flood4Cast Masterplanner. These maps serve to interpret real-time flood alerts on street level. Additionally, an economic risk model is linked to these flood maps to assess the economic damage resulting from the floods.

To achieve maximum impact, there is a close collaboration with three Vietnamese government agencies: VDDMA, NCHMF, and NCN. The "train the trainers" principle is applied to transfer knowledge to these partners, enabling them to operate it effectively and subsequently pass it on to local stakeholders and citizens.

Examples of support provided for technology development and transfer by the Government of **Wallonia**:

– « Project to strenghten the environmental and community resilience of the population of Gihanga and Mutimbuzi in the face of climate change led by Pro-Action Développement (PAD) in Burundi. ». [PRCC (RREC) Project] Overall, the project, led by the NGO PAD and its partners in Burundi, has made it possible to strengthen the health and environmental conditions of Gihanga/Mutimbuzi, near the capital Bujumbura, in the face of climate change, in particular through the construction of latrines, the recovery of sanitized manure as fertilize, the search for crops better adapted to the climate and new income-generating activities.

Technology development and transfer: the project has enabled the development of latrines, eco-sanitation and a more in-depth analysis of EcoSan derivatives, which have been in use since 2013, in order to optimise their use, identify the most receptive crops and the organic and mineral complements needed for other crops, as well as the possibilities of obtaining them locally.

– "Project to set up a sector for the construction of environmentally friendly housing in the Northern Region of Burkina Faso" led by SOS FAIM. Context of the project: Burkina Faso, a Sahelian country, is facing a growing degradation of its forest areas, under human

pressure. In addition to its use to cook meals, the use of wood (and straw) for traditional constructions is one of the causes. Faced with the scarcity of these traditional materials, low-income rural populations are increasingly resorting to sheet metal construction. However, the homes are poorly adapted to high temperatures and storms. Beneficiaries of the pilot projects, 54 rural households with few resources will have access to a sustainable housing solution adapted to local climatic conditions and 12 farmers unions or groups (primarily women's groups) will benefit from new agricultural buildings, processing or storage premises, premises for their training, etc. Information on Technology transfer and development : Building differently in Africa : The Nubian vault techniques, which is 2000 years old, has being redeveloped by the Nubian Vault (AVN) Social Association. The technique provides buildings that are much more durable and better adapted to local climatic conditions, both for private use and for public, community or agricultural uses. By dispensing with wood and sheet metal, it helps to reduce the pressure on forest resources, avoids greenhouse gas emissions related to the manufacture and transport of cement and sheet metal, and limits the cost of expensive imported materials. The money saved can then be reinvested in local rural economies. Specialized technical assistance was provided by the Nubian Vault Association to supervise the construction sites and train more than 80 artisan masons (farmers with little work in the dry season or people working in the informal economy, with a low level of education), trainers and site managers with entrepreneurial skills.

- "Climate Change Adaptation and Mitigation Support Project people of Saloum supported by the NGO ULB-Cooperation in Senegal". (Gandiaxx Day Nate (GDN) au Sénégal led by ULB-Coopération and its local partner, Nebeday **Information on Technology transfer and development**: Project on sustainable mangrove management through the **dissemination of improved stoves** to use less wood for cooking, carbon sequestration, sustainable management of natural resources. The project also continued the dynamic of exchanges with scientists.
- "Women, Soils and Energy" Project led by the NGO Eclosio in Benin. The aim was to make women agents of change, facilitating the adoption of sustainable agricultural and energy practices on farms. **Information on Technology transfer and development**: over the course of the project, **2 000 women** will each have 2 improved earthen stoves built by a specially trained villager, one for the dough and the other for the sauce that accompanies the meal, which will allow them to halve the wood used, the chore of collecting and deforestation. In addition, the fireplaces have a chimney to evacuate the smoke from the hut ad reduce eye and lung diseases usually caused by smoke.
- « Project to promote raw earth habitats to fight climate change and deforestation in the Atacora region of Benin, led by UCLouvain. Context: The Atacora region in northern Benin is seeing, as in the previous project, a gradual decrease in the number of its raw earth dwellings (HTC), including the tatas, splendid small fortified farms with their straw-topped granaries, which are part of its identity. In Atacora, there are more and more modern habitats using cement, cinder blocks and sheet metal, which consume a lot of energy and are less well air-conditioned than traditional housing. Still, HTCs should be promoted, using a material that is widely available and using rudimentary tools. Their production does not generate GHGs. In addition, they mobilise ancestral know-how and are potential generators of economic income. **Information on Technology transfer and development** : Among other objectives and results, this project included the training of monitors for the **construction of improved stoves** and monitors specialized in restoration and earthen construction, pilot sites, model buildings, etc. At the end of the project, the trained staff was able to **pass on the skills acquired to the people and local authorities** and, in doing so, to **promote earthen housing again in the Atacora**.
- "Provision of solar equipment to analytical laboratories around the lake Tanganyika in addition to the integrated resource management project in Great Lakes Region / **installation of photovoltaic solar panels** » (top-up project from the Enabel's Sahel project portfolio, funded by Wallonia and implemented in the field by Enabel). Recipient: Burkina Faso and Senegal mainly, The Great Lakes Region. **The Lake Tanganyika Water Quality Monitoring Network laboratories are powered by renewable energy from solar photovoltaic installations**. Information on Technology transfer and development: As part of the integrated management of water resources in the Great Lakes region, the top-up consists of a project to equip the analysis laboratories of the four countries bordering Lake Tanganyika with the installation of photovoltaic solar panels with electricity storage (EUR 500 000.00). The study mission on the sizing of solar photovoltaic systems aims to propose facilities to ensure the operation of laboratories in isolation from the local electricity network that is often uncertain in terms of quality and energy availability. The possibility equipping one or the other laboratory with batteries with a very low environmental impact will be studied and possibly implemented for one of the 4 laboratories. The launch of the 4 calls for tenders is scheduled for early 2023 with the aim of equipping the laboratories as soon as possible, taking

into account the constraints and imperatives related to the availability of technical and electronic equipment and tensions related to maritime transport if applicable. The installation phase of solar photovoltaic equipment will include training dedicated to operation and maintenance of the facility **CRH solar photovoltaic plant, Uvira, DRC** The solar photovoltaic system of the CRH (Uvira) will be installed the week of October 09, 2023 and will deliver a minimum power of 20 KWh allowing the analysis laboratory to operate autonomously of the waters. Provisional acceptance is scheduled for October 2023. **TAFIRI solar photovoltaic plant, Kigoma, Tanzania** The solar photovoltaic system of Tanzania Fisheries Research Institute - TAFIRI (Kigoma) will be installed in November 2023 (given the additional pre-import certification deadlines in Tanzania) and will deliver a minimum power of 24KWh allowing the laboratory to operate autonomously water analysis. Provisional acceptance is scheduled for December 2023.

5.5. Capacity-building support provided

Capacity building is an essential element of all programs and projects of Belgium's climate action. In what follows some concrete examples are given.

The Federal Government

The federal government provided support to three in-country NDC Facilitators in partner countries Niger, Burkina Faso and Rwanda through the NDC Partnership, in response to requests from these countries. In-country facilitators are local experts tasked with supporting the government in engaging, coordinating, facilitating and mobilising actors and resources for the implementation of the country's NDC. The in-country facilitator is embedded into the relevant government Ministry in order to strengthen national capacity. In 2021 this support was upscaled significantly with annual contributions to the NDC Partnership Action Fund. The PAF ensures countries have better access to technical and financial resources and the widest possible range of Partnership members can respond rapidly to the needs of developing Country Members.

The federal government also supported the Partnership on Transparency in the Paris Agreement (PATPA) with the establishment of a Q&A service which enables member countries of the French-speaking cluster to request specific and limited support for transparency matters such as inventories and reference scenarios to update or improve NDCs. These capacity building efforts were also significantly increased in 2021 through a cooperation with UNDP's Climate Promise and the UNFCCC secretariat.

In this context, it is also appropriate to highlight Belgium's support to the Local Adaptive Living Mechanism of the United Nations Capital Development Fund, fostering locally led solutions for adaptation to communities; aiming to bring climate finance from the global to the local level. It is an internationally recognized standard/mechanism that helps local government authorities in developing and least developed countries access the climate finance, capacity building and technical support they need to respond and adapt to climate change.

Brussels-Capital Region

In the context of the above-mentioned project in Rwanda, the Brussels-Capital Region, in collaboration with its implementing partner agency Enabel, aimed for an approach that promotes capacity-building. Local engineers and masons are being trained in the technique of constructing stone arch bridges. This training was conducted in both the private sector and in educational institutions, including the Institute of Engineers and the Rwanda Transport Development Agency (RTDA). So far, 83 engineers and 13 masons have been trained.

Government of Flanders

"Cross-border collaboration for climate-resilient watersheds" coordinated by Join For Water (partners: Protos Andes, Naturaleza y Cultura Internacional, De Watergroep). An information and education stakeholder platform on water is supported by three pillars.

- Education and research: Capacities of specific target groups, such as water technicians, operators of water systems, local government representatives, and women's groups, are strengthened through a binational water school. The aim is to understand and address the impacts of climate change on water resources and infrastructure.
- Water and biodiversity: Support is provided for the development of protection plans for affected water-rich ecosystems, along with the implementation of nature restoration activities to restore and enhance the climate resilience of these ecosystems.
- Environmental policy: Support is provided for the development and establishment of a binational water fund as a mechanism to redistribute financial contributions from companies, governments, and communities in the basin for targeted climate adaptation and mitigation solutions.

Through the combination of capacity building activities, nature restoration, and the development of financial support mechanisms, solutions for climate adaptation and mitigation can be developed at the appropriate geographic and institutional scale. This strengthens the social-ecological resilience of the watershed and its inhabitants in the long term.

Pilot interventions are conducted to protect and restore 39 000 hectares of vulnerable freshwater ecosystems. Healthier ecosystems will be better able to provide water for human consumption and food production, and will contribute to climate mitigation and adaptation measures, such as carbon sequestration and water regulation. A binational water fund is established, approved by the members of the information and education stakeholder platform.

The Walloon Region

- "Women, Soils and Energy Project led by the NGO Eclosio in Benin". The aim was to make women agents of change, facilitating the adoption of sustainable agricultural and energy practices on farms. Information on Capacity-Building : the leaders of income-generating initiatives in the villages will be part of an entrepreneurial logic (60 women trained in the manufacture of improved stoves, at least 25 women in the development of economic activities ; 1 200 women supported in the organization of collective savings and credit banks). 800 family farms were supported in the promotion of agroecological practices, sustainable land management and adaptation to climate change. The project supported the grouping of women through 5 communal associations and 2 departmental associations of Women Farmers (Atacora and Donga), so that they would be able to defend their rights and continue to offer hem training and supervision. 300 resource women were strengthened and involved in the reflection on the management of natural resources within the communities.
- Project to set up a sector for the construction of environmentally friendly housing in the Northern Region of Burkina Faso led by SOS FAIM. Context of the project: Burkina Faso, a Sahelian country, is facing a growing degradation of its forest areas, under human pressure. In addition to its use to cook meals, the use of wood (and straw) for traditional constructions is one of the causes. Faced with the scarcity of these traditional materials, low-income rural populations are increasingly resorting to sheet metal construction. However, the homes are poorly adapted to high temperatures and storms. Beneficiaries of the pilot projects, 54 rural households with few resources will have access to a sustainable housing solution adapted to local climatic conditions and 12 farmers unions or groups (primarily women's groups) will benefit from new agricultural buildings, processing or storage premises, premises for their training, etc. Information on Capacity-Building : The project initiated the development of a construction sector and the creation of a specialized support unit within the federation. It also contributed to the costs of a small numbers of construction sites (private homes and community buildings) in order to serve as an example and generate self-sustaining demand. The development of demand for these constructions at the end of the 32-month project has opened up prospects for social and professional integration, allowing them to live decently on the income from their work.
- « Un sol vivant pour une production durable »/ « Ten Viiga pour sol vivant », developed by the NGO îles de Paix in favour of populations (farming families) from Burkina Faso. It aims at environmentally friendly agricultural techniques such as agroforestry have been integrated into to cultivation practices of the intervention villages. The producers benefiting from the project will use enriched compost on their food corps. They applied mechanized zai to their cereal crops : using a rudimentary plough, made on site, they make holes in the desertified soil, put a little fertilizer on them and then sow or transplant a plant, recovering fields from the advancing desert. Additional information on capacity-building : Environmentally friendly practices have spread and have been transmitted between the villages of intervention of the NGO Îles de Paix, via the participation of the municipalities. Furthermore, the project introduced innovative techniques in nowadays farming families of Burkina Faso. At the time, the project complemented an ongoing programme funded by the DGD for a spin-off in other intervention villages (a total of 900 households / 7 200 people were positively affected by the action).
- Agroforestry Fields to Improve Resilience Project of farmers in the North of Kivu supported by the World Wide Fund for Nature (WWWF). Activity/ results and information on Capacity-Building: The project has mentored 300 family farming households for training on agro-forestry practices and sustainable land management in order to diversify their agricultural production and better withstand environmental and climatic constraints. In particular, school/pilot fields have been set up. The 300 households have strengthened their skills in order to market their products in the best possible way (simplified market analysis, rapid response to needs, facilitation of business links with agricultural product processing companies, etc.). Remark : knowing the terms of access to the carbon market, WWWF RDC has ensured that the proposed productions are technically eligible for the carbon fund by meeting the standards of the Verified Carbon Standard (VCS) for subsequent valorization.
- Climate Change Adaptation and Mitigation Support Project people

of Saloum supported by the NGO ULB-Cooperation in Senegal. (Gandiaxx Day Nate (GDN) au Sénégal led by ULB-Coopération and its local partner, Nebeday Information on Capacity-Building: the project aimed to improve the capacity for sustainable management of forest areas by different actors, whether public authorities politicians, members of protected area management committees or members of civil society.

– « Project to promote raw earth habitats to fight climate change and deforestation in the Atacora region of Benin, led by UCLouvain. Context: The Atacora region in northern Benin is seeing, as in the previous project, a gradual decrease in the number of its raw earth dwellings (HTC), including the tatas, splendid small fortified farms with their straw-topped granaries, which are part of its identity. In Atacora, there are more and more modern habitats using cement, cinder blocks and sheet metal, which consume a lot of energy and are less well air-conditioned than traditional housing. Still, HTCs should be promoted, using a material that is widely available and using rudimentary tools. Their production does not generate GHGs. In addition, they mobilise ancestral know-how and are potential generators of economic income. Information on Capacity-Building : this project aimed to increase local skills in restoration and construction and the transfer this knowledge and skills.

– « Support for the development of a sustainable and inclusive wood-energy sector in Senegal and Burkina Faso, complementary to the Regional Climate Programme from Enabel to Sahel » (top-up project from the Enabel's Sahel project portfolio, funded by Wallonia and implemented in the field by Enabel). Information on Capacity Building: First, a diagnosis of the capacities (technical, material, operational and managerial services) was carried out at the level of the departments (in particular the technical services decentralized, in the area of intervention, from the Water and Forestry Directorate of the Ministry of Environment and Sustainable Development) with a focus on participatory forest management. Indeed, in order to guarantee the sustainability of the actions and to encourage the continuation of the dynamics initiated, it is necessary to ensure capacity building of the State's technical services, in particular the forestry services. A diagnosis of capacities (technical, material, operational and managerial) was carried out at the level of the intervention area. Training sessions were organized on the application of the regulatory framework for the transfer of ecosystem management. In a second phase, training sessions were organized on the application of the framework on the transfer of forest ecosystem management to local communities and on participatory forest management, among others. Training and capacity building were organised for the production of AM in such a way as to (i) be able to meet the demand and (ii) constitute income-generating activities. Scrap metal craftsmen were also reinforced in order to offer metal fireplaces. Rice farmer/processors' groups have benefitted support and strengthening of technical and material capacities for the development of rice husks in briquettes.

5.6. Additional information

The federal government's development cooperation integrates the gender dimension transversally in all its interventions, which includes its climate finance, and also supports specific interventions. The following approaches are followed when it comes to gender: 1) a rights-based approach, 2) two-track approach on gender, mixing gender mainstreaming and gender-specific actions, and finally 3) contextualization according to national and local priorities.

In the selection process of project proposals received in light of the Flemish International Action Programme, specific attention goes to ensuring that the project proposals clearly indicates how it takes into account the socio-cultural and socio-economic situation of the project area and how it seeks solutions to take into account these situations as well as how local communities or target groups, including women, youth and marginalized groups are included in the execution of the project. The level of gender-responsiveness of the project calls is therefore an important indicator in the selection process. ■

6. Improvements in reporting

6.1. Areas of improvement identified by the Party and technical expert review team

This report is the first biennial transparency report, so it has not yet been improved following a review.

6.2. Addressing areas of improvement

Although there has not yet been a review of the biennial report in terms of transparency, as far as possible, the recommendations mentioned in the last review report of the 5th biennial report and the 8th National Communication have been taken into account in the various chapters concerned. ■

7. Other information

In order to educate and raise awareness about climate change and also to inform about all the measures taken in this context in the various sectors, Belgium carries out numerous actions with the public and stakeholders. A broad overview is available in the 8th National Communication of Belgium, whi[ch will be updated in our second BTR/9]th National Communication.

Belgium is a staunch defender of gender equality, which is legally entrenched by the federal gender mainstreaming law of 2007 which mandates all ministers to integrate the gender dimension into all policies, actions and measures. In this context, each legislature needs to put forward a federal plan on the integration of the gender dimension into all policies, on which the government needs to report regularly to the Parliament. With regard to climate, this reporting happens for two policy areas: adaptation and the implementation of the Paris Agreement. Belgium is signatory to the COP28 Gender-responsive Just Transitions and Climate Action Partnership. ■

8. Annexes

8.1. Common tabular formats annexes

- Common tabular formats for information necessary to track progress
- Common tabular formats for information on support provided and mobilized

The section 'Assessment of the achievement of the Party's NDC' of CTF NDC table 4 is not included here because it applies after the end of the BTR period only, and the CTF reporting tool does not allow filling in this information at this point in time.

8.2. Methodology applied for the identification of GHG emissions from international aviation and navigation in the scope of the EU NDC

The scope of the EU NDC goes beyond national GHG emissions and removals in the scope of the national GHG inventory; it also includes specific emissions from international aviation and navigation. This annex describes the methodology for identifying these emissions.

International aviation and maritime emissions are estimated by using the Joint Research Centre's Integrated Database of the European Energy System (JRC-IDEES).[1] It allows to split the international transport CO_2 emissions into into intraEU/extraEU and intraEEA/extraEEA and the departing flights from the EU to the UK and Switzerland, categories backwards in

[1] European Commission, Joint Research Centre, Rózsai, M., Jaxa-Rozen, M., Salvucci, R., Sikora, P., Tattini, J. and Neuwahl, F., JRC-IDEES-2021: the Integrated Database of the European Energy System – Data update and technical documentation, Publications Office of the European Union, Luxembourg, 2024, doi:10.2760/614599.

time (i.e. 1990)) (i.e. for the time period back to 1990).[2]

For international transport, JRC-IDEES applies a decomposition methodology that reconciles the scopes of available primary statistics and harmonises historical data on international aviation and maritime emissions, energy use, and transport activity. The resulting annual dataset covers 1990-2021 and distinguishes domestic, intraEU/intraEEA, and extraEU/extraEEA activity for each EU Member State, Norway and Iceland.

In aviation, JRC-IDEES distinguishes passenger and freight modes, with three geographical categories of flight origin/destinations for each mode: domestic, intra-EEA + UK, and extra-EEA + UK. Intra-EU, the UK, and EEA[3] categories are also used internally during calibration but aggregated for reporting. For each mode/category combination, JRC-IDEES estimates activity (as passenger-km or tonnes-km), energy use and CO_2 emissions, aircraft stock (expressed as representative aircraft), load factors, and aircraft efficiencies. As country-specific activity statistics are not available, the decomposition first allocates EU-level activity data from the Transport Pocketbook[4] of the European Commission's Directorate-General for Mobility and Transport to each country and flight category.

For passenger modes, this allocation calculates average load factors using Eurostat data on total passengers and flights. These load factors and total flight numbers are combined with average flight distances from EUROCONTROL, the pan-European organisation dedicated to air traffic management, to yield an initial estimate for passenger transport activity. For intra-EU activity, a uniform scaling factor is then applied across Member States to match total EU-level Transport Pocketbook data. Freight activity follows a similar process, using a 'representative flight' concept with a common load factor across all Member States to account for mixed passenger-freight flights.

Next, the decomposition estimates fuel use from EUROCONTROL data, by deriving a distance-dependent average aircraft efficiency, then applying it to the country-specific ensemble of flights and routes. The final step scales the estimates to meet Eurostat energy balances for total domestic and international consumption back to 1990 values, maintaining intra-EEA/extra-EEA fuel use ratios derived from EUROCONTROL. JRC-IDEES additionally reports resulting differences with submissions by Parties to the UNFCCC. The above process is followed throughout the entire decomposition period (1990-2021). Data gaps are estimated from the existing indicators as follows:

- The process iterates backwards towards 1990, starting from the oldest years in which data is available in each Member State.
- Average flight distance is kept constant for early years without EUROCONTROL data (generally before 2004).
- If the load factor (passengers per flight) cannot be calculated due to a lack of passenger and/or flight data, it is estimated from the trend of the existing time series.
- Missing numbers of flights are calculated from the load factor and the passengers carried.
- If no passenger data is available, the total mileage is estimated from the energy consumption, and combined with average flight distance to estimate the number of flights. The number of flights is then combined with the load factor to estimate the total passengers carried.
- For early years without data, constant values are assumed for the factors used to *i)* scale intra-EU activity to the Transport Pocketbook, *ii)* adjust the estimated fuel use to EUROCONTROL data for specific routes, and *iii)* scale this adjusted fuel use to Eurostat energy balances (e.g. before 1995 for Transport Pocketbook data; before 2004 for EUROCONTROL data).

For international maritime transport, JRC-IDEES estimates data both for intra-EU/extra-EU and intra-EEA/extra-EEA geographical categories. The emission estimates in the GHG inventory already include CO_2, CH_4, and N_2O gases. Transport activity (tonnes-km) is estimated from Eurostat data on gross weight of transported goods, using port-level and country-level data for intra-EU and extra-EU categories, respectively. Intra-EU activities are then scaled to match the Transport Pocketbook totals, accounting for domestic coastal shipping (calibrated separately in JRC-IDEES). Next, transport activity is combined with data reported under the monitoring, reporting and verification system for maritime transport under the EU ETS ('THETIS MRV'[5]), namely EU-level mileage data and country-specific vessel sizes to estimate load factors (tonnes per movement). The load factors and resulting annual mileage (km) are calibrated to meet EU-level THETIS MRV mileage. The annual mileage is in turn combined with THETIS MRV average efficiency to yield a total technical energy consumption, with corresponding emissions derived from default emissions factors. This energy consumption is scaled to Eurostat energy balances so as to minimise discrepancy to total intra-EU THETIS MRV emissions.

[2] The JRC-IDEES analytical database is designed to support energy modelling and policy analysis, by combining primary statistics with technical assumptions to compile detailed energy-economy-emissions historical data for each key energy sector. For aviation, EEA emissions includes emissions related to the UK but not to Switzerland, where total CO_2 emissions for the scope are additionally estimated from EUROCONTROL data.

[3] In this annex, EEA stands for European Economic Area, which comprises the 27 EU Member States, Iceland, Liechtenstein and Norway.

[4] Statistical pocketbook 2023, https://transport.ec.europa.eu/facts-funding/studies-data/eu-transport-figures-statistical-pocketbook/statistical-pocketbook-2023_en.

[5] THETIS MRV, https://mrv.emsa.europa.eu/#public/eumrv.

As with aviation, JRC-IDEES reports corresponding differences to submissions under the UNFCCC. Early years with data gaps are estimated from existing indicators as follows:

- The process iterates backwards towards 1990, starting from the oldest years in which data is available in each Member State.
- Average distance of voyages is kept constant for early years without Eurostat activity data (generally before 1997-2000).
- If the load factor (tonnes per movement) cannot be estimated due a lack of activity data, it is kept constant.
- If activity data is not available, it is estimated from Eurostat energy consumption.
- Missing mileage data is derived from the activity and load factor estimates.
- For early years without data, constant values are assumed for the factors used to i) scale intra-EU activity to the Transport Pocketbook, ii) scale estimated mileage to meet EU-level THETIS MRV mileage, and iii) scale domestic and intra-EU CO_2 emissions estimated from energy consumption so as to match total THETIS MRV CO_2 emissions.
- Finally, the ratios between the estimated MRV emissions and the CO_2 emissions for the reported transport activity (for intra-EU/EEA and extra-EU/EEA categories) between 2018 and 2021 are used to calculate the MRV compliant estimates back to 1990 levels.

For the year 2022, the international navigation and aviation emissions under the EU NDC scope have been estimated by applying the same share of those emissions on the total international navigation and aviation emissions (as reported in the GHG inventory) as in 2021.

Aviation emissions covered by the EU NDC scope

Emissions	Domestic aviation		Intra-EEA aviation			Extra-EEA aviation
Current NDC commitment	Domestic EU flights (e.g. Palermo Milan	Domestic "non-EU EEA" flights (e.g. Oslo to Bergen)	Flights between "non-EU EEA" countries (from Oslo to Reykjavik)	Flights within the EEA, departing from EU airports	Flights to/from EU airports to OMRs	Departing flights from EU airports to UK and Switzerland
Current NDC commitment	Yes	No	No	Yes	Yes From Jan 2024	Yes

Maritime navigation emissions covered by the EU NDC

Emissions	Domestic maritime navigation		International maritime navigation				International maritime navigation	
	Domestic EU flights (e.g. Palermo Milan	Voyages within NO/IS (e.g. Oslo - Bergen	Voyages between two EU MS (e.g. Valencia - Rotterdam)	Voyages between a MS and NO/IS (e.g. Rotterdam - Oslo)	Voyages between an EU MS and a third country	Voyages between NO/IS and a third country (or IS/NO)	Emissions within a port of an EU MS (reported under domestic emissions)	Emissions within a port of NO or IS (or another third country)
Current NDC commitment (CO_2; CH_4; N_2O)	Yes	No	Yes	No	No	No	Yes	No

8.3. Description of used models

8.3.1. Flemish energy and greenhouse gas simulation model

A new Flemish simulation model has been developed in 2014 (and is continuously updated since) to construct short term projections for Flanders.

The simulation model is a projection model for energy demand, greenhouse gas emissions and emissions of air pollutants (SO_2, NO_x, PM and VOC) that covers most of the relevant emission sectors (energy sector, industry, waste, agriculture, residential and commercial buildings).

This simulation model works as a "bottom-up" type, i.e. explaining energy consumptions and emissions from activity variables expressed as far as possible in physical units, and the main determining factors of the evolution of energy demand and emissions.

The model, which includes a database on the energy consumption, emission factors, activity data and reduction effects of climate & energy and air quality policy measures, can be used in particular for:

- the construction of a reference scenario (business as usual), representing the expected future evolution in the absence of any new emission reduction policy based on expected economic and demographic evolutions;
- constructing emission reduction scenarios, based on the implementation of a combination of reduction measures;
- assessing the impact of existing or draft legislations on energy consumption and emission levels.

The model starts from reference year data:

- energy demand per industrial sector;
- emissions per industrial sector;
- large combustion plants and all electricity producing plants are included at installation level (energy consumption, electricity production and emissions);
- detailed information on the evolution of the installed power for electricity generation (including electricity import);
- a representation of the structure of the residential heating (type and age) and of residences (idem for the heating of tertiary buildings).
- Share of the emissions, per sector, that comes from processes (and thus is not related to fuel consumption).
- For the agricultural emissions (dust, greenhouse gasses and ammonia emissions coming from stables and from manure), the starting point is the number of animals (detailed per animal category and per type of stable) and the amount of manure that is spread out.

For the residential sector, projections are driven by assumptions on degree days in the future, the share of new residences and the lifetime of existing installations. Policies on energy efficiency and on ecodesign are taken into account.

For industry, major assumption are the evolution of industrial activity and energy efficiency (yearly growth rate per sector), the share of CHP per sector and the lifetime of installations (since new installations mostly can respect lower emission levels than the existing ones). This leads to a projection on energy consumption and electricity.

Electricity demand from all sectors (including transport) is the main driver for the electricity part of the model. The model searches for the most cost optimal mix of electricity generating installations (including import) to produce the necessary electricity, taking into account different time slices (electricity demand is not equal in winter and in summer, neither during night or day), based on production efficiencies and fuel cost. The model has the possibility to install additional production capacity (CCGT or gas turbine).

For all energy consuming sectors, energy consumption is translated into emission projections through emission factors (per fuel) that reflect policy (either current policy or additional measures). For industry and electricity production, current emission factors are compared to the emission factors based on policy and the lowest of both is used (installations that already comply with future emission standards don't need to realize additional reductions). For the residential sector, the emission factors take into account the use of different types of boilers and stoves.

For the agricultural sector, the predicted number of animals is multiplied with animal specific emission factors (both for the greenhouse gasses as for ammonia and dust). These emission factors are lower for the new low emission stables. The amount of manure that is spread out is multiplied with specific emission factors.

8.3.2. FASTRACE[6] (Road transport in the Flemish Region)

FASTRACE is a software tool implemented by VITO to calculate spatially disaggregated emissions (on line segments) from road transport for a region of interest. The output of FASTRACE is designed for use as input to urban scale air pollution models.

FASTRACE starts from a detailed break-down of the vehicle fleet on the one hand (number of vehicles per vehicle type, annual mileage per vehicle type) and from geographically explicit vehicle counts per road segment on the other hand (number of passing vehicles per road segment and the associated speed). This data is often provided by a software tool that can simulate the flow of traffic (e.g. VISUM).

[6] https://vito.be/en/product/fastrace-traffic-emission-model

The emissions within FASTRACE are estimated based on country or region specific emission factors extracted from COPERT, the software used worldwide to calculate emissions from road transport. As the vehicle speed determines the emission factor to a large extent, FASTRACE also takes this parameter into account and employs speed dependent emission factors. FASTRACE offers numerous flexibilities in calculating detailed geographically distributed emissions for road transport, both for small and large regions.

8.3.3. EMMOSS model

The EMMOSS model is used to calculate emissions from:

- Track locomotives and railcars in rail traffic
- Inland navigation
- Maritime navigation

Emissions from railway locomotives and railcars are calculated using the EMMOSS model based on gross tonne-kilometres, specific final energy consumption and emission factors.

Emissions from inland navigation are calculated using the EMMOSS model. The model calculates based on the number of tonne-kilometres travelled by inland vessels per waterway. This information comes from the waterway manager "De Vlaamse Waterweg". Other parameters in the model are: the percentage of vessel kilometres empty per waterway, sulphur percentage in fuel, age distribution of vessel types, speed of vessels, distance (route) of the waterway.

Emissions from maritime shipping are calculated using the EMMOSS model. Emissions are calculated in Flemish ports, on the Schelde in the port of Antwerp and at sea within the 12-mile zone. Maritime shipping includes : merchant shipping, military vessels, sea fishing, tugboats, dredging activities and sand extraction at sea and in the port. Emission factors are combined with data on loads and discharges from MORA (Mobility Council), Department of Agriculture and Fisheries, quantities of sand dredged, data from dredging companies and towage services.

More detailed information (in Dutch) can be found via https://www.tmleuven.be/en/project/emmoss.

8.3.4. Modelling tools in the Walloon Region

8.3.4.1. TIMES-Wal

A new model, called « TIMES-Wal » has been developed for Wallonia since 2016. After a transition period, he model is used for the first time for reporting purposes for WEM and WAM scenarios. TIMES-Wal model has been built in close collaboration between public (the Public Service of Wallonia) and private actors (ICEDD and E4SMA).

The TIMES model generator was developed by IEA-ETSAP (International Energy Agency-Energy Technology Systems Analysis Program). TIMES belongs to the "bottom-up" energy system models: it is based on a detailed technological set with associated costs and technical parameters. TIMES is an integrated model: one change in a sector can impact any other sector. TIMES is an optimization model: it must satisfy all energy service demands and constraints while minimizing the costs. In TIMES, perfect foresight (i.e. all future events within the defined temporal horizon are known) and competitive markets are assumed.

The model is calibrated in order to best reflect the energy consumption data provided in the regional energy balance and the emission inventories. For all energy consuming sectors, energy consumption is translated into emission projections through emission factors (per fuel). At this stage, the model is fully calibrated for the year 2018 and later data is integrated through additional constraints, demand evolution,…

TIMES-Wal is a single region model. The interactions with other regions and countries are modelled through exogenous import and export processes. The temporal horizon is 2050.

TIMES-Wal does not include all the regional emissions. The model considers only the combustion emissions of the main regional sectors described in the model (which account for most of the combustion emissions).

For reporting purposes, specific sectoral discount rates are considered.

The energy system is divided into 7 main sectors: residential, commercial, industrial, transport, agricultural (only combustion), supply and electricity generation. The model uses very detailed regional data coming from regional studies. Updating models on the basis of the best available data, collected through studies or actors, is an important point of attention.

Residential

The residential sector modelling is based on a comprehensive typology of buildings (20 categories of existing buildings depending on the period of construction and on the number of facades, and distinguishing apartments and houses). For each category, building surfaces are described and net needs for space heating and hot water are differentiated.

The evolution of demand for new buildings is defined according to the expected growth in the number of households. For those new buildings, specific net needs take into consideration that new buildings are more and more efficient according to the existing regional regulation.

In addition to hot water and space heating, other energy services are defined: lighting, cooking, refrigeration and freezing, cloth washing and drying, dish washing and other electricity services.

To satisfy all the demands, a set of technologies is described through the standard parameters: type of commodity, stock, efficiency, availability factor, lifetime, etc.

The model can choose to invest in four types of retrofitting options (walls, roof, windows, and ground renovation). The retrofitting options are differentiated according to the 20 categories of buildings.

Commercial

The evolution of demands is linked to employment growth.

The commercial sector is divided into 7 subsectors: education, health, culture and sports, shops, private offices, public offices, datacentres. Different energy services are defined: heating, hot water, cooling, and other services including cooking, private and public lighting, refrigeration, and other electrical devices.

Demands are defined here in PJ (detailed data on surfaces for the commercial sector are not available). The structure of the sector is very similar to the residential one: the base year technologies and new technologies are defined, and retrofitting options are also included.

Industry

The future evolution of demands is driven by hypotheses on economic activity.

The industrial sector is divided into 20 subsectors: milk, sugar, transformed potatoes, other food industry, cement, lime, hollow glass, flat glass, bricks, ceramics, other non-metallic minerals, ammonia, other chemicals, wood industry, pulp and paper, iron and steel, non-ferrous metals, non-energy consumption (chemicals and others) and other industries.

The industrial sector is modelled with data on each specific sub-sector (costs, temporal availability of new technologies…) and accurate data on production processes.

Transport

Concerning road transportation, demands are described in terms of passenger-kilometres or in tonnes- kilometres. For the other transport modes, the demand is simply described in terms of energy demand.

As in typical TIMES models, individual modal travel demand is exogenously defined over the model time horizon. While technologies can compete within modes based on technical parameters and cost, there is no competition between modes.

The TIMES-Wal transport sector includes a stock of technologies, in competition, that contribute to meet each exogenously defined modal travel demand. Regarding aviation, railways and domestic navigation, only one generic technology is described.

Agriculture

For the agriculture sector, only the combustion-related part is included in TIMES-Wal model. Different energy services are defined: electric appliances, house heating and off-road.

Electricity generation

Electricity demand from all sectors is a main driver for the electricity part of the model.

Every year is divided into time slices in order to best reflect variations in the load curve for electricity demand and intermittent energy sources. Each representative day is divided into multiple periods in order to consider different day and night times.

The electricity generation sector is described in detail and regroups all the main activity producers, that is those generating electricity (and heat) for sale to third parties through the grid. Three main types of producers are separately regrouped: the nuclear, renewable and thermal power plants.

Concerning new technologies, the model can make its choice on a varied list of new plants (gas power plants, renewable energy plants, …) based on technical parameters and costs.

For Belgian reporting purpose "TIMES-Wal" is only used to model renewable and CHP (the rest being modeled on a Belgian scale).

8.3.4.2. Excel tools

Excel tools are used by Wallonia to estimate some sectors non included in TIMES-Wal: agriculture (excluding energy) and waste. For agriculture, different parameters are used to estimate the evolution of activity data (for example: livestock, agricultural area and fertilizer uses). For waste, the analysed parameters are the amount of total waste disposed, the recovery rate of landfill, CH_4 and N_2O emissions of wastewater handling, etc.

8.3.5. Energy and Atmospheric Emissions projection model for Brussels-Capital Region

Brussels Environment has developed an energy and emission projection model for the Brussels-Capital Region. The model is developed in Excel and it is a bottom-up type model. It is compose of 4 main sectoral modules: Industry, Residential, Tertiairy and Energy Production. The model has been calibrated for each sector with the regional annual energy balances from 2000 to 2020. The modelled energy consumptions have then been converted into atmospheric emissions through emission factors, the ones used to establish the emission inventories. The model produces information for serveral energy carriers such as: natural gas, light oil, propane/butane, coal, electricity, wood, heat; and for several pollutants: CO_2, CH_4, N_2O, NO_x, NMVOC, SO_x, NH_3, $PM_{2.5}$.

The model also takes into account the direct emissions that are not related to energy consumption: i.e. the fugitive methane emissions of natural gas delivery, the industrial processes ans product use, and waste (composting plant, water purification plant).

This model is a dynamic one. It allows new available data to be integrated (for instance future energy balances) as well as new assumptions reflecting new studies and new phenomena (in the fields of regulation, technological change, through awareness campaigns, incentives, or the evolution of energy costs, among others.

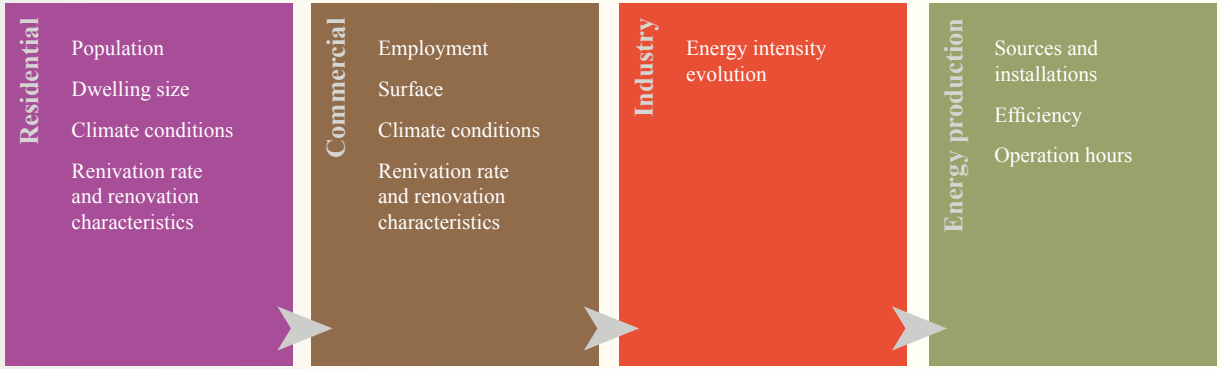
Each sector is defined by different parameters that impact the future development as shown in Figure 31.

8.3.6. Transport Emission Projection model for Brussels-Capital Region

The calculation of atmospheric pollutants emissions and fuels consumption for road transport is based on the European COPERT IV approach. The model used starts from the last known vehicles fleet circulating on the Brussels road network, available from the emissions inventories. The projections of the evolution of the vehicles fleet are based on historical survival curves, combined with other constraints like LEZ exclusions. The mobility demand scenarios comes from the Good Move project of Brussels-Mobility (scenarios No Move [WEM scenario] and Good Move [WAM scenario]). New vehicles are added to the fleet if the existing fleet, combined with annual mileages, does not reach the total mobility demand.

The Good Move scenarios have been simulated with the Multimodal strategic displacement model for BCR (MUSTI), which allows a mathematical modelling of passengers' behaviour in the BCR during a regular working day. The model is based on surveys and counting that provides a precise view of the mobility situation in the region. MUSTI is calibrated with a variety of observations. The counting shows, as precisely as possible, the displacement per road section, per vehicle type and per hour as well as the chosen itineraries. The model calculates the mileage focusing in the rush hours (morning 6h-10h and evening 15h-19h).

Figure 31 Key parameters for projections



Pollutants emissions calculations with COPERT have been processed using the same software version and hypotheses as for the UNFCCC 2021 GHG inventory preparation. Fuels consumption are detailed for gasoline, diesel, LPG, CNG and electricity. In Belgium, biofuels are mixed with gasoline and diesel in public fuel tank stations (blends). The CO_2 emissions from the biogenic part of fuels (bioethanol or biodiesel) are calculated on the basis of the composition of blends, which may vary from year to year.

For railways, the evolution of liquid fuel (gasoil) consumption is derived from the evolution of freight transport demand at the Belgian level. The starting point of the projections comes from the regional energy balance. Pollutants emissions are calculated by combining fuel consumptions with emission factors from IPCC 2006 Guidelines for national emission inventories.

For inland navigation, the evolution of liquid fuel (gasoil) consumption is derived from the evolution of freight transport demand at the Belgian level. The starting point of the projections comes from the regional energy balance. Pollutants emissions are calculated by combining fuel consumptions with emission factors from IPCC 2006 Guidelines for national emission inventories.

8.3.7. Off-Road Emission model (OFFREM)

The emissions from off-road are estimated using the OFFREM model (OFF-Road Emission model), which is used by the three regions. This makes it possible to report emissions for Belgium in a coherent manner in the context of mandatory international reporting.

Both exhaust and non-exhaust emissions by non-road mobile machinery are calculated for each sector separately, based on statistical data. Emissions are estimated based on detailed energy consumptions of non-road mobile machines and vehicle kilometres of non-road vehicles, according to following methodology:

Exhaust emissions

– Technology related pollutants (NO_x, VOC, NMVOC, CH_4, CO, N_2O, NH_3, PM and benzene)
  - Mobile machines: emission factors from EMEP/EEA for non-road mobile machinery are used (EMEP/EEA 2017).
  - Non-road vehicles: emission factors are derived COPERT IV (version 11.4) calculations for speeds of 15 km/h.
  - Emission factors for passenger cars on CNG are added, based on COPERT IV calculations. Euro 4 up to Euro 6 are available. For Euro 6DTemp and Euro 6 the emission factor for Euro 6 is kept.
  - EC emissions are added. f-BC (fraction of BC within PM) reported in the EMEP/EEA methodology is used for machinery. For vehicles, the f-EC (fraction of EC within $PM_{2.5}$) is calculated based on COPERT IV (version 11.4) for speeds of 15 km/h.

– Fuel related pollutants (SO_2, CO_2, heavy metals)
  - Biofuels: as from 2009 biofuels are mixed into commercially available fuels. Within the offroad sector, equipment on diesel is assumed to use red diesel, and thus no biofuels are present. For equipment on petrol the Belgian fuel mix for road transportation is assumed. The fuel mix in weight percentage can be adapted per year, sector, fuel type and machine vs vehicle.
  - SO_2 and Pb emissions depend on the sulphur and lead content of fuels used. For this purpose, the parameters used in the COPERT runs for the Belgian emission calculations for road transport are applied.
  - CO_2 emissions depend on the fuel type. IPCC emission factors are applied.
  - Heavy metals also depend on the fuel consumption. Tier 1 emission factors per fuel type from EMEP/EEA for non-road mobile machinery (2017, Table 3-1) are used. For CNG and LPG, emission factors derived from COPERT IV are applied.

– ○ PAH/POP:
  - Mobile machines: Tier 1 emission factors in mg/kg fuel from the EMEP/EEA Air Pollutant Emission Inventory Guidebook for non-road mobile sources and machinery are applied (EMEP/EEA 2017, Table 3-1).
  - Non-road vehicles: bulk emission factors in µg/km for the EMEP/EEA Air Pollutant Emission Inventory Guidebook for road transportation are applied (EMEP/EEA 2016a, Table 3-75). Note that these emission factors are no longer based on the fuel consumption, as was the case in OFFREM I.

Non-exhaust emissions: emissions of PM (brakes, tyres, road surface, clutches, chassis and shovel) are included.

– Mobile machines: non-exhaust emission factors of CARBOTECH are implemented (Carbotech, 2000).
– Non-road vehicles: EMEP/EEA Tier 2 non-exhaust emission factors and size distributions are applied for PM emissions, as used in calculating road transport emissions in the Belgian emission inventory (EMEP/EEA 2016b, Tables 3-4 and 3-5 for tyre wear, Tables 3-6 and 3-7 for brake wear and 3-8 and 3-9 for road surface wear). For heavy vehicles (trucks and buses) a load factor of 100% is assumed. To calculate the emission of non-exhaust heavy metals, the mean value of the weight fraction in table 3-12 is implemented.
– Only resuspension emissions for the sector 'agriculture' are included.

8.3.8. F-gas projections

F-gas projections are made through separate study assignments. In the most recent projection study[7], the methodology per sector is explained in detail. In general, it can be stated that the projection of F-gases is based on the same methodology as the emission inventory. It also uses assumptions consistent with those of this inventory. The projections have been established simultaneously for Belgium and for each of the three Regions, on a harmonised basis (regarding methodology and assumptions), in the same way as for the emission inventory. This means that when there is uncertainty on a parameter, as long as there is no evidence of a difference between regions on the value of that particular parameter, a common value has been chosen.

All calculations have been performed by extrapolating into the future the calculation models of the emission inventory, year by year, from 2021 up to 2050, which allows to consider changes in parameters occurring between the 5 yearly projection years, as well as the dynamic aspects of yearly stock changes.

It should be stressed that there are many uncertainties. The projections are

[7] https://www.cnc-nkc.be/sites/default/files/report/file/final_report_2022_public_-_projections.pdf

not meant to be forecasts, they are based on many assumptions and should be considered as a possible future, given the anticipated legislative context. In the context of these uncertainties, a conservative approach has generally been pursued, i.e. the assumptions made generally tend to overestimate rather than underestimate the emissions.

The calculation method is specific to each sector. All sectors of the emission inventory have been considered, even the smallest ones, which ensures complete consistency with the inventory.

8.3.9. Crystal Super Grid power model

The CRYSTAL SUPER GRID power model is developed by Artelys[8] and belongs to the family of unit commitment optimal dispatch models. These are models in which the optimal mix of generation technologies in a given area (country, region, continent, etc.) is determined as a function of demand. The optimal mix corresponds to the configuration where total production costs for the are minimized, and electricity demand is covered by production at all times, given a certain production, taking into account a certain number of technical and physical system limits.

These technical and physical limits may concern power plants (maximum efficiency, ability and/or speed and/or speed of start-up and power adaptation, etc.), interconnection (possibility and capacity of electricity exchanges with a neighbouring country), demand management (possibility of shifting part of the electricity demand over time, or even erase it), etc.

Unit commitment' refers to the process of determining which units are activated at which times and are therefore able to produce electricity. The decision may be made by the operator (in the case of thermal power plants), but activation can also be the result of a fortuitous phenomenon (for units dependent on weather-dependent units such as wind turbines or solar panels). As for “Economic dispatch”, it refers to the actual production of the various power plants successively activated, according to the cost-effectiveness criterion.

Belgium is not modelled as an isolated island: interactions with the power systems of the countries of the CWE zone (Central Western Europe) and Southern Europe (Portugal, Spain and Italy), which in turn must ensure a balance between supply and demand at all times, while taking into account a number of technical and physical constraints. As a result, the optimal electricity mix is not determined at Belgian level alone. If it is more cost-efficient to operate a power plant abroad and import surplus electricity (electricity that is not needed to cover demand in the country of production), this possibility must also be included in the calculations.

Unit commitment optimal dispatch models use relatively complex optimization algorithms, given the very high number of possible combinations of active and inactive generation units in the power system, for each unit of time. Typically, the time period studied is the whole year, hour by hour, so that 8760 time units are examined. The time horizon covered by the model can vary from short-term (e.g., 1 to 3 years) to long-term horizon (e.g., to 2030). ■

[8] https://www.artelys.com/crystal/super-grid/

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