

National Energy and Climate Plan

**NECP
2021-2030**

Section B - Analytical Basis

Current data and projections

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Belgium

1. Description of the current situation and projections with existing policies for each of the five dimensions

In the rest of this document, projections taking account of existing policies are referred to as the 'WEM scenario' (WEM = with existing measures).

General parameters and variables

The projections are specifically based on changes in the population and number of households and on the number of heating degree days. They are not based on changes in prices or costs (fuels, CO₂, technology, etc.), or on projections for macroeconomic variables (GDP, value added and disposable income).

Table 1 - Parameters and variables specifically used in the projections with existing measures

	2005	2010	2015	2020	2025	2030
Population (in millions)	10.4	10.8	11.2	11.5	11.8	12.0
Number of households	4.4	4.6	4.8	5.0	5.1	5.2
Household size	2.4	2.3	2.3	2.3	2.3	2.3
Heating degree days	1,828	2,309	1,688	1,870	1,870	1,870

Source: Assumptions, compilation of regional projections for 2020-2030.

Household size = average number of people per household.

Dimension decarbonisation

1.1.1. GHG emissions and removals

**Table 2 - Trends in GHG emissions
(WEM scenario, in Mt CO₂eq)**

	2005	2010	2015	2020	2025	2030
Total excluding LULUCF	145.3	132.9	117.1	113.3	119.6	127.5
Total including LULUCF	142.3	131.4	115.9	112.6	118.7	126.3
EU ETS (according to ETS 2013-2020 scope)	66.6	54.8	44.7	42.3	49.8	58.1
ESD ¹ (according to ETS 2013-2020 scope)	78.6	78.1	72.4	71.0	69.8	69.4
LULUCF	-3.0	-1.5	-1.2	-0.7	-0.9	-1.2

Source: Belgian CRF report (15 March 2019) for 2005-2015;

compilation of regional and federal projections for 2020-2030.

Between 2005 and 2015, total GHG emissions (excluding LULUCF) fell from 145 Mt CO₂eq to 117 Mt CO₂eq, a reduction of 19% (**Error! Reference source not found.**). This fall was mainly due to a 33% reduction in EU ETS emissions in 2015 compared with 2005. During the same period, emissions under the Effort Sharing Decision (ESD) fell by 8%. Between 2005 and 2015, Belgium's total LULUCF emissions balance contracted by 60%, although it remained a significant carbon sink in 2015.

In the WEM scenario, total GHG emissions (excluding LULUCF) are expected to rise between 2015 and 2030 to 128 Mt CO₂eq (-12% compared with 2005). This increase can be explained by a rise in EU ETS emissions of up to 58 Mt CO₂eq (-13% in 2030 compared with 2005), chiefly as a result of higher emissions from electricity generation. In the WEM scenario, due to the phasing out of nuclear power by 2025, nuclear energy generation

¹ ESD for 2013-2020; ESR for 2021-2030.

is partly offset after 2025 by increased generation at gas-fired power stations. In the WEM scenario, *ESD* emissions record a moderate change, falling by 8% (in 2015) to 12% (in 2030), as compared with 2005. Belgium's LULUCF emissions balance will still be a carbon sink after 2015. Following a slight fall between 2015 and 2020, this carbon sink grows by 3% between 2015 and 2030 in the WEM scenario.

**Table 3 - Trends in total GHG emissions by IPCC sector
(WEM scenario, in Mt CO₂eq)**

	2005	2010	2015	2020	2025	2030
1 Energy	105.5	98.8	85.7	81.9	89.6	98.3
1A Fossil fuel combustion	104.8	98.0	85.1	81.3	89.0	97.7
1A1 Energy industries	29.4	26.5	21.2	16.5	22.0	29.9
1A2 Manufacturing industries and construction	18.5	15.6	13.6	14.4	16.5	17.0
1A3 Transport	26.6	26.4	26.7	26.9	27.5	28.3
1A4 Other sectors	30.0	29.3	23.5	23.4	22.9	22.4
1A5 Other	0.2	0.1	0.1	0.1	0.1	0.1
1B Fugitive emissions from fuels	0.7	0.8	0.7	0.6	0.6	0.6
2 Industrial processes and product use	26.4	21.5	19.7	20.3	19.6	19.2
3 Agriculture	10.3	10.2	10.0	9.8	9.4	9.2
4 LULUCF	-3.0	-1.5	-1.2	-0.7	-0.9	-1.2
5 Waste	3.1	2.5	1.6	1.3	1.0	0.8

Source: Belgian CRF report (15 March 2019) for 2005-2015;
compilation of regional and federal projections for 2020-2030.

At sectoral level, a 19% reduction in energy-related emissions (IPCC sector 1) can be seen between 2005 and 2015. This fall is spread between the subsectors of energy industries (mainly power stations, refineries and coking plants), manufacturing industries and space heating (i.e. 'other sectors'). In the transport sector, emissions stabilised during this period. Emissions from industrial processes were down by 25% in 2015 compared with 2005 levels, largely due to a decline in iron and steel production. During the period 2005-2015, (non-energy) emissions from agriculture saw a modest decrease of 2%. The 48% drop in emissions from the waste sector in 2015 (compared with 2005) is mainly explained by the reduction in methane emissions from landfill.

By 2030, the WEM scenario shows an increase in energy-related emissions that can be mainly attributed to the energy industries subsector. This is explained by the increased use of gas-fired power stations (see above). To a lesser extent, the WEM scenario also projects higher emissions in the transport sector and manufacturing industries, while emissions from buildings continue to fall steadily. Emissions from industrial processes and agriculture see relatively modest falls between 2015 and 2030, with a reduction of 28% and 10% respectively in 2030 compared with 2005 levels. Waste-related emissions continue to decline to 2030.

**Table 4 - Trends in GHG emissions by type of GHG, excluding LULUCF
(WEM scenario, in Mt CO₂eq)**

	2005	2010	2015	2020	2025	2030
CO ₂	125.5	113.8	99.8	97.2	105.0	113.8
CH ₄	9.3	8.8	8.1	7.5	6.9	6.6
N ₂ O	8.4	7.6	6.0	5.7	5.7	5.7
F-gases	2.1	2.8	3.3	2.9	2.0	1.5

Source: Belgian CRF report (15 March 2019) for 2005-2015;
compilation of regional and federal projections for 2020-2030.

In terms of the types of GHG, reductions of 21%, 13% and 29% were recorded for CO₂, CH₄ and N₂O respectively during the period 2005-2015. Over the same period, the only increase observed was in F-gases, which rose by 58%. This can be largely explained by the increased use of F-gases, resulting in higher emissions. The main reason for this is that ozone-depleting substances are no longer used in refrigeration plants, and F-gases have long been the most obvious alternative.

CO₂ emissions are forecast to rise from 100 Mt CO₂eq to 114 Mt CO₂eq between 2015 and 2030, due to the increase in energy-related emissions (see also Table 3). The continued fall in methane emissions can be largely explained by the trend in emissions from landfill (see also **Error! Reference source not found.**). Nitrous oxide emissions also fall during the period 2015-2030, with the same applying to F-gas emissions. Due to stricter EU regulations and Belgium's own policy, F-gases with a very high global warming potential (GWP) are expected to be phased out and replaced with greener alternatives or F-gases with a less negative impact on the climate.

**Table 5 - Trends in ESD GHG emissions by IPCC sector
(WEM scenario, in Mt CO₂eq)**

	2005	2010	2015	2020	2025	2030
1 Energy	63.1	62.3	56.9	56.6	56.8	57.3
1A Fossil fuel combustion	62.4	61.7	56.3	56.0	56.2	56.7
1A1 Energy industries	1.9	2.0	2.4	2.2	2.1	2.1
1A2 Manufacturing industries and construction	4.0	4.1	3.9	3.4	3.7	3.9
1A3 Transport	26.5	26.3	26.6	26.9	27.5	28.3
1A4 Other sectors	29.9	29.2	23.4	23.3	22.8	22.3
1A5 Other	0.2	0.1	0.1	0.1	0.1	0.1
1B Fugitive emissions from fuels	0.6	0.7	0.6	0.6	0.6	0.6
2 Industrial processes and product use	2.7	3.7	4.1	3.6	2.9	2.3
3 Agriculture	10.3	10.2	10.0	9.8	9.4	9.2
4 LULUCF	-	-	-	-	-	-
5 Waste	2.6	1.9	1.3	1.0	0.7	0.6

Source: Belgian CRF report (15 March 2019) for 2005-2015;
compilation of regional and federal projections for 2020-2030.

The 8% reduction in ESD emissions between 2005 and 2015 can be largely attributed to reductions in emissions from buildings (i.e. 'other sectors') and waste-related emissions (in particular methane emissions from landfill – see above). Between 2015 and 2030, energy-related ESD emissions stabilise in the WEM scenario. This stabilisation can be explained by an increase in transport-related emissions, offset by a reduction in other subsectors. Emissions from industrial processes fall in the WEM scenario from 4.1 Mt CO₂eq in 2015 to 2.3 Mt CO₂eq in 2030. This decrease can be primarily attributed to the reduction in F-gas emissions (see also **Error! Reference source not found.**). As explained above, waste-related emissions also continue to decline to 2030.

1.1.2. Renewable energy sources

**Table 6 - Share of renewable energy sources in gross final energy consumption, total and by sector
(WEM scenario, in %)**

	2005	2010	2015	2020	2025	2030
RES	2.3	5.7	7.9	11.2	10.7	10.5
RES-E	2.4	7.1	15.5	24.8	24.4	23.8
RES-T	0.6	4.7	3.8	8.7	8.4	8.4
RES-H&C	3.4	6.1	7.8	7.8	7.3	7.1

Source: Eurostat and SHARES 2016 results (<https://ec.europa.eu/eurostat/web/energy/data/shares>) for 2005-2015; compilation of regional and federal projections for 2020-2030.

The share of renewable energy sources (RES) increased over the period 2005-2015, from 2.3% in 2005 to 7.9% in 2015.

The pace of change varied by sector. The increase was particularly pronounced in the electricity sector, where the RES share (RES-E) rose from 2.4% in 2005 to 15.5% in 2015. The RES shares for heating and cooling (RES-H&C) and transport (RES-T) also increased, but more slowly: from 3.4% in 2005 to 7.8% in 2015 for heating and cooling, and from 0.6% in 2005 to 3.8% in 2015 for transport. The RES share in transport was lower in 2015 than in 2010 due to the reduction in biodiesel supplies following the repeal in June 2015 of the law laying down rules on blending biodiesel with diesel.

The increase in RES-E was mainly due to the growth in wind energy and solar PV (see the energy mix in electricity generation). A small proportion of the increase was also due to a slight fall in gross final electricity demand (-2% between 2005 and 2015).

The increase in RES-T mainly stemmed from biofuels, as the contribution of renewable electricity to rail and road transport remained marginal.

Lastly, despite the rapid growth in heat pumps between 2005 and 2015, their contribution to RES-H&C remained low in 2015. The increase in RES-H&C mainly resulted from biomass, which accounted for more than 94% of RES consumption for heating, and, to a lesser extent, from the fall in heating energy consumption (-8% between 2005 and 2015).

The projections ⁽²⁾ with existing measures show an increase in the share of renewable energy (total share and by sector) in 2020 compared with 2015. Despite the total share rising to 11.2% in 2020, compared with 7.9% in 2015, the existing measures are expected to fall short of the 13% target for 2020. After 2020, the total share of RES stabilises at around 10.5%.

Growth in RES-E is particularly pronounced in 2020. This reflects the significant increase in electricity generation from wind turbines (offshore wind turbines in particular). It is assumed that there will be no new investment in offshore wind after 2020.

For RES-T, the projection is around 8.5% for the period 2020-2030. The jump between 2015 and 2020 is essentially due to the introduction of E10 petrol in January 2017. However, the trend for RES-T shows that existing policies for the development of biofuels and the use of electricity for transport (numerator) are insufficient to meet the 10% target for 2020 and to stimulate the development of renewable energy sources beyond 2020.

Among the RES sectors, the RES-H&C sector remains at the same level between 2015 and 2020.

² Projections of RES indicators are available only up to 2030 due to missing data from the Flemish Region (absence of political agreement for the period 2030-2040).

Dimension energy efficiency

**Table 7 - Primary and final energy consumption in the economy and by sector
(WEM scenario, in ktoe)**

	2005	2010	2015	2020	2025	2030
Primary energy consumption	52,544	53,937	45,741	48,597	46,953	46,076
Final energy consumption	37,803	38,036	35,880	36,675	38,160	38,945
Industry	12,935	12,468	11,918	13,265	14,507	15,100
Residential	9,925	9,411	8,163	7,898	7,720	7,531
Tertiary	4,995	5,812	5,358	5,109	5,159	5,196
Transport	9,948	10,345	10,440	10,404	10,775	11,117

Source: Eurostat (June 2018) for 2005-2015 (updated for solid fuels) ⁽³⁾; compilation of regional projections for 2020-2030.

Note: For the period 2020-2030, final energy demand in the transport sector corresponds to fuel sales in Flanders and in the Brussels Capital Region, but to fuel consumption in Wallonia.

Belgium's primary energy consumption fell by 13% between 2005 and 2015. The lower level of primary energy consumption in 2015 compared with 2005 and 2010 is partly explained by the sharp decrease in nuclear energy generation.

Furthermore, final energy consumption fell by 5% over the period 2005-2015. Industry and the residential sector were responsible for this downward trend as their energy consumption fell by 8% and 18% respectively. On the other hand, energy consumption rose in the transport sector (+5%) and tertiary sector (+7%).

The projections with existing measures show a general downward trend for primary energy consumption to 2030 (-12% in 2030 compared with 2005 levels). The downward trend is mainly due to implementation of the law on phasing out nuclear power over the period 2022-2025; the higher level in 2020 than in 2015 is due to the availability of nuclear generation capacity. The projection for primary energy consumption in 2020 (48,597 ktoe) is higher than Belgium's indicative energy efficiency target (47,300 ktoe).

However, the projection for final energy demand with existing measures shows an upward trend to 2030. In 2020, final energy demand (36,675 ktoe) exceeds Belgium's indicative energy efficiency target (32,500 ktoe). In 2030, final energy demand is 3% higher than in 2005. The increase over the period 2020-2040 is mainly due to transport.

Dimension energy security

Table 8 - Energy mix of gross domestic consumption (WEM scenario)

	2005	2010	2015	2020	2025	2030
Solid fuels	10.6	6.8	5.9	5.2	5.5	5.7
Oil	40.9	39.8	44.6	40.8	43.2	45.3
Natural gas	24.5	27.3	25.7	24.0	30.4	36.5
Nuclear heat	20.4	20.2	12.4	19.0	8.4	0.0
Electricity	0.9	0.1	3.3	0.9	2.7	2.8
Renewable energy	1.9	4.6	6.8	8.4	8.1	7.9
Waste	0.8	1.2	1.3	1.7	1.8	1.7

³ Historical figures are taken from Eurostat energy balances for Belgium (European Commission recommendations/requests), while projections are based on regional energy balances. The difference between the two sources is small and reduces over time, for both total primary energy consumption and total final energy consumption: for 2005, it is 4% for both primary and final energy consumption; for 2015, it is zero for primary energy consumption and 1% for final energy consumption. However, the differences at energy and sector level may be much greater. It is worth noting that the consumption of solid fuels is currently under review and will be updated; the update will be sent to Eurostat as soon as possible.

Source: Eurostat (June 2018) for 2005-2015 (updated for solid fuels) (4);
compilation of regional projections for 2020-2030.

Around three quarters of Belgium's gross domestic consumption came from fossil fuels (solid fuels, oil and natural gas) in 2005, 2010 and 2015. In 2005 and 2010, 20% came from nuclear power. However, this share fell to 12% in 2015 following the shutdown of several nuclear reactors. Part of the reduction in nuclear energy generation in 2015 was offset by electricity imports, which increased to 3.3% (compared with less than 1% in 2005 and 2010). The share of renewable energy sources rose steadily, from 2% in 2005 to almost 7% in 2015.

The projections with existing measures point to an increasing share of fossil fuels (almost 90% in 2030). The increase is particularly pronounced for natural gas owing to its more intensive use for electricity generation. In addition, the share of renewable energy sources stabilises at around 8%. An increasing (or decreasing) share is not necessarily synonymous with increasing (or decreasing) consumption. For example, domestic oil consumption is lower in 2020-2030 than in 2005. Gross domestic consumption of natural gas and renewable energy rises steadily over the period covered by the projection.

Table 9 - Import dependency (WEM scenario, in %)

	2005	2010	2015	2020	2025	2030
Import dependency	77.2	73.8	78.9	71.0	81.7	90.4

Source: Eurostat (June 2018) for 2005-2015 (updated for solid fuels) (5); compilation of regional projections for 2020-2030.

Note: For the period 2020-2030, the breakdown between domestic renewable energy generation and net imports is not available. For the purposes of calculating import dependency, it is assumed that the renewable energy is generated entirely in Belgium.

Belgium relies on imports for almost all its energy needs as the country has very limited domestic energy sources. These include renewable energy sources (wind, solar and biomass), as well as nuclear heat, although the uranium needed is imported. Domestic production of renewable energy increased by a factor of 3.4 between 2005 and 2015. All fossil fuels are imported. However, fossil fuel imports fell by 8% between 2005 and 2015. Belgium's import dependency varies from 74% to 79%.

The projections with existing measures point to increasing import dependency (90% in 2030). The main reasons for this trend are the phasing out of nuclear power (nuclear heat is considered domestic production according to Eurostat's statistical convention) and the growth in natural gas imports. By contrast, renewable energy sources are projected to increase only moderately.

Dimension internal energy market

Electricity and natural gas prices for 2005, 2010 and 2015 are reported in Annex I, Part 2. No projections are available because they are not used in modelling WEM (and WAM) scenarios.

Dimension research, innovation and competitiveness

1.1.3. Current situation of the low-carbon-technologies sector and, to the extent possible, its position on the global market (that analysis is to be carried out at Union or global level)

Under Regulation (EU) No 691/2011, as amended by Regulation (EU) No 538/2014, the EU Member States must submit six environmental economic accounts from 2017. One of these accounts concerns the environmental goods and services sector (EGSS).

⁴ Ibid.

⁵ Ibid.

The EGSS accounts provide data on the output and gross value added of the environmental goods and services sector as well as on employment in that sector. Environmental goods and services are the products of two types of environmental activities: environmental protection activities (e.g. protection of ambient air, wastewater management) and resource management activities (e.g. management of energy resources, management of minerals). The management of energy resources comprises the production of energy from renewable resources and energy saving measures. These two EGSS ‘subsectors’ are important elements in the low-carbon-technologies sector. As a result, the EGSS accounts offer useful information on the current situation of the low-carbon-technologies sector in Belgium and enable a comparison with the European average.

The most recent EGSS data (2014-2015) were published in December 2017 (<http://www.plan.be>). They were prepared by the Federal Planning Bureau (Bureau fédéral du plan/Federaal Planbureau) (6). The report identifies the share of the environmental goods and services sector in the Belgian economy. Several indicators are reviewed, in particular output, value added and employment:

‘In the period 2014-2015, the market output of environmental goods and services was on average 3.8% of Belgium’s total market output. Environmental goods and services accounted for 2.9% of total Belgian exports, whilst 2.6% of the gross value added linked to market activities was created by enterprises active in the environmental area. The share of the environmental goods and services sector in Belgium’s market sector employment (expressed as full-time equivalents) was 2.4%.’

The EGSS accounts also provide estimates of the share of the production of energy from renewable resources and energy saving measures in the environmental goods and services sector. **Error! Reference source not found.** sets out these estimates for Belgium and the EU (where available).

Table 10 - Share of ‘low-carbon-technologies’ in all environmental protection and resource management activities, 2015

	Output		Value added		Employment	
	BE	EU	BE	EU	BE	EU
Production of energy from renewable resources	7%	25%	8%	21%	7%	n/a
Heat/energy saving and management	7%	20%	6%	19%	6%	n/a

Source: ICN, 2017. Note: n/a = not available.

The two ‘subsectors’ (renewable energy and energy savings) contribute almost equally to output, value added and employment in the environmental goods and services sector, i.e. around 7%.

However, these shares of around 7% are much lower than those in the EU as a whole, which range from 19% to 25%.

1.1.4. Current level of public and, where available, private research and innovation spending on low-carbon-technologies, current number of patents, and current number of researchers

In response to the IEA’s SLT/CERT questionnaire, Belgium provides annual data on public RD&D spending. The annexed 2017/2018 questionnaire contains the most recent data (2016 data for the federal and regional levels; the nuclear energy data include estimates for 2017 and the 2018 budget).

Further information on the RD&D statistics is available at <http://www.iea.org/statistics/RDDonlinedataservice> and in the IEA’s in-depth review of Belgium’s energy policies in 2015 (published in 2016) <https://webstore.iea.org/energy-policies-of-iea-countries-belgium-2016-review>.

⁶ Institut des comptes nationaux (ICN), *Comptes des biens et services environnementaux 2014-2015*, Bureau fédéral du Plan, December 2017.

It is not common or standard practice to collect data on private RD&D spending on low-carbon technologies, as this would be a very lengthy and complex exercise. Data on private RD&D spending is generally collected through the NACE nomenclature, which does not cover the low-carbon-technologies sector. As a result, assumptions have to be made based on several NACE codes (to a certain extent).

Moreover, it is also not common or standard practice to collect data on the current number of patents and the current number of researchers, for the same reasons as those given above.

Information specific to the Federal Government and the Regions is set out below.

Information specific to the Federal Government

The **Energy Transition Fund** aims to finance measures designed to encourage and support research and development in innovative energy projects falling under the responsibility of the Federal State and also measures to maintain and/or develop and/or research a system capable of guaranteeing security of supply and network balance, particularly as regards energy production and storage, and also demand-side management.

<https://economie.fgov.be/fr/themes/energie/transition-energetique/fonds-de-transition>

The purpose of the Energy Transition Fund is described as follows in the parliamentary proceedings on the Law of 28 June 2015 laying down various provisions on energy: 'encourage research and development in innovative energy projects and, in particular, develop energy production and storage (7)'.

The parliamentary proceedings also refer to the government agreement of 10 October 2014, which states that: 'This transition must be technologically neutral'.

In that regard, the responsibilities of the Federal State in the energy transition are set out below according to three thematic priorities:

- (a) renewable energy sources in the Belgian Exclusive Economic Zone in the North Sea and biofuels;
- (b) nuclear energy;
- (c) security of supply and balancing of the transmission system (8).

The subsidies approved by the Energy Transition Fund total:

- (a) renewable energy: EUR 13 million;
- (b) nuclear energy: EUR 9 million;
- (c) security of supply and balancing of the transmission system: EUR 6 million.

The **National Pact for Strategic Investments** aims to make Belgium future-ready, create jobs and preserve prosperity.

The Strategic Committee that advises the government has identified EUR 144 billion to EUR 155 billion of key investments that are urgently needed in six areas so that Belgium can meet these objectives:

- (d) digital transition: EUR 28-32 billion;
- (e) cybersecurity: EUR 15 billion;
- (f) education: EUR 12 billion;
- (g) healthcare: EUR 7.5-9.5 billion;
- (h) energy: EUR 60 billion;
- (i) mobility: EUR 22-27 billion.

In terms of energy, improving the energy efficiency of buildings, continuing to develop smart power grids and greening traffic are key priorities.

⁷ <http://www.dekamer.be/FLWB/PDF/54/1046/54K1046001.pdf>

⁸ Article 6(1)(VII) of the Special Institutional Reform Law of 8 August 1980 (Loi spéciale de réformes institutionnelles – LSRI).

The plan is to invest EUR 1,700 billion in nuclear decommissioning and research into waste processing over the period to 2030.

According to the report, around 45% of all investment is set to be made by the authorities.

https://www.premier.be/sites/default/files/articles/Report_FULL-FR_WEB_FINAL.pdf

Under the National Pact for Strategic Investments, all the Belgian governments have agreed to call for more favourable treatment of public investment in the context of EU budgetary surveillance. Several options have been studied, with the first being to revise the investment flexibility clause set out in Regulation (EC) No 1466/97. This revision would entail removing the condition associated with the poor economic situation of the requesting country – which currently prevents all Member States (except for Greece) from invoking the clause – and extending eligible investment to investment directly co-financed by the European Investment Bank. However, only Member States having carried out major structural reforms in the last three years could benefit from this revised clause.

This option has already been discussed with the Commission and Member States within the Economic and Financial Committee. The aim in all cases would be to ensure a better balance between fiscal sustainability and support for future growth.

Federal R&D in the nuclear energy area:

Since the global economic crisis in 2008, public funding of nuclear R&D has increased from under EUR 60 million in 2010 to over EUR 100 million in 2018. Almost one third of this sum has been allocated to SCK•CEN to fund research into nuclear safety and new materials, among other subjects, with one fifth being allocated each time to the management of nuclear waste (ONDRAF/NIRAS), advanced nuclear technologies (SCK•CEN) and the new MYRRHA research infrastructure, as developed by SCK•CEN. Lastly, nearly EUR 6 million have been allocated to nuclear fusion.

Despite the law on the gradual phase-out of electricity generation through nuclear fission in Belgium, the country will continue its nuclear R&D and innovation activities and will maintain or develop a high level of expertise. Nuclear know-how will remain a priority for Belgium in the coming decades. Through the MYRRHA project, Belgium will continue the international research needed into innovative solutions for highly radioactive waste and the qualification of materials for fusion reactors. Support for skills must also ensure the continued production of radioisotopes in Belgium.

MYRRHA will be a nuclear research infrastructure of pan-European importance. The Belgian Government has financially supported the project since 2010. Additional funding of EUR 558 million for the period 2019-2038, granted by the Belgian Government on 7 September 2018, will be used to complete the first important part of MYRRHA: construction at the SCK•CEN site in Mol of the first part of its particle accelerator and its irradiation stations, which will be commissioned in 2026. The Council of Ministers has also approved the formation of the MYRRHA international non-profit association so that foreign partners can become involved. This type of legal status is ideal for large projects funded by several foreign countries, which will help to finance the next stages of the MYRRHA project. This decision will encourage foreign partners interested in the MYRRHA project and its applications to become involved.

Belgium will also continue to work on developing nuclear fusion energy in collaboration with Euratom and the other Member States under the European action plan 'Fusion Electricity: a roadmap to the realisation of fusion energy'.

Information specific to the Walloon Government

Annual public spending on energy research averages between EUR 35 million and EUR 40 million. Most of this sum is devoted to energy efficiency, which since 2012 has accounted for around two thirds of the total amount. All energy efficiency sectors are covered (industry, residential, transport, other). The rest of the sum is allocated to the development of renewable energy, smart power grids and hydrogen, and energy storage.

Universities and research bodies have around 250 full-time equivalent (FTE) researchers.

1.1.5. Breakdown of current price elements that make up the main three price components (energy, network, taxes/levies)

Through its brochure 'Chiffres clés de l'énergie 2016' [Key Energy Data 2016], published in May 2018, the Federal Public Service for the Economy provides objective information on prices, energy, innovation and new technologies. This modern and proactive form of communication makes effective and targeted use of statistical data, market data, databases, and analysis and planning instruments. It can be downloaded from <https://economie.fgov.be/nl/publicaties/energie-kerncijfers-2016> or <https://economie.fgov.be/fr/publications/energie-chiffres-cle-2016>.

Data on the prices and taxes of oil products, natural gas and electricity, and all energy price indices are sent to the IEA every quarter by the Federal Public Service for the Economy, SMEs, Self-Employed and Energy. This information is available from <https://www.iea.org/statistics/topics/pricesandtaxes/>.

Natural gas and electricity prices can be found in the <http://ec.europa.eu/eurostat/data/database> database, which contains all publicly accessible Eurostat data (Database by themes/Environment and energy/Energy/).

A recent study commissioned by the Belgian Federal Commission for Electricity and Gas Regulation (Commission fédérale belge de Régulation de l'Electricité et du Gaz – CREG) <https://www.creg.be/sites/default/files/assets/Publications/Studies/F180628pwc.pdf> compares the energy prices of two residential and two small professional consumer profiles between the three Belgian regions and four other countries (Germany, France, the Netherlands and the United Kingdom) in February 2018. The comparison covers four components for residential consumers and three components for small professional consumers (pure energy component, network component, costs/taxes/VAT).

The breakdown of current electricity and natural gas prices (February 2018) between the main price components is presented in Chapter 6.

1.1.6. Current level of national subsidies for fossil fuels

Ecofys 2014 study commissioned by the European Commission:

https://ec.europa.eu/energy/sites/ener/files/documents/ECOFYS%202014%20Subsidies%20and%20costs%20of%20EU%20energy_11_Nov.pdf

Document provided by Policy Department A of the European Parliament for the Committee on Environment, Public Health and Food Safety (ENVI) at the request of the Committee on Environment, Public Health and Food Safety of the European Parliament:

[http://www.europarl.europa.eu/RegData/etudes/IDAN/2017/595372/IPOL_IDA\(2017\)595372_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/IDAN/2017/595372/IPOL_IDA(2017)595372_EN.pdf)

2. Impact assessment of planned policies and measures

Assessment of impact on energy system and GHG emissions

This chapter sets out the impact of the policies and measures described in Chapter 3 on the energy system and GHG emissions and removals. In the rest of this document, projections taking account of planned policies and measures are referred to as the 'WAM scenario' (WAM = with additional measures).

This chapter also includes a comparison with projections based on existing policies and measures (described in Chapter 4).

2.1.1. GHG emissions and removals

**Table 11 - Trends in GHG emissions
(WAM scenario, in Mt CO₂eq)**

	2005	2010	2015	2020	2025	2030
Total excluding LULUCF	145.3	132.9	117.1	113.3	119.6	127.5
Total including LULUCF	142.3	131.4	115.9	112.6	118.7	126.3
EU ETS (according to ETS 2013-2020 scope)	66.6	54.8	44.7	42.3	49.8	58.1
ESD (⁹) (according to ETS 2013-2020 scope)	78.6	78.1	72.4	71.0	69.8	69.4
LULUCF	-3.0	-1.5	-1.2	-0.7	-0.9	-1.2

Source: Belgian CRF report (15 March 2019) for 2005-2015;
compilation of regional projections for 2020-2030.

In the WAM scenario, total GHG emissions (excluding LULUCF) are expected to fall between 2015 and 2030 to 112 Mt CO₂eq (-23% compared with 2005). A reduction in ESD emissions is observed between 2015 and 2030, from 72 Mt CO₂eq to 53 Mt CO₂eq. By contrast, EU ETS emissions rise to 59 Mt CO₂eq (compared with 58 Mt CO₂eq in the WEM scenario), chiefly as a result of higher emissions from electricity generation. In the WAM scenario, the LULUCF emissions balance does not differ from the WEM scenario.

Table 12 below shows the distribution of ESD emissions between the Regions in the WAM scenario. In 2030, the WAM scenario sees a reduction in ESD emissions of 32.6% in Flanders (¹⁰), 36.8% in Wallonia and 39.4% in the Brussels Capital Region, compared with 2005.

Table 12 - Distribution of ESD GHG emissions by region (WAM scenario)

Change from 2005 (%)	2005	2010	2015	2020	2025	2030
Belgium		-2.7%	-9.9%	-14.9%	-24.3%	-34.4%
Flemish Region		-1.3%	-7.4%	-11.2%	-21.3%	-32.6%
Wallonia		-5.7%	-13.1%	-20.3%	-28.6%	-36.8%
Brussels Capital Region		0.5%	-16.1%	-20.7%	-30.1%	-39.4%

⁹ ESD for 2013-2020; ESR for 2021-2030.

¹⁰ The Flemish Region has set itself the target of further reducing the remaining emissions deficit [of 3.8 Mt CO₂eq]. As a way of ensuring that the set target [of -35%] is achieved, it is using the available flexibility in accordance with Article 6 of the European Effort Sharing Regulation (see above, strategic section 1.1.1.ii., Flemish Region).

**Table 13 - Trends in total GHG emissions by IPCC sector
(WAM scenario, in Mt CO₂eq)**

	2005	2010	2015	2020	2025	2030
1 Energy	105.5	98.8	85.7	81.9	89.6	98.3
1A Fossil fuel combustion	104.8	98.0	85.1	81.3	89.0	97.7
1A1 Energy industries	29.4	26.5	21.2	16.5	22.0	29.9
1A2 Manufacturing industries and construction	18.5	15.6	13.6	14.4	16.5	17.0
1A3 Transport	26.6	26.4	26.7	26.9	27.5	28.3
1A4 Other sectors	30.0	29.3	23.5	23.4	22.9	22.4
1A5 Other	0.2	0.1	0.1	0.1	0.1	0.1
1B Fugitive emissions from fuels	0.7	0.8	0.7	0.6	0.6	0.6
2 Industrial processes and product use	26.4	21.5	19.7	20.3	19.6	19.2
3 Agriculture	10.3	10.2	10.0	9.8	9.4	9.2
4 LULUCF	-3.0	-1.5	-1.2	-0.7	-0.9	-1.2
5 Waste	3.1	2.5	1.6	1.3	1.0	0.8

Source: Belgian CRF report (15 March 2019) for 2005-2015;
compilation of regional projections for 2020-2030.

In the WAM scenario, energy-related emissions are expected to fall at sectoral level to 2030. Only emissions from the energy industries subsector continue to rise between 2015 and 2030, from 21 Mt CO₂eq to 31 Mt CO₂eq. This is explained by the increased use of gas-fired power stations (see above). The most significant reductions are in the transport and buildings sectors, with falls of 27% and 41% respectively by 2030 compared with 2005. Emissions from industrial processes see relatively modest falls between 2015 and 2030. In the agricultural sector, the planned additional measures lead to a 20% reduction by 2030 compared with 2005 (as opposed to 10% in the WEM scenario). Waste-related emissions continue their downward trend to 2030, as in the WEM scenario.

**Table 14 - Trends in GHG emissions by type of GHG, excluding LULUCF
(WAM scenario, in Mt CO₂eq)**

	2005	2010	2015	2020	2025	2030
CO ₂	125.5	113.8	99.8	94.4	98.9	99.5
CH ₄	9.3	8.8	8.1	7.3	6.5	5.8
N ₂ O	8.4	7.6	6.0	5.6	5.2	5.0
F-gases	2.1	2.8	3.3	2.6	1.8	1.0

Source: Belgian CRF report (15 March 2019) for 2005-2015;
compilation of regional projections for 2020-2030.

Between 2015 and 2030, the WAM scenario suggests that CO₂ emissions will stabilise (as opposed to increasing to 114 Mt CO₂eq in 2030 in the WEM scenario). The continued decline in methane emissions is largely explained by changes in landfill emissions (see also Table 13), although further reductions in the agricultural sector also play a part. Nitrous oxide emissions fall more sharply during the period 2015-2030 compared with the WEM scenario, particularly due to further reductions in the agricultural sector and in emissions from industrial processes. Likewise, further reductions in F-gases are expected during the period 2015-2030 compared with the WEM scenario.

	2005	2010	2015	2020	2025	2030
Belgium		-2.7%	-9.9%	-14.9%	-24.3%	-34.4%
Flemish Region		-1.3%	-7.4%	-11.2%	-21.3%	-32.6%
Wallonia		-5.7%	-13.1%	-20.3%	-28.6%	-36.8%
Brussels Capital Region		0.5%	-16.1%	-20.7%	-30.1%	-39.4%

**Table 15 - Trends in ESD GHG emissions by IPCC sector
(WAM scenario, in Mt CO₂eq)**

	2005	2010	2015	2020	2025	2030
1 Energy	63.1	62.3	56.9	56.6	56.8	57.3
1A Fossil fuel combustion	62.4	61.7	56.3	56.0	56.2	56.7
1A1 Energy industries	1.9	2.0	2.4	2.2	2.1	2.1
1A2 Manufacturing industries and construction	4.0	4.1	3.9	3.4	3.7	3.9
1A3 Transport	26.5	26.3	26.6	26.9	27.5	28.3
1A4 Other sectors	29.9	29.2	23.4	23.3	22.8	22.3
1A5 Other	0.2	0.1	0.1	0.1	0.1	0.1
1B Fugitive emissions from fuels	0.6	0.7	0.6	0.6	0.6	0.6
2 Industrial processes and product use	2.7	3.7	4.1	3.6	2.9	2.3
3 Agriculture	10.3	10.2	10.0	9.8	9.4	9.2
4 LULUCF	-	-	-	-	-	-
5 Waste	2.6	1.9	1.3	1.0	0.7	0.6

Source: Belgian CRF report (15 March 2019) for 2005-2015;
compilation of regional projections for 2020-2030.

The reduction in ESD emissions of 53 Mt CO₂eq by 2030 (as opposed to 70 Mt CO₂eq in the WEM scenario) is largely attributable to the reductions in energy-related emissions, which fall from 57 Mt CO₂eq to 42 Mt CO₂eq between 2015 and 2030 (as opposed to 57 Mt CO₂eq by 2030 in the WEM scenario). In absolute terms, the main reductions during the period 2015-2030 are in the buildings and transport subsectors. Emissions from industrial processes decrease in the WAM scenario from 4.1 Mt CO₂eq in 2015 to 1.5 Mt CO₂eq in 2030 (as opposed to 2.3 Mt CO₂eq in 2030 in the WEM scenario). This is chiefly due to the fall in F-gas emissions (see also Table 14) and additional policy efforts in the WAM scenario targeting nitrous oxide emissions from caprolactam production. As explained above, waste-related emissions also continue to decline to 2030, as in the WEM scenario.

As a guide, Graph 1 compares the ESR emissions in the WEM and WAM scenarios with the ESR emission allocation, as (provisionally) set by the EEA (European Environment Agency). The emissions during the periods 2021-2024 and 2026-2029 have been determined by interpolation. In the WEM scenario, the emission allocation is exceeded in each year of the ESR period (2021-2030). In the WAM scenario, the emission allocation is exceeded to a limited extent in the years 2029-2030. The cumulative ESR targets are met in the period 2021-2030, with a total surplus of 11 Mt CO₂eq.

Graph 1 - ESR projections 2021-2030, WEM and WAM scenarios (in Mt CO₂eq)



Source: Compilation of regional projections for 2020-2030 (ESR emissions, WEM and WAM scenarios); EEA Report No 16/2018 (¹¹) (ESR emission allocations).

émissions ESR WEM	WEM ESR emissions
émissions ESR WAM	WAM ESR emissions
quota d'émissions ESR	ESR emission allocations

2.1.2. Renewable energy

Table 16 - Share of renewable energy sources in gross final energy consumption, total and by sector (WAM scenario, in %)

	2005	2010	2015	2020	2025	2030
RES	2.3	5.7	7.9	11.7	13.7	17.5
RES-E	2.4	7.1	15.5	25.1	27.6	37.4
RES-T	0.6	4.7	3.8	11.0	17.6	23.7
RES-H&C	3.4	6.1	7.8	8.0	9.4	11.3

Source: Eurostat and SHARES 2016 results (<http://ec.europa.eu/eurostat/web/energy/data/shares>) for 2005-2015; compilation of regional and federal projections for 2020-2030.

The planned policies and measures deliver a total share of renewable energy sources of 17.5% in 2030, i.e. 7 percentage points higher than in the WEM scenario (10.5%).

By comparison with the WEM scenario, the increase during the period is particularly striking in the electricity generation and transport sectors.

The share of renewable energy sources in electricity consumption (RES-E) climbs to 37.4% in 2030 in the WAM scenario, compared with 23.8% in the WEM scenario and 15.5% in 2015. The higher share in the WAM scenario than in the WEM scenario is due to growth in electricity generation from RES (+63% compared with the WEM scenario in 2030) (¹²), although the increase in final electricity consumption should also be noted (+4% compared with the WEM scenario in 2030).

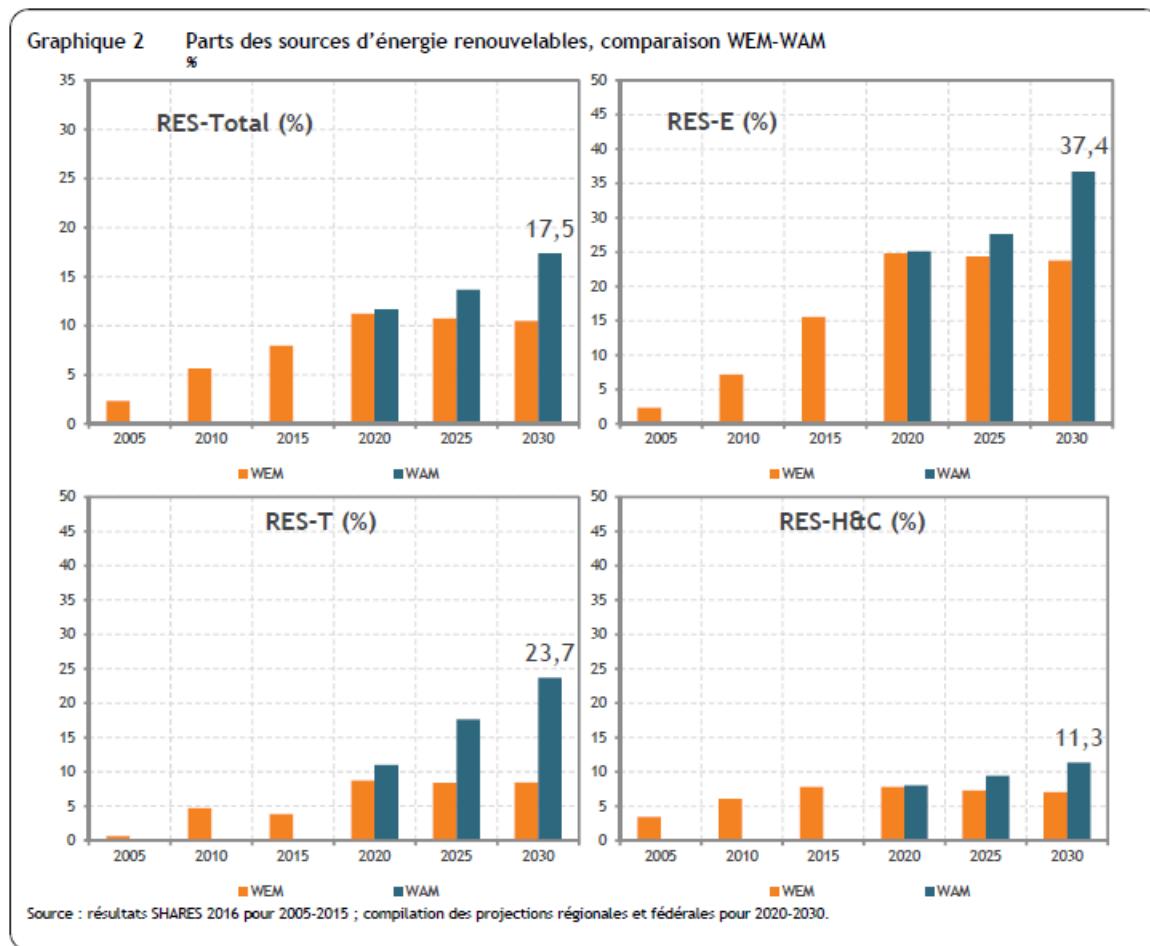
The share of renewable energy sources in transport (RES-T) rises to 23.7% in 2030 in the WAM scenario, compared with 8.4% in the WEM scenario and 3.8% in 2015. The higher share in the WAM scenario than in the

¹¹ <https://www.eea.europa.eu/publications/trends-and-projections-in-europe-2018>

¹² This growth applies to all RES technologies, but is particularly pronounced for wind energy (both onshore and offshore): +77% for wind, +44% for solar PV and +20% for biomass.

WEM scenario is due to increased use of biofuels (+20% compared with the WEM scenario in 2030) and RES-E (4 times the WEM level in 2030) following growth in the use of electric vehicles, as well as the fall in final energy consumption for transport (-21% compared with the WEM scenario in 2030).

Graph 2 - Share of renewable energy sources, WEM-WAM comparison

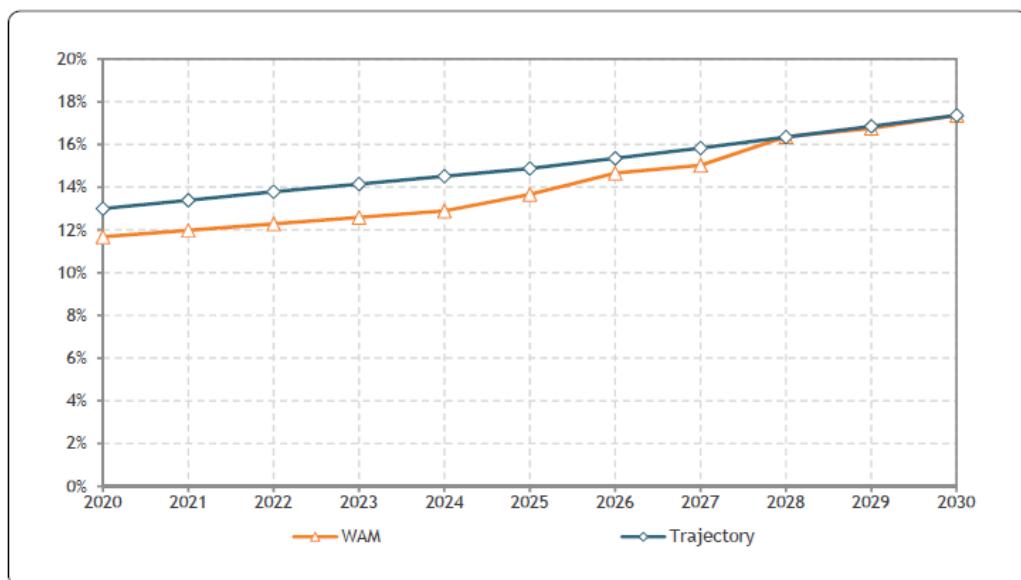


Source: SHARES 2016 results for 2005-2015;
compilation of regional and federal projections for 2020-2030.

Lastly, the share of renewable energy sources in heating and cooling (RES-H&C) increases moderately in the WAM scenario to 11.3% in 2030, compared with 7.1% in the WEM scenario and 7.8% in 2015. Given that the total energy consumption for heating and cooling is comparable in the WAM and WEM scenarios, the sole reason for this increase is greater use of RES for heating and cooling (e.g. biomass, electric heat pumps).

Graph 2 compares the trends in the share of RES in the WAM scenario over the period 2020-2030 with the indicative trajectory defined in Article 4(a)(2) of the Governance Regulation.

Graph 2 - Trends in the share of RES in the WAM scenario and indicative trajectory (in %)



Lastly, the following table shows the development in RES by technology in the WAM scenario.

(ktoe)	2015	2020	2025	2030
RES-E	1,199.3	2,049.0	2,347.7	3,269.5
Hydro	28.4	31.7	35.2	38.6
Wind	434.8	1,162.9	1,340.5	2,102.3
Solar PV	262.5	387.5	604.4	836.7
Biomass	473.6	466.9	367.6	291.9
RES-T	288.7	717.2	933.9	983.6
RES elec road	0.2	12.3	43.8	118.3
RES elec rail	33.9	34.7	45.5	64.7
Biofuels	254.6	670.2	844.6	800.6
RES-H&C	1,432.5	1,515.7	1,781.8	2,071.6
Biomass	1,343.5	1,393.1	1,529.4	1,665.3
Derived heat	48.6	36.1	75.3	116.1
Heat pumps	40.4	86.5	177.1	290.2

2.1.3. Dimension energy efficiency

Projections with the planned policies and measures show a decline in both primary and final energy consumption during the period 2020-2030. In 2030, primary energy consumption is 42.7 Mtoe, i.e. 19% below the 2005 level (¹³). Final energy consumption is 35.2 Mtoe, i.e. 7% below the 2005 level (¹⁴).

¹³ According to Eurostat energy balances. If the total regional primary energy consumption for 2005 is used, the percentage reduction in 2030 is 22%.

¹⁴ According to Eurostat energy balances. If the total regional final energy consumption for 2005 is used, the percentage reduction in 2030 is 11%.

**Table 17 - Primary and final energy consumption in the economy and by sector
(WEM scenario, in ktoe)**

	2005	2010	2015	2020	2025	2030
Primary energy consumption	52,544	53,937	45,741	47,817	45,602	42,710
Final energy consumption	37,803	38,036	35,880	36,008	36,212	35,202
Industry	12,935	12,468	11,918	13,129	14,436	15,005
Residential	9,925	9,411	8,163	7,802	7,168	6,516
Tertiary	4,995	5,812	5,358	5,017	4,786	4,526
Transport	9,948	10,345	10,440	10,060	9,823	9,156

Source: Eurostat (June 2018) for 2005-2015 (updated for solid fuels) (15); compilation of regional projections for 2020-2030.

Note: For the period 2020-2030, final energy demand in the transport sector corresponds to fuel sales in Flanders and in the Brussels Capital Region, but to fuel consumption in Wallonia.

The planned policies and measures deliver primary and final energy savings of 3.4 Mtoe and 3.7 Mtoe respectively in comparison with the WEM scenario in 2030. In percentage terms, the savings are -7% and -10% respectively.

The sectors that contribute the most to the downward trend (in both absolute and relative terms) are the residential, tertiary and transport sectors. In 2030, the final energy consumption of each sector is 13% to 18% lower than in the WEM scenario. However, the planned policies and measures in industry reduce the sector's final energy consumption only by 1%.

Table 18 shows the trends in primary and final energy consumption to 2030 according to the PRIMES 2007 baseline. Compared with the levels projected in 2030 in this scenario, primary and final energy consumption in the WAM scenario are respectively 15% and 12% lower.

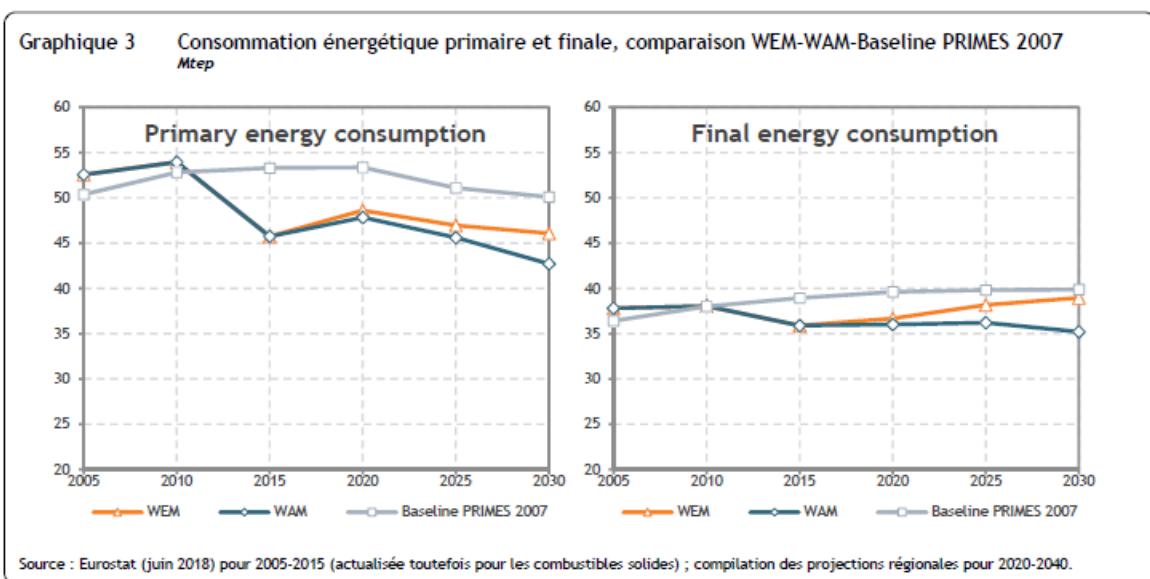
Table 18 - Primary and final energy consumption according to the PRIMES 2007 baseline (in ktoe)

	2005	2010	2015	2020	2025	2030
Primary energy consumption	50,369	52,803	53,289	53,353	51,078	50,094
Final energy consumption	36,403	38,013	38,938	39,613	39,803	39,870

Source: European Energy and Transport - Trends to 2030 – Update 2007 (EC, 2008).

¹⁵ Historical figures are taken from Eurostat energy balances for Belgium (European Commission recommendations/requests), while projections are based on regional energy balances. The difference between the two sources is small and reduces over time, for both total primary energy consumption and total final energy consumption: for 2005, it is 4% for both primary and final energy consumption; for 2015, it is zero for primary energy consumption and 1% for final energy consumption. However, the differences at energy and sector level may be much greater. It is worth noting that the consumption of solid fuels is currently under review and will be updated; the update will be sent to Eurostat as soon as possible.

Graph 3 - Primary and final energy consumption: comparison of WEM, WAM and PRIMES 2007 baseline (Mtoe)



Source: Eurostat (June 2018) for 2005-2015 (updated for solid fuels); compilation of regional projections for 2020-2040.

Dimension energy security

Table 19 - Energy mix of gross domestic consumption (WAM scenario, in %)

	2005	2010	2015	2020	2025	2030
Solid fuels	10.6	6.8	5.9	5.2	5.5	5.9
Oil	40.9	39.8	44.6	40.1	40.2	40.2
Natural gas	24.5	27.3	25.7	24.4	32.4	38.9
Nuclear heat	20.4	20.2	12.4	19.1	8.6	0.0
Electricity	0.9	0.1	3.3	1.0	1.6	1.1
Renewable energy	1.9	4.6	6.8	8.6	9.8	12.2
Waste	0.8	1.2	1.3	1.7	1.7	1.7

Source: Eurostat (June 2018) for 2005-2015 (updated for solid fuels) (16); compilation of regional projections for 2020-2030.

The planned policies and measures reduce the share of fossil fuels in 2030, particularly oil (40.2% in the WAM scenario compared with 45.3% in the WEM scenario), while the share of RES increases by 4.4 percentage points.

Table 19 [sic-20] - Import dependency (WAM scenario, in %)

	2005	2010	2015	2020	2025	2030
Import dependency	77.2	73.8	78.9	70.6	79.8	86.0

Source: Eurostat (June 2018) for 2005-2015 (updated for solid fuels) (17); compilation of regional projections for 2020-2030.

Note: For the period 2020-2030, the breakdown between domestic renewable energy generation and net imports is not available. For the purposes of calculating import dependency, it is assumed that the renewable energy is generated entirely in Belgium.

¹⁶ Ibid.

¹⁷ Ibid.

Despite the additional policies and measures to stimulate the development of renewable energy sources, fossil fuels continue to account for more than 80% of the primary energy mix in 2030. However, Belgium's import dependency reduces by 4 percentage points compared with the WEM scenario.

IMPACT ASSESSMENT OF PLANNED POLICIES AND MEASURES

This assessment is chiefly made in the NECP. Federal measures are partly assessed in Chapter 3. See also the impact assessment note in the Federal Energy and Climate Plan, produced by the Federal Planning Bureau in September 2018, which focuses on the environmental, budgetary and macroeconomic impact of the two main federal measures with regard to renewable energy, namely offshore wind energy and blending of biofuels.

Overview of investment needs

- i. Existing investment flows and forward investment assumptions with regard to the planned policies and measures

On 11 September 2018, under the National Pact for Strategic Investments (Pacte National pour les Investissements Stratégiques – PNIS), a report was submitted by a Strategic Committee (group of independent experts) to the country's various governments. The report's specific aim was to offer an assessment of the strategic investment needs in Belgium to 2030, which cover six areas⁽¹⁸⁾, including energy and mobility.

- ii. Sector or market risk factors or barriers in the national or regional context
- iii. Analysis of additional public finance support or resources to fill identified gaps identified under point ii

Again under the National Pact for Strategic Investments, careful consideration has been given to the funding sources for strategic investments. Mobilising capital is one of the four cross-cutting areas identified in the Strategic Committee's report⁽¹⁹⁾ on which action needs to be taken to encourage investment. The [report of the 'Mobilisation of capital' working group](#) sets out a number of financial instruments that can be used to achieve the investments identified in the Strategic Committee's report.

However, this work of mapping the funding sources at national, regional and EU level is still ongoing. In particular, technical work on the subject has been carried out within two working groups⁽²⁰⁾ formed by a decision of the Consultation Committee of 27 March 2019.

¹⁸ The six areas of the PNIS are: 'Digital', 'Cybersecurity', 'Education', 'Healthcare', 'Energy' and 'Mobility'.

¹⁹ The four cross-cutting areas are: 'Better regulations for strategic investment projects', 'Mobilising capital', 'Public-Private Partnerships', and 'A budgetary strategy and European rules that promote public investment'.

²⁰ The aim of these technical working groups, set up in the context of implementing the PNIS, is to prepare for the work of the Interministerial Conference on Strategic Investments, created by a decision of the Consultation Committee of 7 November 2018. The two groups involved in this case are: 'Group I: Interfederal governance and synergy with European bodies' and 'Group III: Mobilisation of capital (PPP and EPC)'.

1. CURRENT SITUATION AND PROJECTIONS WITH EXISTING POLICIES AND MEASURES

Projected evolution of main exogenous factors influencing energy system and GHG emission developments

Dimension decarbonisation

1.1.1. GHG emissions and removals

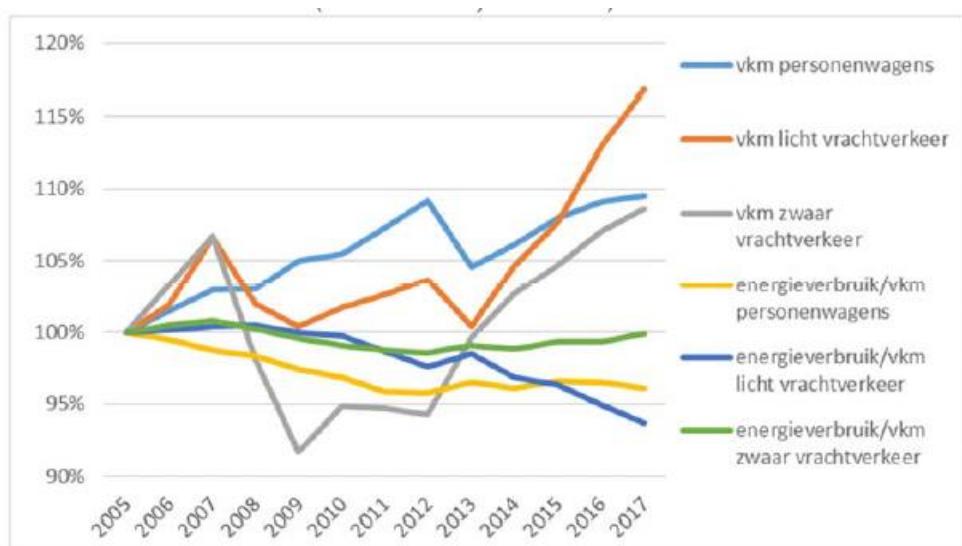
i. Trends in current GHG emissions and removals in the EU ETS, effort sharing and LULUCF sectors and different energy sectors

1.2.1.1. Transport sector

Figure 1-1 gives an overview of the main indicators of transport volumes and vehicle efficiency in road transport for the period 2005-2017. The source and method for calculating the number of vehicle-kilometres in road transport changed in 2013. The Federal Public Service for Mobility and Transport provided the data for the period 2005-2012. Since 2013, this task has been carried out by the Flemish traffic management centre (VMM). The change in method led to a 1% reduction in the total number of vehicle-kilometres (for passenger cars, light commercial vehicles and heavy goods vehicles combined). The estimated activity of passenger cars was revised downwards, especially on country roads. However, the estimate for heavy-duty vehicles was revised upwards, particularly in towns and villages, but less so on motorways. These changes mean that the vehicle-kilometres between 2005 and 2012 are not entirely comparable with those in subsequent years. The trend in the traffic indicators between 2013 and 2017 is based on one and the same method and can therefore be analysed in an entirely consistent manner.

Taking the above into account, the number of vehicle-kilometres for passenger cars in the period 2005-2017 grew by 10%. Over the same period, the growth for vans and lorries was 17% and 9% respectively. It can also be seen that the energy efficiency of vehicles is improving somewhat, but not enough to compensate for the increase in volume.

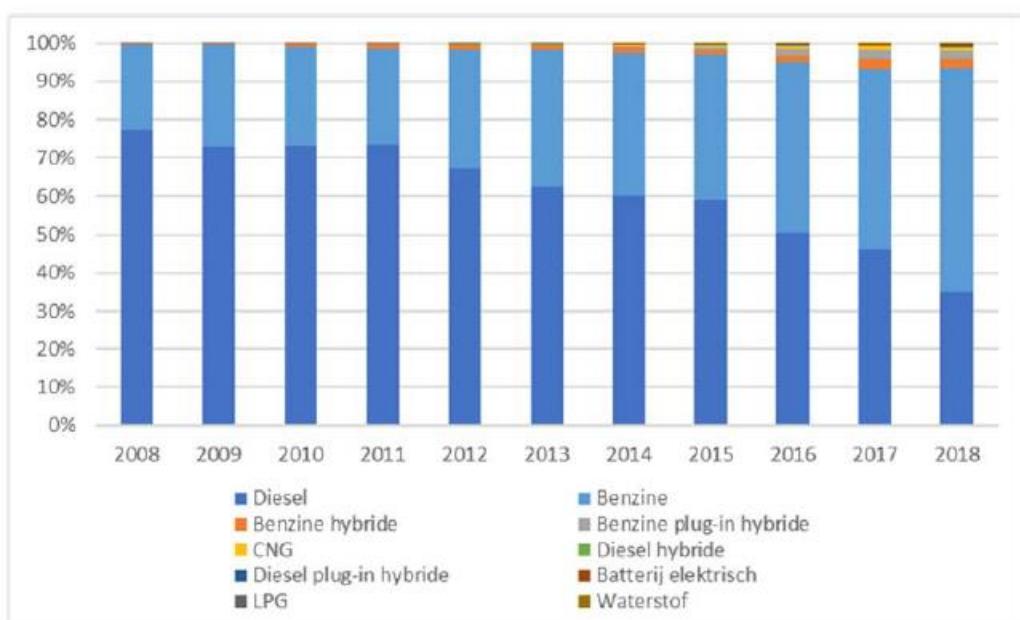
Figure 1-1. Overview of volumes and efficiency in road transport in Flanders (source: VMM, March 2019)



vkm personenwagens	vkm passenger cars
vkm licht vrachtverkeer	vkm light commercial vehicles
vkm zwaar vrachtverkeer	vkm heavy goods vehicles
energieverbruik/vkm personenwagens	energy consumption/vkm passenger cars
energieverbruik/vkm licht vrachtverkeer	energy consumption/vkm light commercial vehicles

The size and composition of the vehicle fleet has a considerable impact on the emissions caused by the transport sector. Figure 1-2 shows that the proportion of diesel vehicles in new vehicle sales has been falling for several years, reaching 35% in 2018. This is due to the fact that even the latest Euro 6 standard is not sufficient to achieve the European air quality objectives, and policies have therefore been put in place to discourage the purchase of diesel vehicles. For example, the Flemish Government has endeavoured to make vehicle taxation greener by adjusting vehicle registration tax and annual road tax. As a result, demand has mainly shifted towards petrol vehicles. Despite the strong relative growth in alternative technologies (battery electric vehicles, plug-in hybrid electric vehicles and natural gas (CNG) vehicles), together these accounted for only just over 4% of new passenger car sales in 2018. The goal for 2020 is to achieve a market share of 7.5% for battery electric vehicles among new car sales. We will assess at the end of 2020 whether this goal has been achieved and make the necessary adjustments. Based on current projections, 3.7% of vehicles will be zero-emission vehicles by the end of 2020. The total size of the Flemish passenger car fleet grew by 20% between 2005 and 2018.

Figure 1-2. Distribution of fuel technology in new passenger cars (source: Ecoscore reports)



Diesel	Diesel
Benzine hybride	Petrol hybrid
CNG	CNG
Diesel plug-in hybride	Diesel plug-in hybrid
LPG	LPG
Benzine	Petrol
Benzine plug-in hybride	Petrol plug-in hybrid
Diesel hybride	Diesel hybrid
Batterij elektrisch	Battery electric
Waterstof	Hydrogen

Passenger transport emissions largely depend on the methods of transport used. A higher proportion of public transport usually leads to lower GHG emissions because the number of vehicle-kilometres travelled in cars is reduced. In the period 2000-2016, the modal share ⁽²¹⁾ of cars/motorbikes fell from 84% to 79%, but that share

²¹

Source: MIRA report: <https://www.milieurapport.be/sectoren/transport/sectorkenmerken/personenkilometers->

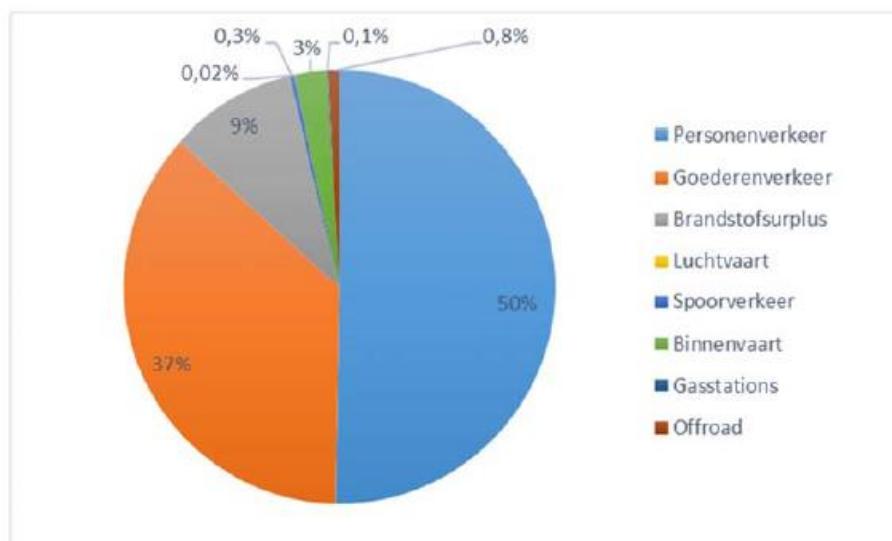
has remained stable over the last few years. A limited modal shift has taken place, but cars remain dominant and, as explained above, have increased in absolute terms.

As regards goods transport, road traffic continues to account for the largest proportion of transport volumes ⁽²²⁾. The share of road traffic in total goods transport has increased from 75% in 2000 to 82% in 2016. The more environmentally friendly modes of rail and inland navigation have therefore not succeeded in reducing the share of road traffic in total goods transport.

The non-ETS transport sector emitted 16.0 Mt CO₂eq in 2017, or 37% of the total non-ETS GHG emissions in Flanders. Emissions in the transport sector are composed of emissions from passenger transport and goods transport by road, plus the relatively low emissions from rail transport, maritime transport ((national share of) marine navigation and inland navigation), petrol stations (caused by the compression or decompression of natural gas) and off-road vehicles at ports and airports (Figure 1-3). Only the consumption of fossil fuels is taken into account within the scope of non-ETS emissions. This means that electricity generation for electric transport (electric trains, trams and road vehicles) falls outside this scope. CO₂ emissions from biofuels are regarded as zero in accordance with European and international inventory directives. Intra-EU aviation CO₂ emissions in the period 2013-2020 are covered by the ETS regulations, while extra-EU aviation and maritime (bunkering) emissions are not covered by international climate agreements. GHG emissions in the transport sector therefore primarily relate to the consumption of fossil fuels for passenger transport and goods transport by road, rail (diesel trains) and inland navigation.

The correction factor for fuel sales (or fuel surplus) accounts for a large proportion of total transport emissions. This correction is necessary due to the difference between emissions calculated using emission models and reported emissions based on federal fuel sales figures for road traffic. Over the past few years, this fuel surplus has fluctuated between 9% and 14% of modelled emissions.

Figure 1-3. Distribution of Flemish non-ETS GHG emissions from transport in 2017



Personenverkeer	Passenger transport
Goederenverkeer	Goods transport
Brandstofsurplus	Fuel surplus
Luchtvaart	Aviation
Spoorverkeer	Rail transport
Binnenvaart	Inland navigation

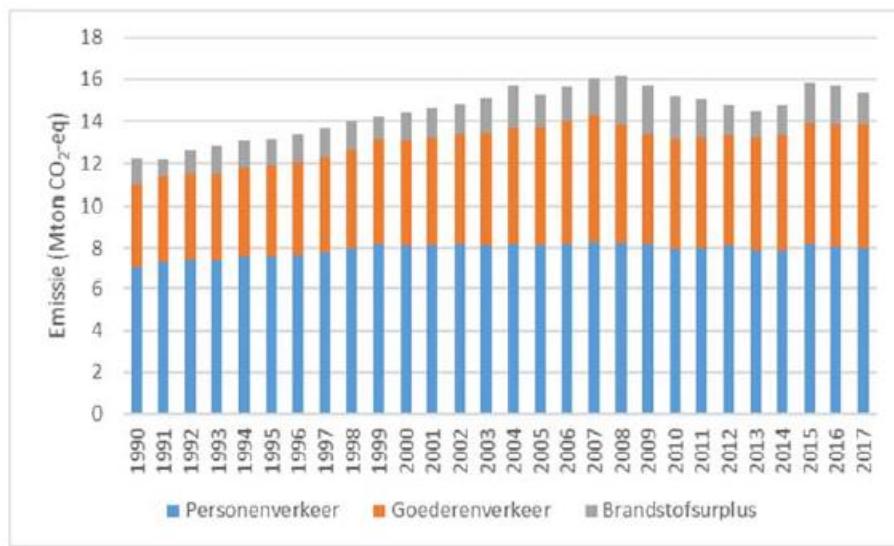
van-personenvervoer

²² Source: MIRA report: <https://www.milieurapport.be/sectoren/transport/sectorkenmerken/tonkilometers-van-goederenvervoer>

Gasstations	Petrol stations
Offroad	Off-road

Figure 1-3 clearly shows that road transport is a decisive factor in transport sector emissions as a whole. The trends in road traffic emissions in Flanders are shown in Figure 1-4.

Figure 1-4. Trends in GHG emissions from road traffic in Flanders for the period 1990-2017 (in Mt CO₂eq)



Emissie (Mton CO ₂ -eq)	Emissions (Mt CO ₂ eq)
Personenverkeer	Passenger transport
Goederenverkeer	Goods transport
Brandstofsurplus	Fuel surplus

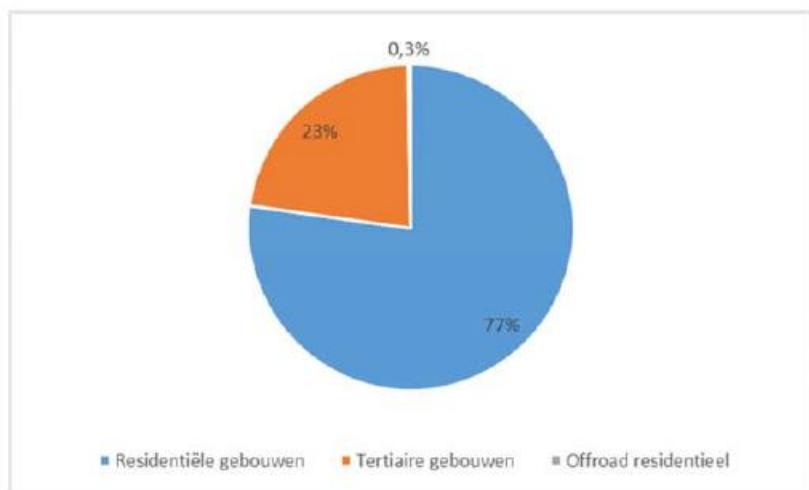
In 2008-2009, due to the financial crisis, there was a considerable dip in the activity and emissions of goods transport by road, but these began to rise again from 2012. Despite increasing fuel efficiency of vehicles and greater use of biofuels, GHG emissions are still not falling because activity has continued to increase. This has resulted in a 1% increase in total emissions from the transport sector in the period 2005-2017.

1.2.1.2. Buildings sector

Overview of the buildings sector

The non-ETS buildings sector emitted 12.2 Mt CO₂eq in 2017, or 28% of the total non-ETS GHG emissions in Flanders. Residential buildings and tertiary buildings respectively accounted for 77% and 23% of this figure in 2017. There are also very limited emissions from off-road activities (e.g. lawnmowers).

Figure 1-5. Buildings sector share of non-ETS emissions in 2017

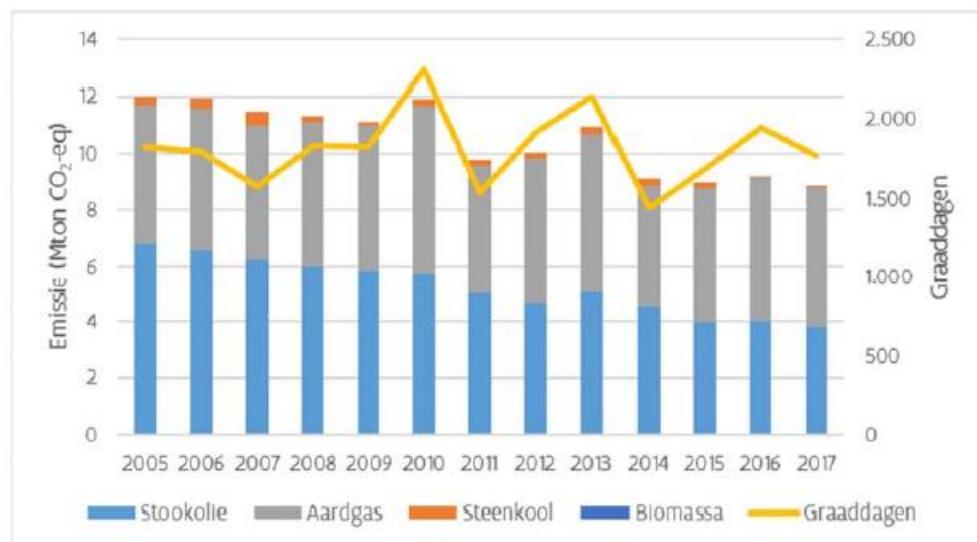


Residentiële gebouwen	Residential buildings
Tertiaire gebouwen	Tertiary buildings
Offroad residentieel	Off-road residential

Residential sector

Figure 1-6 shows the trends in (absolute) GHG emissions from residential buildings and the degree days (23). GHG emissions are heavily dependent on heating requirements, which are proportional to degree days. Between 2005 and 2017, there was a 25% reduction in GHG emissions. Natural gas and heating oil accounted for the bulk of emissions in 2017, at 55% and 42% respectively.

Figure 1-6. GHG emissions (24) from residential buildings between 2005 and 2017 (in Mt CO₂eq)



²³ Heating needs over a year are expressed in the number of degree days, which are generally based on a threshold value of 15°C for turning on the heating. To calculate the number of degree days in a year, each average daily temperature is compared with a constant daily average of 15°C. This means that each degree below the average daily temperature of 15°C is called a degree day.

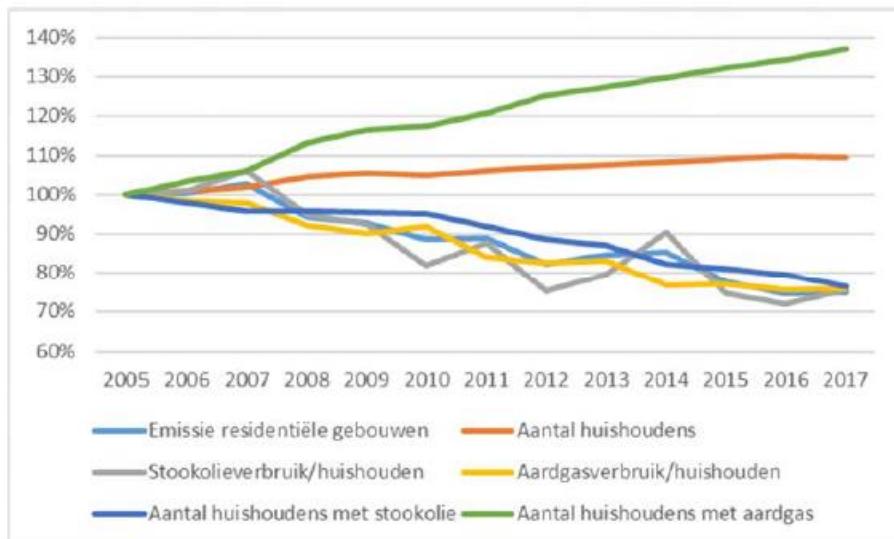
²⁴

Aardgas	Natural gas
Steenkool	Coal
Biomassa	Biomass
Graaddagen	Degree days

Figure 1-7 shows a series of trends in energy and emissions data corrected for the number of degree days. Between 2005 and 2017, emissions were on a downwards trend, despite the increasing number of households in Flanders. This can be partly explained by the fall in energy demand for heating per household. Over the period 2005-2017, this fall was 25% for heating oil and 24% for natural gas. A switch can also be seen from fuels with a high carbon content, such as heating oil and coal, to fuels with a lower carbon content, such as natural gas and, to a lesser extent, renewable energy sources such as wood, heat pumps and solar water heaters. In the same period, the number of households using heating oil fell by 24%, while the number of households using natural gas increased by 37%.

The challenge over the coming period is therefore to continue and intensify this downwards trend through a highly ambitious renovation policy and the continuation of the EPB policy for new-builds.

Figure 1-7. Overview of trends for residential buildings (with correction for degree days)



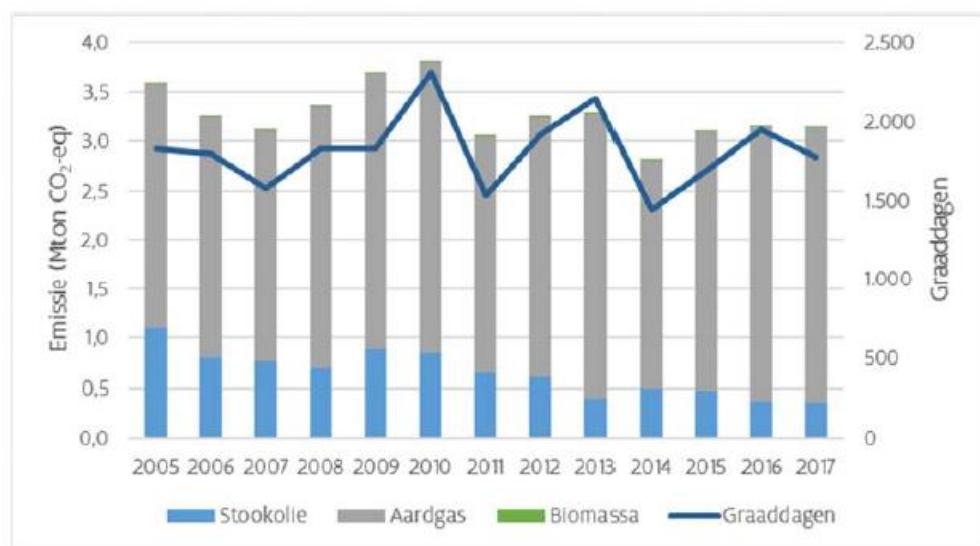
Emissie residentiële gebouwen	Emissions from residential buildings
Stookolieverbruik/huishouden	Heating oil consumption/household
Aantal huishoudens met stookolie	Number of households with heating oil
Aantal huishoudens	Number of households
Aardgasverbruik/huishouden	Natural gas consumption/household
Aantal huishoudens met aardgas	Number of households with natural gas

Tertiary sector (25)

Figure 1-8 shows the trends in GHG emissions in the tertiary sector and the degree days. GHG emissions are heavily dependent on heating requirements, which are proportional to degree days.

²⁵ The tertiary sector is defined as non-residential and non-industrial buildings.

Figure 1-8. Trends in GHG emissions in the tertiary sector between 2005 and 2017



Emissie (Mton CO ₂ -eq)	Emissions (Mt CO ₂ eq)
Stookolie	Heating oil
Aardgas	Natural gas
Biomassa	Biomass
Graaddagen	Degree days

Between 2005 and 2017, there was an 11% reduction in GHG emissions. Up to 2005, GHG emissions had been in line with economic activity. Since then, emissions have more or less stabilised, with fluctuations depending on degree days. The further increase in activity has therefore been offset by improved energy efficiency and by the switch to fuels with a lower carbon content, primarily from heating oil to natural gas.

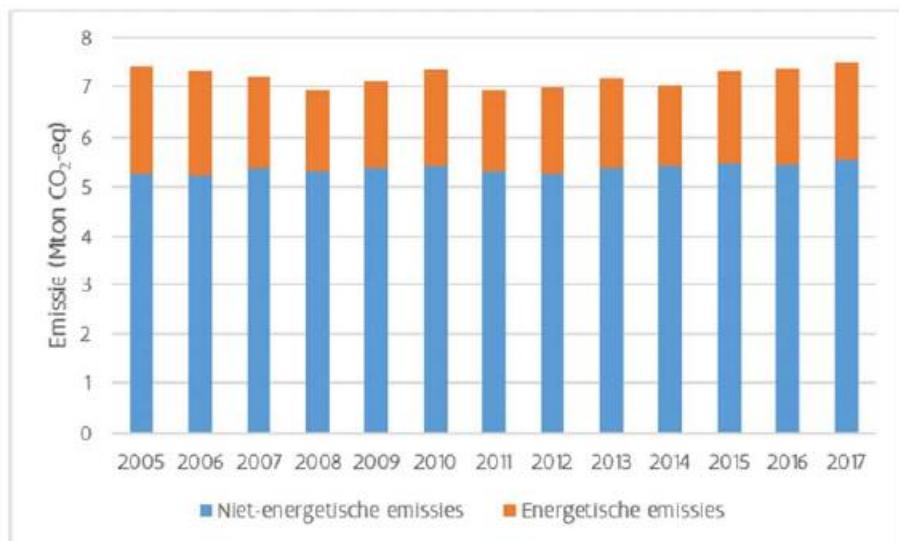
In order to convert this stabilisation of the last few years into a downward trend, a far-reaching renovation policy is required.

1.2.1.3. Agricultural sector

In 2017, the agricultural sector in Flanders emitted 7.5 Mt CO₂eq, or 17% of non-ETS emissions. The main energy sources of greenhouse gases in agriculture are fossil fuels (e.g. for heating greenhouses and barns) and off-road mobile machinery. Non-energy sources are primarily methane production through fermentation in animal digestion and manure storage, and production of nitrous oxide following the use of animal manure and chemical fertilisers. The use of urea and lime is also a very limited source of CO₂.

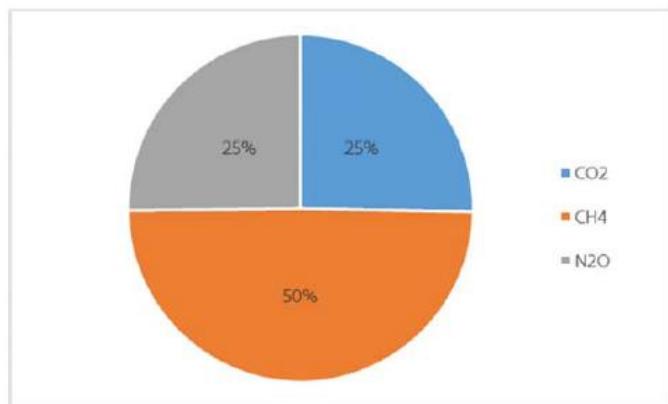
In the period 2005-2017, total emissions in the agricultural sector remained stable (Figure 1-9). In the same period, Flemish agricultural production grew, in terms of both production volumes and final product value for all subsectors combined (+16.7% between 2005 and 2018). These figures indicate that the agricultural sector has been successful in achieving a relative decoupling in this period.

Figure 1-9. Trends in GHG emissions in the agricultural sector 2005-2017



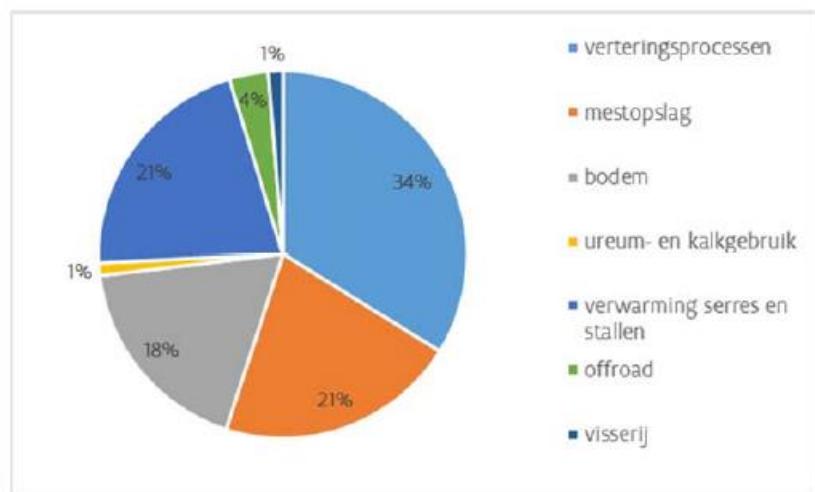
The main greenhouse gases in the agricultural sector in 2017 were, in decreasing order, methane (CH₄), nitrous oxide (N₂O) and carbon dioxide (CO₂) (Figure 1-10). Methane and nitrous oxide together account for 75% of these gases. Methane emissions mainly stem from the digestive processes of ruminants and from the production, storage and use of animal manure. Nitrous oxide is released into the atmosphere during the production and storage of animal manure and through soil processes following the use of nitrogen fertilisers (animal manure/artificial fertiliser). Both CH₄ and N₂O are emitted during the production and storage of manure/fertilisers.

Figure 1-10. Proportions of greenhouse gases in the agricultural sector in 2017



Non-energy emissions account for 74% of Flemish agricultural emissions, with energy emissions representing 26% (Figure 1-11).

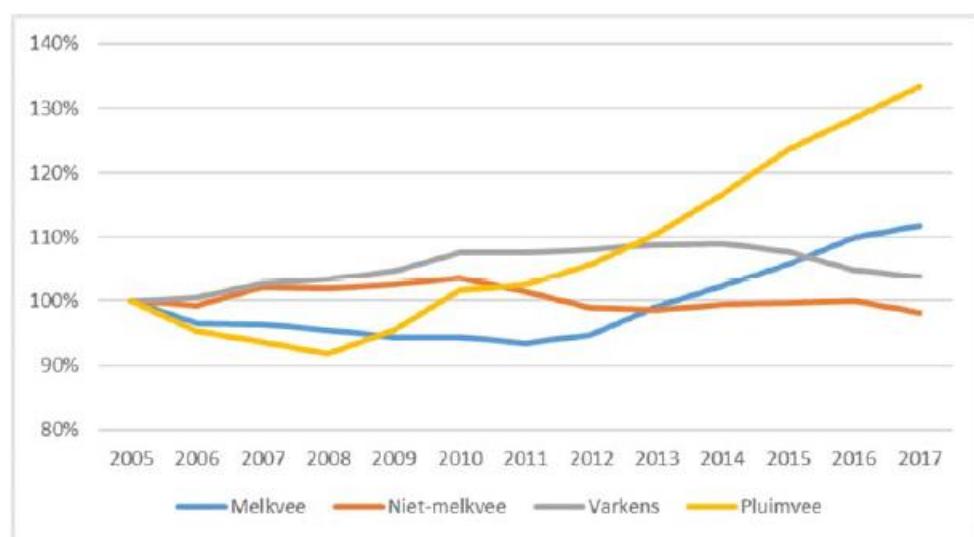
Figure 1-11. Proportions of sources in the agricultural sector in 2017



Verteringsprocessen	Digestive processes
Mestopslag	Manure storage
Bodem	Soil
Ureum- en kalkgebruik	Urea and lime
Verwarming serres en stallen	Heating of greenhouses and barns
Offroad	Off-road
Visserij	Fisheries

Non-energy emissions from digestive processes (CH_4) and manure storage (CH_4 and N_2O) are closely linked to changes in the size and composition of livestock. In this context, cattle (dairy and non-dairy cattle) play an important role. Between 2005 and 2017, the number of non-dairy cattle remained stable, whilst the number of dairy cattle and pigs rose (Figure 4-17). The number of poultry increased significantly in this period. However, as poultry are monogastric, they contribute less to GHG emissions.

Figure 1-12. Trends in livestock according to VLM reports between 2005 and 2017



Melkvee	Dairy cattle
Neit-melkvee	Non-dairy cattle
Varkens	Pigs
Pluimvee	Poultry

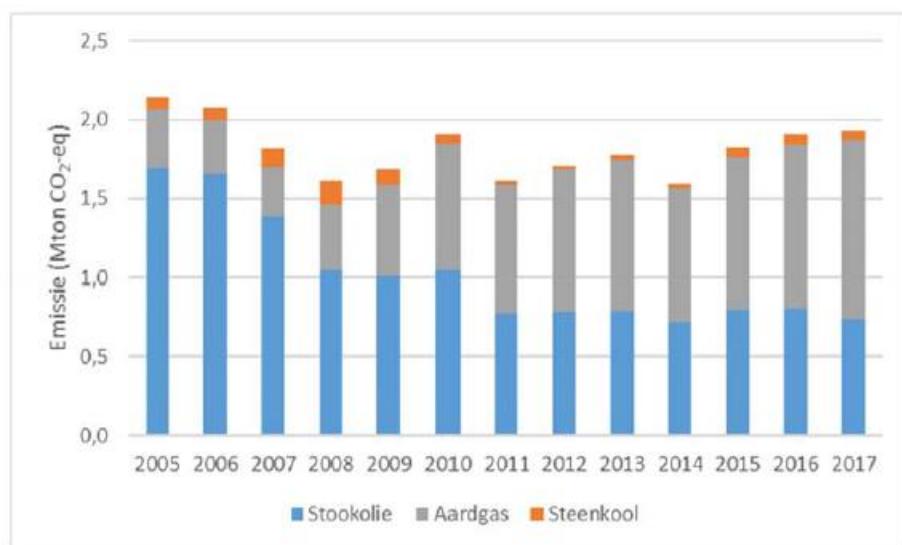
Emissions from manure consist of nitrous oxide and methane. These two gases are formed by the bacteria that break down the organic material. Barn and manure management therefore has an impact on the formation and emission of these greenhouse gases. Nitrous oxide emissions from manure mainly stem from cattle, whilst methane emissions from manure primarily stem from pigs.

Soil emissions are nitrous oxide emissions that are directly and indirectly released (through nitrogen deposition) from nitrification and denitrification processes in the soil. Nitrous oxide emissions from grasslands and arable land are the result of agricultural activities that add nitrogen to the soil. The main agricultural activities that add nitrogen are the administration of manure, production of manure by grazing animals and crop residues that are left on the land after harvesting.

Energy emissions stem from burning fossil fuels, primarily in greenhouse horticulture and intensive livestock farming in order to heat greenhouses and barns. In 2017, they accounted for 26% of total agriculture emissions.

Figure 1-13 shows that energy emissions, taken as a whole, fluctuated to a certain degree in the period 2005-2017 but did not reduce, despite efforts being focused on rational energy consumption and use of less carbon-intensive fuels in greenhouse horticulture. Since 2006, there has been a switch from petroleum-based products (mainly heating oil) to natural gas and biomass (both biogas and solid biomass). However, since 2008, natural gas consumption has risen more quickly due to an increasing number of stand-alone cogeneration units being commissioned. Although most of these have been new installations, some have replaced older equipment that was largely being operated in conjunction with an electricity producer and that has now been replaced by self-managed equipment. In the greenhouse gas inventory, this has resulted in a shift of natural gas consumption from the electricity and heating sector to the agricultural sector.

Figure 1-13. Trends in energy emissions in the agricultural sector 2005-2017



Emissie (Mton CO ₂ -eq)	Emissions (Mt CO ₂ eq)
Stookolie	Heating oil
Aardgas	Natural gas
Steenkool	Coal

Agricultural production in Flanders is mainly market-oriented. Any change in consumption and eating patterns on the demand side leads to changes in production on the supply side, and therefore impacts emissions in the agricultural sector.

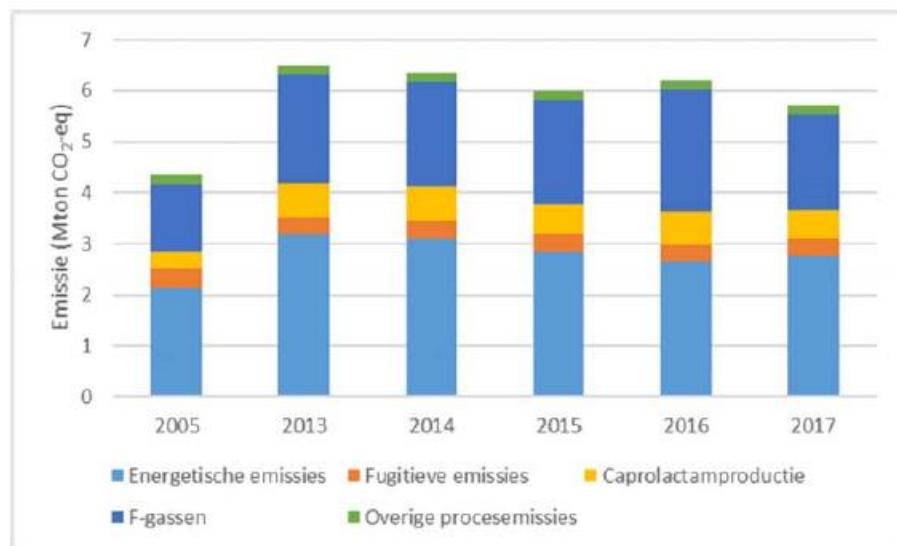
In all logic, technological innovation and management techniques should enable the rise in productivity to continue between 2021 and 2030, in particular through measures such as improved fertility, genetic selection and better biosafety.

1.2.1.4. Non-ETS industry

The total non-ETS GHG emissions from the industrial sector according to the ETS scope 2013-2020 were 5.7 Mt CO₂eq in 2017, or 13% of the total non-ETS GHG emissions in Flanders.

Figure 1-14 shows the trends in GHG emissions in non-ETS industry.

Figure 1-14. Trends in GHG emissions in non-ETS industry 2005-2017



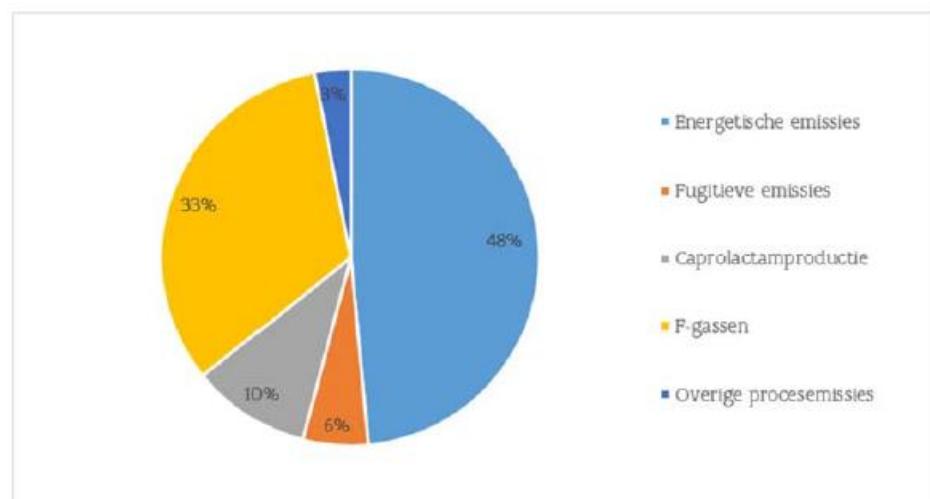
Emissie (Mton CO ₂ -eq)	Emissions (Mt CO ₂ eq)
Energetische emissies	Energy emissions
Fugitive emissies	Fugitive emissions
Caprolactamproductie	Caprolactam production
F-gassen	F-gases
Overige procesemissies	Other process emissions

Several factors particularly underlie the trends shown in Figure 1-14.

- There is a rising trend in the use and emission of F-gases, largely as a result of no longer using ozone-depleting substances in cooling systems, for which F-gases have long been the most obvious alternatives.
- Caprolactam production is a major source of nitrous oxide (N₂O) emissions in Flanders, which come from a single business. Emissions increased considerably between 2005 and 2013 because of rising production. Since then, emissions have fallen again due to process-related measures that have reduced the specific emissions. Over the last few years, emissions have fluctuated around 0.6 Mt CO₂eq.

Energy emissions from non-ETS industry (i.e. businesses that do not fall under the EU ETS) accounted for the bulk of emissions in 2017 (Figure 1-15) at 2.8 Mt CO₂eq., or 48%.

Figure 1-15. Proportions of GHG emissions in the industrial sector in 2017



Energetische emissies	Energy emissions
Fugitive emissies	Fugitive emissions
Caprolactamproductie	Caprolactam production
F-gassen	F-gases
Overige procesemissies	Other process emissions

Most of the energy emissions in industry fall under the ETS. This section only concerns the non-ETS part. Energy emissions in non-ETS industry mainly relate to the consumption of energy by the smallest businesses, which are often less energy-intensive. Their energy consumption (and energy emissions) partly stem from the heating of buildings (offices and other workspaces), as well as from the heating and steam needs of the businesses themselves (e.g. in the food industry). Around 25% of these energy emissions come from businesses that have signed up to the 'non-EDE' strategic measure (namely 0.7 Mt CO₂), of which 95% come from the combustion of natural gas.

Emissions from off-road mobile machinery in the industrial sector (including forklifts in both ETS and non-ETS industry and machinery in the agricultural sector) also form part of these energy emissions and accounted for 0.4 Mt CO₂eq in 2017.

Table 1-1. F-gas emissions (Mt CO₂eq)

	2005	2010	2015	2016	2017
Stationary cooling	0.74	1.07	1.25	1.21	1.21
<i>Air-conditioning and heat pumps</i>	0.04	0.10	0.19	0.20	0.23
<i>Commercial and industrial cooling and air-conditioning of large buildings</i>	0.70	0.97	1.06	1.01	0.98
Chemicals	0.18	0.10	0.29	0.65	0.16
Mobile air-conditioning	0.16	0.26	0.30	0.30	0.29
<i>Car air-conditioning</i>	0.12	0.20	0.23	0.23	0.22
<i>Air-conditioning of other vehicles</i>	0.04	0.06	0.07	0.07	0.07
Plastics industry	0.10	0.11	0.06	0.07	0.06
Sound insulating glass	0.05	0.05	0.05	0.04	0.04
Refrigerated transport	0.02	0.03	0.03	0.02	0.02
Electrical switchgear	0.01	0.01	0.01	0.01	0.01
Other (smaller sources)	0.09	0.07	0.08	0.08	0.08
Total	1.33	1.70	2.05	2.38	1.87

F-gases include PFCs, HFCs and SF₆ and stem from emission sources primarily in the industrial, tertiary and transport sectors (Table 1-1). These F-gas emissions accounted for 40% (or 2.4 Mt CO₂eq) in 2017, which implies a rise in F-gas emissions of approximately 0.5 Mt CO₂eq from 2015.

F-gas emissions resulting from the use of F-gases as a coolant in cooling systems have increased in the last few years. This is mainly due to the rise in F-gas emissions from many cooling applications that are now no longer in use and from which the coolants still present are being insufficiently recovered.

A rise in the number of air-conditioning installations and heat pumps that contain F-gases as a coolant has also led to an increase in the emission of these gases from these systems.

A switch to the use of coolants with a lower GWP value, which has been implemented in the meantime, should slow this rise.

On a positive note, F-gas emissions from stationary cooling systems that are still in operation are falling. Regulation (EU) No 517/2004, which currently applies, aims to reduce Europe-wide emissions by at least 60% by 2030 compared with 2005 levels. To achieve that goal, various measures and conditions have been imposed. Producers of systems that contain coolants and users of F-gases already have to make various efforts and must continue to do so in the future. As these systems are the main sources of these emissions, the fall is therefore explained by a reduction in the use of the most harmful coolants, wider use of more environmentally friendly alternatives and improved leakproofing of the cooling systems.

As regards **process emissions**, since 2013 only nitrous oxide emissions from caprolactam production (and only those from the smallest sources), which accounted for 13% (or 0.8 Mt CO₂eq) of the emissions from non-ETS industry in 2017, have been included under non-ETS emissions. Since 2013, the N₂O resulting from nitric acid production and almost all CO₂ process emissions have been included under the EU ETS.

Only a small proportion of the emissions from non ETS industry (6% or 0.3 Mt CO₂eq) involves **fugitive emissions** from refineries, heating oil transport and gas distribution.

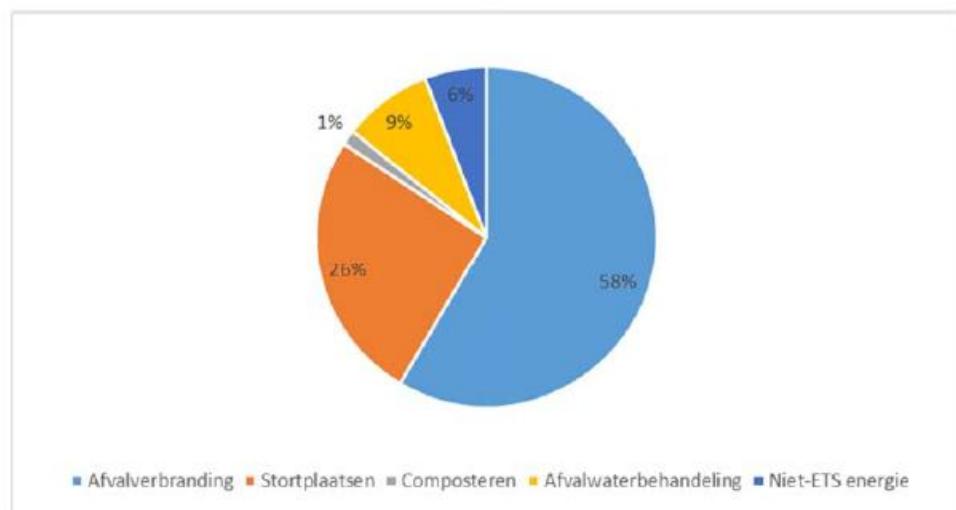
1.2.1.5. Waste sector

In 2017 the waste sector emitted 2.3 Mt CO₂eq, or 5% of non-ETS emissions. GHG emissions taken into account in the waste sector stem from waste incineration, landfills, composting and treatment of wastewater in sewage plants. This category also includes GHG emissions from the non-ETS part of the energy sector. These emissions are limited to methane and nitrous oxide emissions from the production of electricity and heat (as the CO₂ emissions fall under the EU ETS) as well as all GHG emissions from (a very limited number of) non-ETS cogeneration installations operated in collaboration with the electricity sector (²⁶).

Waste incineration accounts for the majority of emissions, at 58% in 2017 (Figure 1-16). Landfills and wastewater treatment account for 26% and 9% respectively.

²⁶ Where a cogeneration installation involves collaboration between an electricity generator and a partner in another sector, its consumption, energy balance and GHG inventory are fully attributed to the electricity sector.

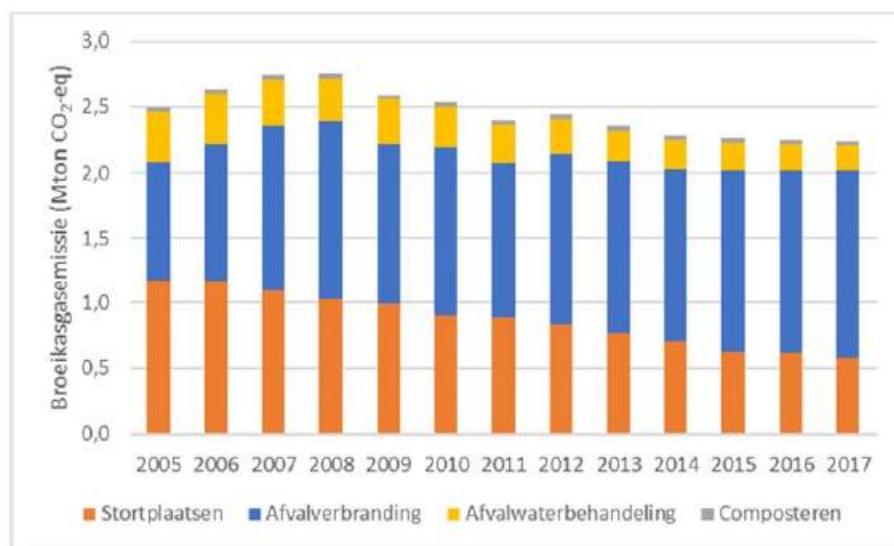
Figure 1-16. Proportions of GHG emissions in the waste sector in 2017



Afvalverbranding	Waste incineration
Stortplaatsen	Landfills
Composteren	Composting
Afvalwaterbehandeling	Wastewater treatment
Niet-ETS energie	Non-ETS energy

Between 2005 and 2017, the waste sector reduced GHG emissions by 20% (Figure 1-17). This is mainly due to the collection and treatment of landfill gas, which have been compulsory since 1995. Dumping in landfill has also been drastically reduced in accordance with the waste treatment hierarchy. A 50% reduction in methane emissions in the period 2005-2017 is the main factor behind the overall reduction in emissions in the waste sector. Restrictions on the dumping of waste continue, with this now being limited to flows for which there is no better treatment currently available. As a result, dumping of flammable waste is limited to fractions that are technically non-combustible. Landfills are designed in accordance with European legislation. Methane production will continue to fall in the future as no (or virtually no) organic waste is now being dumped and methane production at existing landfills is continuing to fall.

Figure 1-17. Trends in GHG emissions in the waste sector (excluding non-ETS energy)

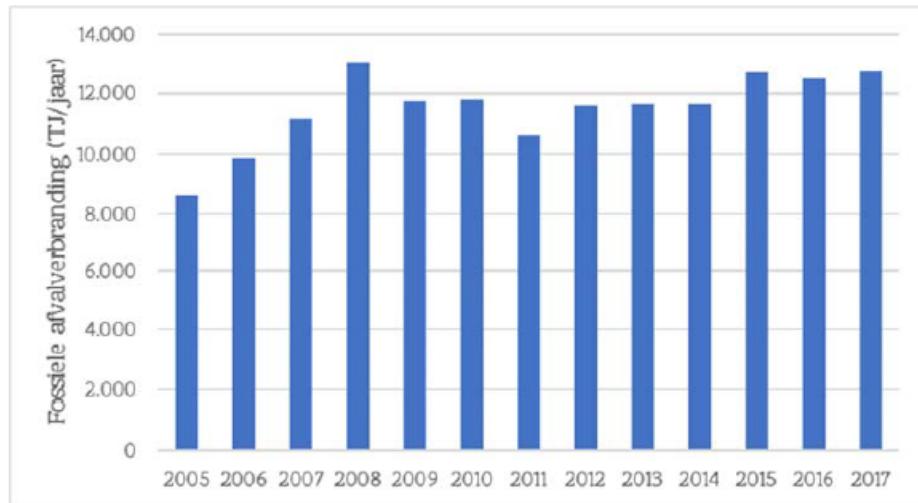


Broeikasgasemissie (Mton CO ₂ -eq)	GHG emissions (Mt CO ₂ eq)
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Stortplaatsen	Landfills
Afvalverbranding	Waste incineration
Afvalwaterbehandeling	Wastewater treatment
Composteren	Composting

Emissions from waste incineration plants increased by 46% in the period 2005-2017. Following a rise in the period 2005-2008, the total quantity of incinerated waste has stabilised (Figure 1-18).

Figure 1-18. Quantity of incinerated waste between 2005 and 2017



Broeikasgasemissie (Mton CO ₂ -eq)	GHG emissions (Mt CO ₂ eq)
Stortplaatsen	Landfills
Afvalverbranding	Waste incineration
Afvalwaterbehandeling	Wastewater treatment
Composteren	Composting

Figure 1-19. Analyses of household waste sorting



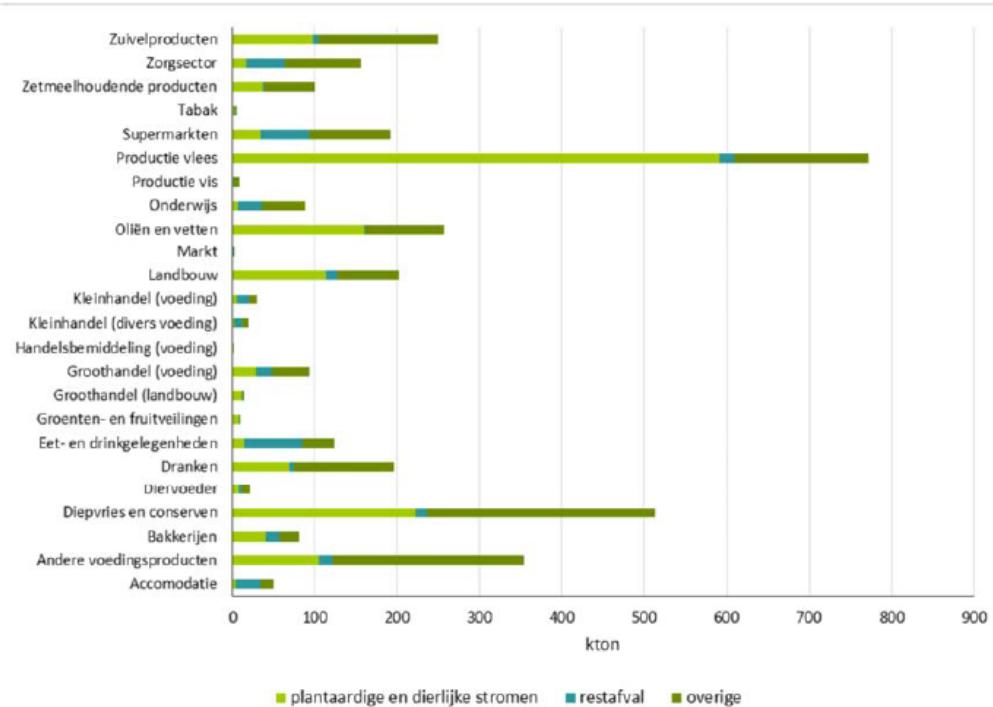
Inhoud van de huisvuilzak	Rubbish bag contents
kga	Small hazardous waste
houtafval	Wood waste
glas	Glass
organisch-biologisch afval	Organic and biological waste
drankkartons	Beverage cartons
textiel	Textiles
papier & karton	Paper and cardboard
kunststoffen	Plastics
metalen	Metals
overige	Other
hygiënisch afval	Hygienic waste
vast en niet-brandbaar afval	Solid and non-flammable waste
TOTAAL	TOTAL

Analyses of household waste sorting conducted by the Public Waste Agency of Flanders (Société publique des Déchets de la Région flamande/Openbare Vlaamse Afvalstoffenmaatschappij – OVAM) show that each inhabitant still generates an average of 110 kg of mixed household waste per year, of which a large proportion is potentially recyclable or can be dumped in landfill free of charge.

Recent waste sorting analyses made of selective roll-on roll-off containers in businesses show that still around 50% of similar residual commercial waste is potentially recyclable.

A recent survey entitled ‘Bedrijfsafvalstoffen productiejaar 2004-2016 (uitgave 2018)’ [Industrial waste production year 2004-2016 (2018 edition)] showed in particular that, in various relevant sectors, most of the organic and biological waste is selectively collected and recovered, but that, in several other sectors, a large part of this waste still ends up in the residual waste. The incineration of this organic and biological fraction is the least appropriate treatment method according to the waste hierarchy.

Figure 1-20. Ratio between plant and animal flows (including secondary raw materials), residual waste and other waste in the food sectors in Flanders in 2016



Zuivelproducten	Dairy products
Zorgsector	Healthcare sector
Zetmeelhoudende producten	Starch products
Tabak	Tobacco
Supermarkten	Supermarkets
Productie vlees	Meat production
Productie vis	Fish production
Onderwijs	Education
Oliën en vetten	Oils and fats
Markt	Market
Landbouw	Agriculture
Kleinhandel (voeding)	Retail (food)
Kleinhandel (diverse voeding)	Retail (miscellaneous food)
Handelsbemiddeling (voeding)	Commission trade (food)
Groothandel (voeding)	Wholesale (food)
Groothandel (landbouw)	Wholesale (agriculture)
Groenten- en fruitveilingen	Fruit and vegetable auctions
Eet- en drinkgelegenheden	Food and beverage outlets
Dranken	Drinks
Diervoeder	Animal feed
Diepvries en conserven	Frozen and canned foods
Bakkerijen	Bakeries
Andere voedingsproducten	Other food products
Accommodatie	Accommodation
plantaardige en dierlijke stromen	plant and animal flows
restafval	residual waste
overige	other

1.2.1.6. LULUCF sector

The way in which land use is organised has a direct impact on CO₂ concentrations in the atmosphere. After all, atmospheric CO₂ stored in soil and biomass (together with a long lifespan) does not contribute to climate change. As a result, better land use and management can slow climate change, while indiscriminate land use can have the opposite effect.

For LULUCF policy, the IPCC advocates five strictly defined categories: forest land, cropland, grassland, wetlands and settlements. In the Flemish greenhouse gas inventory, carbon storage and emissions through the various types of land use and through conversions between these (mandatory) are reported on the basis of these five land use categories. The settlement category in particular includes many different forms of land use, each with a very different carbon storage capacity. Distinctions will be made in this respect to ensure reporting and monitoring that are as accurate as possible. Table 1-2 summarises the breakdown of these categories into types of land use.

Table 1-2. Definition of the land use categories in the current Flemish greenhouse gas inventory

Forest land	- Forest preservation - Other land uses converted to forests
Cropland	- Cropland preservation - Other land uses converted to cropland
Grassland	- Grassland preservation - Other land uses converted to grassland
Wetlands	- Wetland preservation - Other land uses converted to wetlands
Settlements	- Settlement preservation - Other land uses converted to settlements

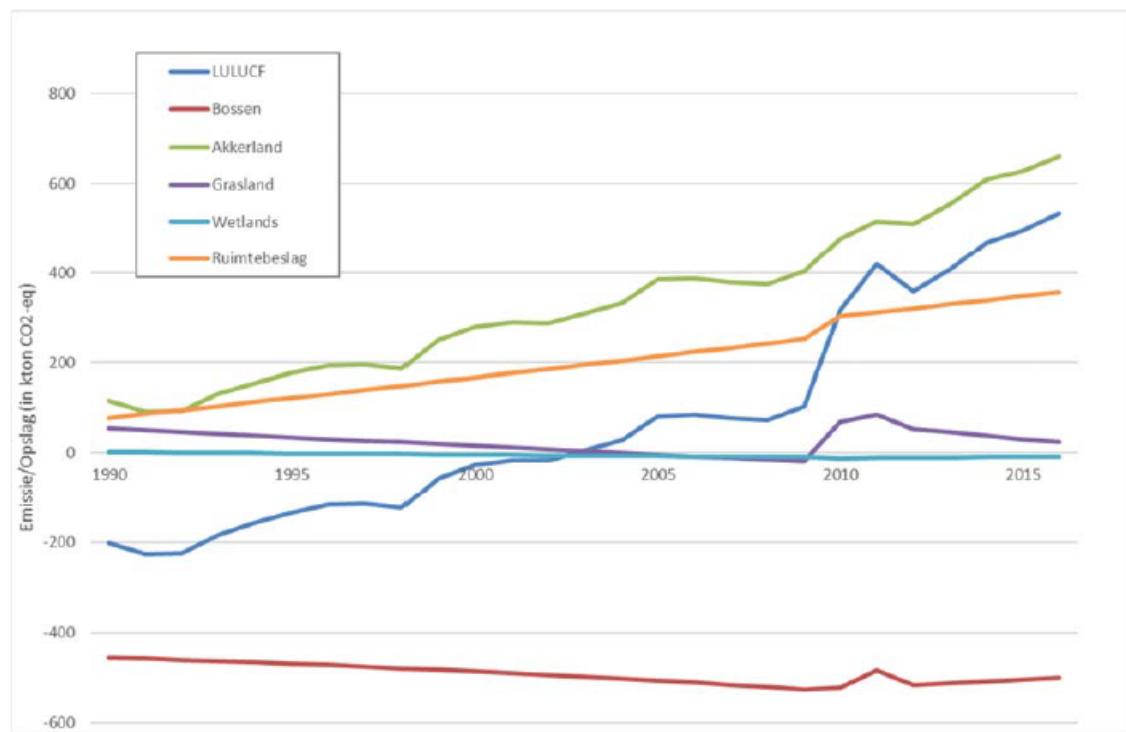
Table 1-3 provides an overview of carbon stocks and soil carbon concentrations for the various land use categories as reported in the Flemish greenhouse gas inventory for 2016. Until a soil carbon monitoring network is established (see Error! Reference source not found.), soil carbon concentrations are determined using the literature available.

Table 1-3. Overview of total carbon stocks in the various land use categories according to the current Flemish greenhouse gas inventory

	Surface area (ha) in 2016	Soil carbon (ton C/ha) in 2016	Total carbon stocks (kt C) in 2016
Forest land	153,938	96.3 (+60.3 in above-ground biomass)	24,159
Cropland	550,317	53.7	29,552
Grassland	188,809	73.5	13,877
Wetlands	33,214	100.0	3,321

Figure 1-21 illustrates the trends in carbon storage and emissions for the various land use categories, as reported in the Flemish greenhouse gas inventory. In accordance with IPCC guidelines, the start year of this inventory is 1990 and the conversion between land use categories is 20 years. In other words, grassland converted to cropland in 1990 leads to emissions in the greenhouse gas inventory up to 2010.

Figure 1-21. Trends in carbon storage and emissions for the various land use categories, as reported in the Flemish greenhouse gas inventory (1990-2016, in kt CO₂eq)



Emissie/Opslag (in kton CO ₂ -eq)	Emissions/storage (in kt CO ₂ eq)
LULUCF	LULUCF
Bossen	Forest land
Akkerland	Cropland
Grasland	Grassland
Wetlands	Wetlands
Ruimtebeslag	Settlements

To date, carbon storage and emissions as a result of these activities have been reported, but have been included in the European climate legislation, and in particular in the European climate targets, only to a very limited extent.

To fill this gap and meet the commitments under the Paris Agreement, Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU (hereinafter referred to as the LULUCF Regulation) has been approved. This regulation sets out the reporting rules and the obligations and objectives of the EU Member States in connection with the LULUCF sector for the period 2021-2030.

The LULUCF Regulation is divided into land use categories in order to cover the carbon storage and emissions through the various types of land use and conversions between them.

Table 1-4 provides an overview of this categorisation.

Table 1-4. Overview and allocation of the various types of land use (including conversions) to the various land use categories (see also Table 1-5)

From	To	Forest land	Cropland	Grassland	Wetlands	Settlements
Forest land	Managed forest land	Uncleared deforested land				
Cropland	Afforested land	Managed cropland	Managed grassland	Managed cropland	Managed cropland	Managed cropland
Grassland	Afforested land	Managed cropland	Managed grassland	Managed grassland	Managed grassland	Managed grassland
Wetlands	Afforested land	Managed cropland	Managed grassland	Wetlands	Wetlands	Wetlands
Settlements	Afforested land	Managed cropland	Managed grassland	Wetlands	Wetlands	Settlements

Carbon storage and emissions through soil and biomass, as shown in Figure 1-21, are partly determined by parameters that stem from natural/biological processes. The LULUCF Regulation is based on the principle that Member States are only responsible for emissions and/or storage of emissions caused by human activity. The accounting legislation agreed at European level therefore aims to count only those emissions and/or storage. That is predominantly why a specific comparison basis is used for counting emissions/storage through the various land use categories in the period 2021-2030.

For some activities such as deforestation and afforestation, all additional storage/emissions are counted, while for other activities (managed cropland, managed grassland, managed wetlands), a comparison is made with a historic reference period. Finally, in a third group, a comparison is made with a storage/emissions projection. To determine the development of storage through existing forests, the specific characteristics of the forest (age, composition, etc.) are decisive. That is why the LULUCF Regulation stipulates that storage/emissions through existing forests must be compared *ex post* with projected storage/emissions where the management of those forests (as in the reference period 2000-2009) is unchanged, i.e. with the Forest Reference Level (FRL) calculated *ex ante*. The 'settlements' category encompasses areas with buildings and infrastructure, including gardens, parks (city parks), sports fields, etc. Every category can be converted by human intervention to a 'settlement', with this category therefore also being relevant for the LULUCF emissions balance. However, the LULUCF Regulation does not advocate a specific reference or point of comparison for this land use category, which of course does not mean that settlements cannot in practice generate emissions. It is just that those emissions are implicitly included in other land use categories where they are part of settlements.

Table 1-5 shows how the various combinations indicated in Table 1-4 are allocated to the land use categories for reporting under the LULUCF Regulation.

Table 1-5. The various land use categories and the comparison basis advocated by the LULUCF Regulation

Land use categories	Reference
Afforested land	Full accounting
Uncleared deforested land	Full accounting
Managed cropland	Comparison with emissions/storage during the period 2005-2009
Managed grassland	Comparison with emissions/storage during the period 2005-2009
Managed forest land	Comparison with emissions/storage calculated <i>ex ante</i> where the management is unchanged (FRL)
Managed wetlands	Comparison with emissions/storage during the period 2005-2009
Settlements	Indirect accounting through other land use categories

ii. Projections of sectoral developments with existing national and Union policies and measures at least until 2040 (including for the year 2030)

1.1.2. Renewable energy

1.2.2.1 Current share of renewable energy in gross final energy consumption and in different sectors (heating and cooling, electricity and transport) as well as per technology in each of these sectors

This must be included in the energy and climate plan.

1.2.2.2 Indicative projections of development with existing policies for the year 2030 (with an outlook to the year 2040)

This must be included in the energy and climate plan.

Dimension Energy efficiency

1.1.3. Current primary and final energy consumption in the economy and per sector (including industry, residential, service and transport)

See 4.3.3.

1.1.4. Current potential for the application of high-efficiency cogeneration and efficient district heating and cooling

Historically, Flanders has had very few district heating systems. However, since financial aid was introduced in 2013 through regular calls for tender for green heat, residual heat, district heating systems and geothermal energy, many new projects have been implemented and are still planned.

At the end of 2017, urban district heating systems generated around 600 GWh of heat. Based on the projects planned and approved, this figure is expected to rise to 1,460 GWh by 2020. The energy plan 2021-2030 predicts continued average growth of 250 GWh/year (4,000 GWh by 2030), with urban district heating systems in Flanders expected to generate 6,568 GWh by 2030 in the most optimistic scenario. In 2017, 39% of the heat in these district heating systems came from renewable energy sources, with estimates predicting that this figure will rise to 52% by 2020.

Cogeneration is fairly widely used in Flanders, with a total capacity of 2,196 MWe in 2018 (3,369 MWth). According to the results of a comparative analysis with the covenants, the major industries sector offers additional potential of 187 MWe. This potential is more difficult to define in other sectors as it is either already incorporated in bio-cogeneration (auxiliary cogeneration) for the production of green heat and energy, or is less economically feasible based on current investment costs (small-scale cogeneration and micro-cogeneration). The capacity of micro-cogeneration is limited to around 2.5 MWe (2018). Around 9% of the electricity produced through cogeneration comes from renewable energy sources.

1.1.5. Projections considering existing energy efficiency policies, measures and programmes as described in point 1.2.(ii) for primary and final energy consumption for each sector at least until 2040 (including for the year 2030)

RESIDENTIAL BUILDINGS

WOM scenario

The WOM scenario starts in 2007 and is based on the principle that no strategy has been adopted. It is therefore a fictional scenario.

WEM scenario

The current strategy scenario or WEM scenario involves continuing the current policy (see above), with actual energy consumption being used up to 2017.

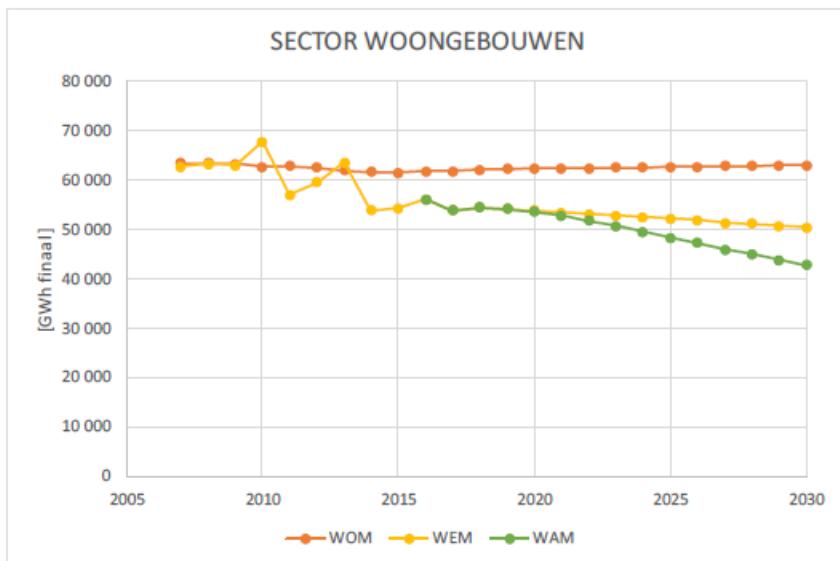
From 2018, a residential model known as the REBUS model is used to determine the fuel consumption of the Flemish housing stock. This is in line with fuel consumption in 2016, as indicated in the energy balance 1990-2017.

The WEM scenario is also based on increasing residential demand for electricity according to the PRIMES 2015. For the years 2019 and 2020, an annual reduction, expressed as a percentage, in electricity consumption of 0.1% is assumed. In the period 2020-2030, an annual increase, expressed as a percentage, of 0.20% is used.

WAM scenario

A WAM scenario has been developed by applying the additional measures to the WEM scenario on a bottom-up basis (by deducting the energy savings made through the additional measures).

[GWh final]	2007	2008	2009	2010	2011	2012
WOM	63,487	63,474	63,213	62,731	62,817	62,570
WEM	62,695	63,332	62,962	67,814	56,946	59,556
WAM						
[GWh final]	2013	2014	2015	2016	2017	2018
WOM	61,929	61,650	61,550	61,752	61,854	62,067
WEM	63,639	53,851	54,269	56,028	53,861	54,514
WAM				56,028	53,861	54,514
[GWh final]	2019	2020	2021	2022	2023	2024
WOM	62,173	62,321	62,357	62,428	62,503	62,554
WEM	54,138	53,805	53,456	53,166	52,876	52,508
WAM	54,121	53,614	52,774	51,780	50,662	49,437
[GWh final]	2025	2026	2027	2028	2029	2030
WOM	62,631	62,731	62,890	62,857	62,930	63,042
WEM	52,149	51,906	51,261	51,091	50,735	50,416
WAM	48,257	47,261	45,866	44,950	43,850	42,791



SECTOR WOONGEBOUWEN [GWh final]	RESIDENTIAL BUILDINGS SECTOR [GWh final]
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The additional measures result in a final energy saving of 7,625 GWh or 15.1% (compared with current policy) by 2030. Compared with the WOM scenario, a final energy saving of 20,250 GWh or 32.1% is made.

The following table summarises the savings expected from the additional measures:

Additional measures	Savings by 2030 (GWh)
Increase the maximum EPB score for rental accommodation	341
Develop tax reduction initiatives (from 2021)	78
Local climate tables	284
Encourage the replacement of electric water heaters with heat pump water heaters (from 2019)	90
Speed up the rate of renewal and optimisation of current gas and heating oil boilers (from 2021)	2,163
No gas connection in new housing developments and large apartment blocks, except in the case of collective heating through cogeneration or in combination with a renewable energy system as the main heating system (from 2021)	76
Ban on using heating oil boilers in new-builds and major energy renovations (from 2021)	10
Measures to encourage demolition (from 2019)	557
Working capital for energy renovations of housing purchased as a matter of urgency (from 2020)	96
Behavioural change through information on bills (from 2021)	52
Major energy renovations – natural gas savings by switching from E90 to E70 (from 2020) and E60 (from 2025)	25
Encourage the renovation of housing following a notary-approved transfer (from 2021)	3406
Speed up the removal of asbestos from the roofs of housing (from 2021)	447
Total of all additional measures	7,625

Changes from the draft energy plan

The WEM scenario has been brought into line with the figures from the 1990-2017 energy balance. In addition, both the WEM and WAM scenarios take account of a change in electricity demand, as the draft energy plan was based on electricity forecasts 'for appliances and lighting'. Given that heating and domestic hot water also consume electricity, it seems more logical to use forecasts covering all electricity consumption.

The REBUS model, used to determine future fuel consumption, has been brought into line with fuel consumption in 2016. In the draft energy plan, the reference year was 2012.

As regards the energy saving calculations, the references have been improved by using data from the energy performance database and system operator incentives.

NON-RESIDENTIAL BUILDINGS

WOM scenario

The starting year is 2007. The WOM scenario is based on the principle that no strategy has been implemented. It is therefore a fictional scenario. The WOM scenario is obtained by adding the savings made through system operator incentives to the WEM scenario.

WEM scenario

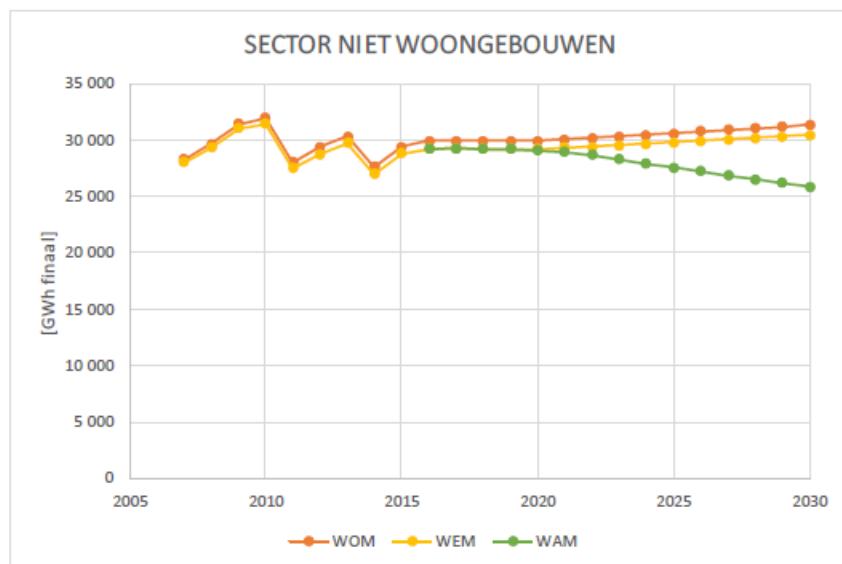
In the WEM scenario, actual consumption figures from the energy balance are used up to 2017. From 2018, the PRIMES assumptions are used to estimate use:

- For fuels: an annual reduction, expressed as a percentage, of 0.064% during the period 2010-2020. For the period 2020-2030, an annual reduction, expressed as a percentage, of 0.307% is used.
- For electricity: during the period 2010-2020, electricity consumption is not expected to change. For the period 2020-2030, an annual increase, expressed as a percentage, of 1.4% is used.

WAM scenario

The WAM scenario is based on additional measures generating savings identical to those in the housing sector.

[GWh final]	2007	2008	2009	2010	2011	2012
WOM	28,250	29,621	31,437	31,920	28,036	29,362
WEM	28,012	29,295	31,006	31,426	27,471	28,762
WAM						
[GWh final]	2013	2014	2015	2016	2017	2018
WOM	30,308	27,608	29,416	29,891	29,915	29,912
WEM	29,693	26,985	28,770	29,223	29,228	29,214
WAM				29,223	29,228	29,214
[GWh final]	2019	2020	2021	2022	2023	2024
WOM	29,916	29,920	30,050	30,182	30,317	30,455
WEM	29,200	29,186	29,299	29,414	29,531	29,651
WAM	29,191	29,083	28,926	28,647	28,295	27,917
[GWh final]	2025	2026	2027	2028	2029	2030
WOM	30,595	30,737	30,882	31,030	31,180	31,333
WEM	29,773	29,898	30,025	30,155	30,288	30,423
WAM	27,551	27,223	26,865	26,530	26,177	25,821



SECTOR NIET WOONGEBOUWEN [GWh final]	NON-RESIDENTIAL BUILDINGS SECTOR [GWh final]
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Given that the additional measures are identical to those in the housing sector and that the savings made are assumed to be the same, a saving of 15.1% is expected. This therefore represents a saving of 4,601 GWh compared with the WEM scenario. Compared with the WOM scenario, a final energy saving of 5,512 GWh or 17.6% is made.

Changes from the draft energy plan

Both the WEM and WAM scenarios take account of a change in electricity demand, as the draft energy plan was based on electricity forecasts 'for appliances and lighting'. Given that heating and domestic hot water also consume electricity, it seems more logical to use forecasts covering all electricity consumption.

INDUSTRY

WOM scenario

The WOM scenario (fictional scenario in which no strategy has been implemented) is obtained by adding the actual energy consumption (in the past) and the future energy consumption (projection of current policy) of industry to the savings made under covenants and energy policy agreements (EPAs) over time.

Final energy consumption in the WOM scenario in 2030 is 156,515 GWh.

WEM scenario

The current strategy is pursued with emphasis on subsequent permanent optimisation of energy efficiency in industry in order to cost-effectively save energy where possible while allowing Flemish industry to grow. As a result of continuing the current EPA, there will be an annual reduction in energy efficiency savings as contractors will find it increasingly difficult to continue improving their energy efficiency processes. That is why the WEM scenario uses a downward trend: from 0.865% (in 2022) to 0.785% (in 2030) in terms of annual energy efficiency improvement for EDE businesses and from 1.22% (in 2022) to 1.14% (in 2030) in terms of annual energy efficiency improvement for non-EDE businesses.

Furthermore, the WEM scenario also assumes that economic growth will increase energy consumption by 1.7% per year (27), where the percentage of both types of EPA business remains the same as currently and where the

²⁷ As regards the impact of economic growth, an increase of 1.30% in the fossil fuel consumption of non-EDE industry is used.

level of electricity consumption also remains constant. In the WEM scenario, the current environmental incentive also continues.

This results in increased efficiency of 8.0% in 2030 compared with 2020.

Final energy consumption in the WEM scenario in 2030 is 132,956 GWh, or 15.1% less than the WOM scenario.

WAM scenario

The WAM scenario takes account of additional measures during the period 2021-2030 as a result of the current instrument being expanded.

The WAM scenario is based on the EPA being extended, resulting in an equivalent level of annual energy efficiency savings over time due to expansions in the measure in energy terms: for EDE businesses, an annual energy efficiency improvement of 0.865% and, for non-EDE businesses, an annual energy efficiency improvement of 1.22%. By extending the legislative framework (reduction in the lower limit of the obligation to produce an appropriate energy plan to 0.1 PJ) to non-energy-intensive businesses, those non-EPA businesses will also achieve an annual energy efficiency improvement of 0.5% in 2030. The environmental incentive remains and results in greening. The mini-EPA also continues to be implemented in non-energy-intensive industry.

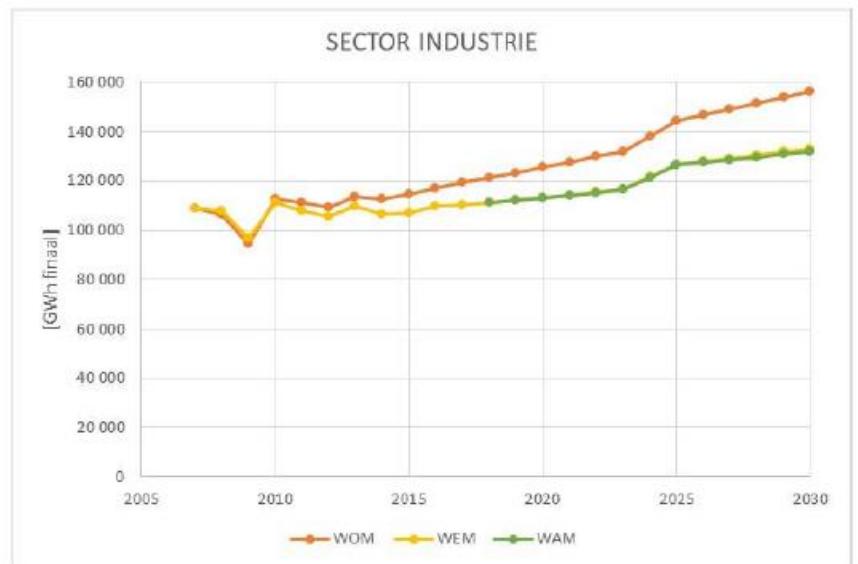
Furthermore, the WAM scenario also assumes that economic growth will increase energy consumption by 1.7% per year ⁽²⁸⁾, where the percentage of both types of EPA business remains the same as currently and where the level of electricity consumption increases in 2030 due to electrification in industry. This results in increased efficiency of 9.2% in 2030 compared with 2020.

The WAM scenario therefore involves final energy consumption of 131,820 GWh in 2030. This represents a reduction in energy consumption of 24,695 GWh (-15.8%) compared with the WOM scenario.

This therefore gives the following figures to 2030:

[GWh final]	2007	2008	2009	2010	2011	2012
WOM	108,554	106,677	94,724	112,629	111,165	109,235
WEM	108,554	108,139	95,761	111,092	107,764	105,516
WAM						
[GWh final]	2013	2014	2015	2016	2017	2018
WOM	113,776	112,895	114,493	117,088	119,288	121,316
WEM	109,923	106,451	107,022	109,639	110,188	111,188
WAM						111,202
[GWh final]	2019	2020	2021	2022	2023	2024
WOM	123,379	125,476	127,649	129,778	131,985	138,228
WEM	112,204	113,238	114,288	115,357	115,453	121,577
WAM	112,232	113,287	114,307	115,334	115,367	121,406
[GWh final]	2025	2026	2027	2028	2029	2030
WOM	144,510	146,831	149,191	151,591	154,032	156,515
WEM	125,730	127,7914	129,127	130,371	131,548	132,956
WAM	126,451	127,504	128,565	129,636	130,720	131,820

²⁸ As regards the impact of economic growth, an increase of 1.30% in the fossil fuel consumption of non-EDE industry is used.



SECTOR INDUSTRIE [GWh final]	INDUSTRY SECTOR [GWh final]
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Changes from the draft energy plan

As indicated in the draft energy plan, the figures for industry have been further refined. In particular, this refined calculation model also takes account, as requested, of impacts and trends in the various economic growth scenarios, electrification in industry and greening of energy carriers.

Forecasts have been made for the scenarios described above: WOM (scenario without any policy), WEM (scenario taking account of current policy) and WAM (scenario taking account of additional policy). The figures are based on the Flemish energy balance. As a result, data provided by the audit office have been used to break down the figures into different categories: energy-intensive or non-energy-intensive, EDE or non-EDE, EPA or non-EPA contractor. Based on this categorisation, forecasts have been made for the various strategic measures.

Compared with the draft energy plan, the WAM scenario now involves an upward trend in energy consumption, whereas it followed a downward trend in the draft. This is due to the fact that the energy savings resulting from measures in non-energy-intensive industry (mini-EPA and environmental incentive) were overestimated. As a result, the WAM scenario in the draft energy plan gave a truncated picture of the trend in energy consumption. This situation has therefore been rectified in the final plan by using the rectified calculation model.

Assumptions

Economic growth

Various trends have been used to estimate how energy consumption and its associated emissions will develop. The first of these is gradual growth in the industrial sector, in terms of both volume and value added. There is no simple correlation between energy consumption and growth in volume. Improvements in the quality of products supplied also have an impact on energy consumption and are reflected in price levels. A growth figure of 1.70% has been used. In terms of growth in fossil fuel consumption in non-EDE industry, a figure of 1.30% has been used.

This assumption is based on figures provided by the HERMREG model for Flanders. Projections of gross value added in volumes and prices were also used to determine an average of 1.70%. In this context, it was also assumed that industry as a whole will experience an improvement in quality (increase in energy consumption).

Several large projects that are currently being prepared at the Port of Anvers and that exceed the average growth figures indicated above have also been taken into account in the figures. All the scenarios involve an absolute

increase in energy consumption in two stages: 4,000 GWh of additional energy consumption from 2024 and a further 4,000 GWh from 2025.

Economic growth mainly affects the reduction in absolute emissions in the non-EDE sector (compared with the reference year 2005) and the proportion of renewable energy (change in the energy consumption denominator). It has little impact on the other forecasts, such as energy consumption or improved efficiency.

Greening of energy carriers and electrification

The forecasts take account of two different types of greening. The first is encouragement to electrify the energy supply of industry. At the same time, there is also increasing use of renewable fuels. These two factors should green energy carriers by 10% in non-EDE industry.

The electrification potential is slowly increasing. EURELECTRIC estimates that, by 2050, between 45% and 60% of all industrial energy consumption will be electric. These figures are based on a current ratio of 33%, which is a European average. In Flanders, the current ratio is 24%, although a more limited forecast of potential should perhaps be used, i.e. between 32% and 44% in 2050. If there is a gradual increase, this will result in electrification of between 27.5% and 32.5% in 2030. The WAM scenario uses a more cautious lower estimate of potential, with maximum electrification being limited to 25.5%.

Without any additional measures, the WOM and WEM scenarios do not include any electrification. In other words, it is assumed that electrification results from industrial policy and innovation.

At the same time, those energy sources that can be used for industrial production need to be gradually greened, which can be achieved by using renewable fuels. This greening may also be accompanied by increased energy consumption and reduced energy efficiency. Furthermore, the availability of renewable fuels in Flanders is limited. The ambition of 10% should be monitored to ensure that it is feasible in the long term.

‘Ecologiepremie+’ environmental incentive

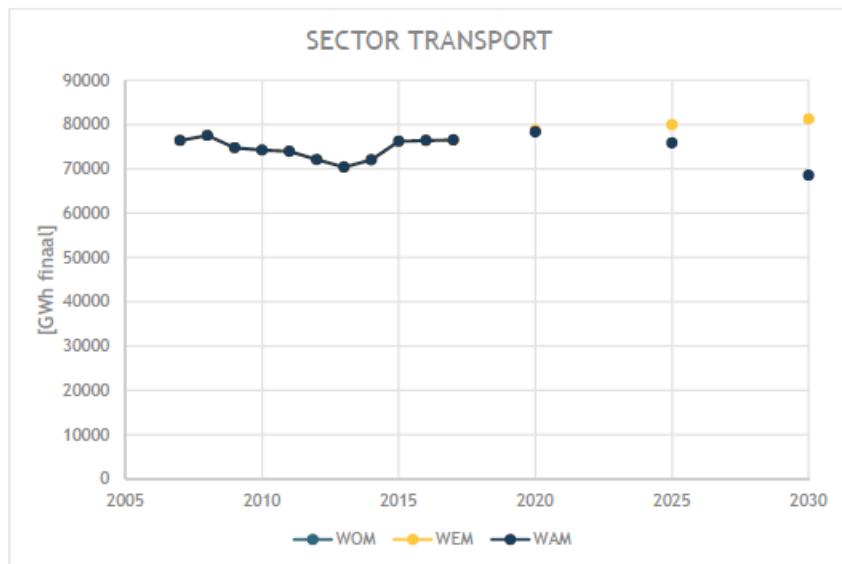
Current environmental incentive projects are not having any impact at the moment in terms of reducing emissions or energy consumption. There is no comprehensive overview of environmental incentive applications that clearly identifies those businesses involved in emissions trading or covered by a covenant or energy policy agreement (EPA). The information currently available is not unequivocal and an estimate of the impact based on that information is also dubious. Improved monitoring will determine whether the estimated orders of magnitude are realistic.

The environmental incentive monitoring system will be adapted in the future. The impact of the environmental incentive in terms of emissions and energy consumption compared with the standard technique will be recorded for each application. Furthermore, an improved database will allow the necessary information and data to be compiled in a structured manner.

Measures covered by the environmental incentive can be classed under energy efficiency improvements, F-gases, renewable heat systems, electrification and environmental measures. This analysis only concerns energy efficiency improvements. Environmental measures are not taken into account as their impact on emissions and energy consumption is not decisive. Renewable heat measures have been suspended since 2015 and are no longer taken into account in the WEM scenario. F-gas measures form part of the F-gas policy.

TRANSPORT

For the assumptions in the WEM and WAM scenarios, please refer to the section on transport in the Climate part.



SECTOR TRANSPORT		TRANSPORT SECTOR	
[GWh final]	[GWh final]	[GWh final]	[GWh final]

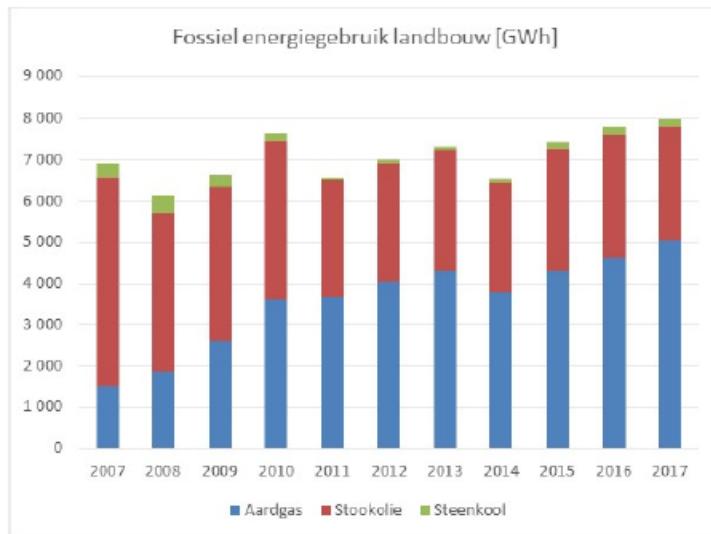
[GWh final]	2007	2008	2009	2010	2011	2012	2013
WEM	76,388	77,545	74,760	74,233	73,949	72,104	70,383
WAM	76,388	77,545	74,760	74,233	73,949	72,104	70,383
[GWh final]	2014	2015	2016	2017	2020	2025	2030
WEM	72,047	76,226	76,410	76,520	78,750	79,944	81,250
WAM	72,047	76,226	76,410	76,520	78,333	75,861	68,556

The WEM scenario forecasts final energy consumption of 81,250 GWh in 2030. The WAM scenario forecasts final energy consumption of 68,556 GWh in 2030, i.e. a reduction of around 16%.

Changes from the draft energy plan

The calculations have been brought into line with the Air Plan. A number of adjustments have also had to be made: in the WEM and WAM scenarios of the draft energy plan, only road transport (without any fuel surplus) was taken into account. Fuel surplus and other modes of transport are now also taken into account. In addition, the WEM scenario was wrongly regarded as a WOM scenario in the draft plan. No WOM scenario is available for transport.

AGRICULTURE



Fossiel energiegebruiklandbouw [GWh]	Fossil fuel consumption in agriculture [GWh]
Aardgas	Natural gas
Stookolie	Heating oil
Steenkool	Coal

The above figure shows that fossil fuel consumption in the agricultural sector did not reduce over the period 2007-2017, despite efforts to rationalise energy consumption and use lower carbon fuels in glasshouse horticulture. Fossil fuels are mainly used, in glasshouse horticulture and intensive farming, to heat greenhouses and barns. The figure also shows a change in fuel, from oil products (particularly heating oil) to natural gas. Since 2008, natural gas consumption has risen at a rapid rate because an ever increasing number of cogeneration units are being brought into service for own use. In addition to installations that are mostly new, some of these cases involve the replacement of older equipment, much of which was operated in collaboration with an electricity producer. This equipment is now being replaced by own-use units, resulting in a shift in natural gas consumption, in the energy balance, from the transformation sector to the agricultural sector.

WOM scenario

The WOM scenario can be calculated as the scenario in which the impact of aid provided by the Flemish Agricultural Investment Fund (Fonds flamand d'investissement Agricole – VLIF) is not taken into account and the change in use of energy carriers is interrupted due to the lack of any support policies. This fictional scenario results in energy consumption of 9,683 GWh in 2030.

WEM scenario

The WEM scenario (existing policy) takes account of existing energy-related VLIF aid (EUR 7 billion/year), which involves around 560 applications/year. If this investment were not made in the absence of VLIF aid, there would be an additional annual energy saving of 224 GWh. Only investment in replacements is included in the WEM forecasts (around 50% of the aid applications), which results in an annual saving of 113 GWh and the respective cumulative total for the entire period. In the WEM scenario, this same rate of investment is used for the period 2021-2030, which results in a final energy consumption of 7,667 GWh in 2030.

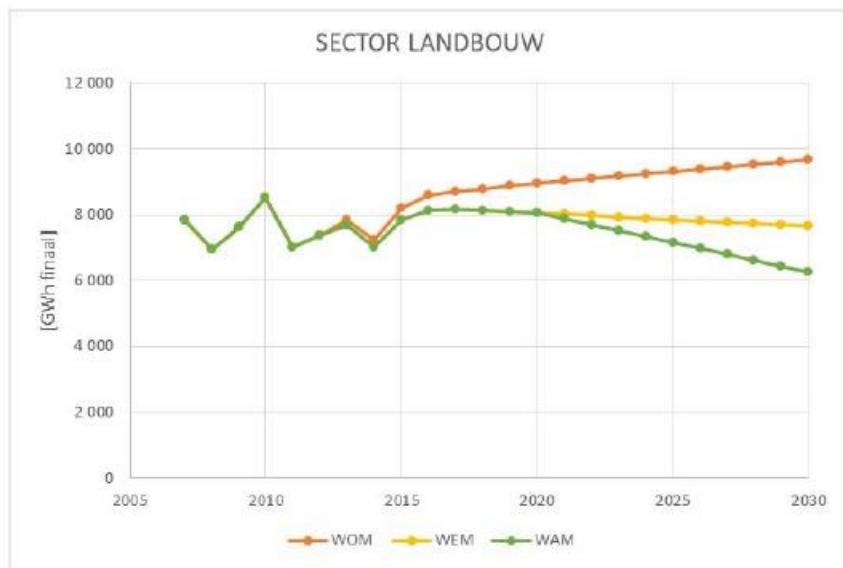
WAM scenario

In the WAM scenario, energy emissions in the agricultural and horticultural sector will be 28% lower than in the WEM scenario in 2030. Achieving this result will require, as in the industrial sector, EPAs for the energy-intensive (glasshouse) horticultural sector, which will take effect in 2023. Under the government agreement for 2019-2024, this is one of the notified expansions, i.e. the expansion of the EPA target group to the (glasshouse)

horticultural sector. Furthermore, mini-EPAs comparable to those for industrial SMEs will also be concluded with less-energy-intensive agricultural undertakings through the relevant (sub-)sectoral federations.

Final energy consumption in the WAM scenario is 6,251 GWh in 2030.

Summary



SECTOR LANDBOUW		AGRICULTURAL SECTOR	
[GWh final]	[GWh final]	[GWh final]	[GWh final]

[GWh final]	2007	2008	2009	2010	2011	2012
WOM	7,841	6,950	7,615	8,534	7,011	7,373
WEM	7,841	6,950	7,615	8,534	7,013	7,373
WAM	7,841	6,950	7,615	8,534	7,013	7,373
[GWh final]	2013	2014	2015	2016	2017	2018
WOM	7,825	7,225	8,189	8,585	8,718	8,792
WEM	7,713	7,001	7,853	8,137	8,158	8,120
WAM	7,713	7,001	7,853	8,137	8,158	8,120
[GWh final]	2019	2020	2021	2022	2023	2024
WOM	8,857	8,941	9,015	9,089	9,163	9,238
WEM	8,083	8,045	8,007	7,969	7,931	7,894
WAM	8,083	8,045	7,865	7,686	7,507	7,327
[GWh final]	2025	2026	2027	2028	2029	2030
WOM	9,312	9,386	9,460	9,534	9,608	9,683
WEM	7,856	7,818	7,780	7,742	7,704	7,667
WAM	7,148	6,969	6,789	6,610	6,431	6,251

Changes from the draft energy plan

The calculations have been brought into line with those in the Climate Plan. The energy savings made as a result of the VLIF aid have been taken into account in the WEM and WAM scenarios by using a bottom-up calculation method. The alignment with the savings figures included in the Climate Plan has led to the assumption that around half of the investment can be categorised as investment in replacements through the VLIF aid.

In addition, the figures for the past in the agricultural sector have been brought into line with the figures in the Flemish energy balance.

A fictional WOM scenario has also been added. In its calculation, it was assumed that, in the absence of relevant support policies, the breakdown of energy carriers would remain the same.

1.1.6. Projections considering existing energy efficiency policies, measures and programmes as described in point 1.2.(ii) for primary and final energy consumption for each sector at least until 2040 (including for the year 2030)

1.1.7. Cost-optimal levels of minimum energy performance requirements resulting from national calculations, in accordance with Article 5 of Directive 2010/31/EU

Residential buildings

In 2017 the Flemish Energy Agency (Agence flamande de l'Énergie/Vlaams Energieagentschap – VEA) re-confirmed the feasibility of the planned reinforcement of energy performance requirements in accordance with cost-optimal measures. In 2012 and 2015, cost-optimal studies were carried out under Directive 2010/31/EU (see <https://www.energiesparen.be/bouwen-en-verbouwen/epb-pedia/epb-beleid/studies>). Those studies involved exhaustive economic optimisation using the method defined in the Commission Delegated Regulation of 16 January 2012. As the input parameters have changed little since the previous study, no exhaustive economic optimisation was required in this study.

The process involved verification calculations for a wider set of buildings (54), with geometries taken from actual files added in the last two years to the energy performance database. Using a limited number of packages of cost-optimal and cost-effective measures deriving from the previous studies, the feasibility of the planned tightening of the requirements to the E30 NZEB level by 2021 was examined for the new geometries.

Although the energy performance levels envisaged were not achieved with the packages of measures examined, further research was conducted to determine the measures needed, the impact on cost optimisation and the cost of the additional investment compared with a package of reference measures (E50). Furthermore, the reasons why certain reference buildings 'more easily' achieved an E-level below that of other buildings with the same packages of measures were examined.

The methodological framework applied in the previous studies was simplified and the following points were adapted:

- new reference buildings, selected from actual files added to the energy performance database;
- limitation of the number of packages of measures to a minimum of 10 (maximum of 15) based on the cost-optimal measures of the previous study;
- limitation of the cost categories to initial investment costs and total energy costs;
- limitation to sensitivity analyses appropriate to this context;
- update of the current methodology and relevant energy performance requirements, with the K level no longer being assessed, but being replaced by the planned S level;
- simplification of the feasibility analysis and results, with no new determination of the cost-optimal levels.

Study results

It generally seems that the additional costs involved in upgrading single-family buildings and apartments to the E30 level are limited to a maximum of 10% of the initial investment cost for most of the packages of measures

defined. These investment costs are largely offset by lower energy bills, and can even lead to cost-optimal solutions, despite additional investments in construction. Some packages of measures may prove more expensive only for large sprawling individual homes with extensive glazing and also apartments (on the top floor) with many windows.

Where there is sufficient space available on the roof for photovoltaic panels, in combination with a gas condensing boiler, the additional investment cost can even be limited to just 2% to 4% of the initial investment cost. The total current cost (TCC) can even be less than the E50 reference package.

However, there are also packages of measures without PV panels that, in combination with building envelope improvements, heat pumps and collective heat production and/or domestic hot water production, can achieve the E30 or E27 levels, with the additional investment still being limited to less than 5% compared with the E50 reference package. Under the current framework conditions, the TCC can therefore be up to 4% higher than the reference package. Collective installations that can also provide renewable energy through heat production can get close to the reference package through the detailed input of performance in accordance with Ecodesign.

It is expected that innovative systems currently available and introduced in the future will increase the number of packages of cost-effective measures.

Further to the above observations, it can also be noted that the calculations were made based on a reference value for the E-level of E50. Since the start of 2018, the E-level requirement has been increased to E40. The actual additional investment needed to achieve E40 will be significantly less than that for E50. In addition, in 2019 the price of photovoltaic panels fell sharply. It can be assumed that this measure is now at the cost-optimal level in all cases.

Furthermore, this study does not use default values at all; rather, it is always based on detailed calculations. This approach clearly requires attention to be paid to all the links in the construction process. Everyone involved will definitely also be on a learning curve.

As regards apartments, certain risks are highlighted: with a high level of glazing, a less favourable density and a possible lack of shaded roof surface, apartments can struggle with the E30 limit. Even the smallest apartments or studio flats with a single external façade can face problems in terms of overheating and cooling needs. The 'high-rise building with many small units' combination can therefore struggle to meet the E requirement and the minimum proportion of renewable energy, despite its potential for very low absolute energy consumption.

Non-residential buildings

To ensure that the set requirements are achievable and affordable, a new study of the cost-optimal E-levels has been carried out every two years. If necessary, this procedure can be adapted.

Results for non-residential buildings

In the cost optimisation study (²⁹), various scenarios were calculated for 11 buildings with a total of 38 functions. Different buildings from those included in the 2015 cost optimisation study were specifically chosen so that the widest possible range of buildings could be studied. The highest possible number of different functions was also examined, where possible several times. This time, buildings were available for 'meeting facilities – low occupancy' and 'other' functions.

The study indicates that the use of photovoltaic panels and the application of free floor cooling are the main options. In other words, these measures are always on the Pareto frontier, which contains all the cost- and energy-optimal solutions. With regard to PV panels, this means that the entire roof of the building is covered with PV panels. The E-level achieved therefore largely depends on the roof area available: the larger the roof,

²⁹ The studies can be consulted through the following list: <https://www.energiesparen.be/bouwen-en-verbouwen/epb-pedia/epb-beleid/studies>

the lower the E-level achieved. Installing PV panels has a major impact on the E-level, but is not always possible (e.g. heavily shaded roof, wrong orientation of the roof, high-rise buildings with a small roof area).

That is why their use was excluded from the base scenario as this removed the high correlation between cost-optimal results and the available roof area, ensuring a wide distribution of results. Without photovoltaic panels as a measure, a uniform range of results was obtained.

The same finding applies to free floor cooling, where the cooling is deemed to be free of charge. With free or passive floor cooling, there is no cold generator, but only a circulation pump to carry the cold stored in the ground during the winter to a heat exchanger in the building. If this form of 'free' cooling can be used, the results point towards less heating and more cooling (which is always free of charge, except where auxiliary energy is used). However, this type of cooling cannot be widely used. There needs to be a sufficient cooling capacity available in the immediate vicinity, which depends on the geological properties of the subsoil (for example, depth of the aquifer sand layers, soil permeability, ground area available). That is why this solution was also removed from the base scenario.

Table 9 shows the macroeconomic cost-optimal E-level (without PV panels and without free floor cooling) by function. For those functions with multiple results, the *range* of results is indicated. In addition to the cost optimisation, a 'tipping point' was also determined, which is the lowest E-level achieved for a current total cost (CTC) 10% higher than the current total cost of the cost-optimal solution. This point is a good indication of the flatness of the area where the costs are optimal. The larger the difference in E-level between the two points, the flatter the Pareto frontier and the wider the area where the costs are optimal. In other words, for a limited additional cost, even lower E-levels can be easily achieved. The following table gives an example of a Pareto frontier with a tipping point and a cost-optimal point.

Table 10. Results of the study of the cost-optimal E-level and tipping point level for new-builds

	E-Level Requirement 2021 (-)	Cost-optimal E-Level (-)	+10% CTC E-Level (-)
Housing	E70	69	49
Office	E50	62-81	46-65
Education	E55	52-54	40-42
Healthcare – Inpatient	E70	47-58	46-52
Healthcare – Outpatient	E65	69	60
Healthcare – Operating theatres	E50	50	48
Meeting facilities – High occupancy	E65	45-72	40-64
Meeting facilities – Low occupancy	E65	38-48	32-40
Meeting facilities – Cafeteria	E60	48-51	43-44
Kitchen	E55	66 (122)	59 (106)
Retail	E60	42-45	40
Sport – Sports hall/gym	E50	56	46
Sport – Fitness/dance	E40	56	50
Sport – Sauna/swimming pool	E50	37-43	28-39
Plant room	E50	5-8	5-6
Communal areas	E80	47	42
Other	E80	58-60	41-42

The results for the cost-optimal E-level are fairly uniform for the various non-residential functions. Only the Kitchen functional part of residential care centres has a markedly different result. This type of kitchen serves many of the 'inpatient care' facilities. Demand for domestic hot water in such kitchens is calculated on the basis of the area of the functional part served (5,155 m²), which is very large. This situation results in a high E-level.

As such kitchens form a small functional part of a larger building, the impact on the E-level achieved for the building as a whole is limited. It is therefore very important that designers and draughtsmen pay the necessary attention to the building's division into functions and to the application of any grouping rules. After all, the E-level requirement applies to the building and not to the function. A less efficient functional part can be partly offset by another more efficient functional part within the same NEP (non-residential energy performance) unit.

Based on the results and analyses, the person in charge of the study divided the various functions into three different groups:

- on average meets a lower E-level (green);
- on average meets the set requirement (no marking);
- on average meets a higher E-level (red).

Table 6. Comparison of results for new-builds with set requirement levels by function

	E-Level Requirement 2021 (-)	Cost-optimal E-Level (-)	+10% CTC E-Level (-)
Housing	E70	69	49
Office	E50	62-81	46-65
Education	E55	52-54	40-42
Healthcare – Inpatient	E70	47-58	46-52
Healthcare – Outpatient	E65	69	60
Healthcare – Operating theatres	E50	50	48
Meeting facilities – High occupancy	E65	45-72	40-64
Meeting facilities – Low occupancy	E65	38-48	32-40
Meeting facilities – Cafeteria	E60	48-51	43-44
Kitchen	E55	66 (122)	59 (106)
Retail	E60	42-45	40
Sport – Sports hall/gym	E50	56	46
Sport – Fitness/dance	E40	56	50
Sport – Sauna/swimming pool	E50	37-43	28-39
Plant room	E50	5-8	5-6
Communal areas	E80	47	42
Other	E80	58-60	41-42

Based on the relatively uniform set of results obtained and on the limited impact of the sensitivity analyses, the Flemish Energy Agency (VEA) concludes that the study results are sufficiently reliable to determine the cost-optimal levels. The VEA notes that it was not always possible to determine, from the database of recent non-residential buildings, to what extent the buildings studied form a reference for new-builds. However, the sensitivity analyses associated with the buildings show that the theoretical approach of the NEP method limits the impact of the building's geometry on the cost-optimal level.

Furthermore, the results must be viewed with caution. The buildings in this study are an extension of the 2015 cost optimisation study. However, the results of the two studies cannot be compared on an individual basis. The NEP method has changed in the meantime and can therefore be compared only based on an order of magnitude. As was the case in 2015, a lack of experience has been noted, both within authorities and in the sector, with regard to the subdivision of buildings and its impact, among other factors. There is not yet any 'sense' of the E-level of the various functions, as is the case with residential buildings.

2. IMPACT ASSESSMENT OF PLANNED POLICIES AND MEASURES

Impacts of planned policies and measures described in section 3 on energy system and GHG emissions and removals, including comparison to projections with existing policies and measures (as described in section 4).

Projections of the development of emissions of air pollutants in accordance with Directive (EU) 2016/2284

On 25 October 2019 the Flemish Government finally approved the Air Policy Plan 2030. This plan contains measures to combat air pollution in Flanders and, in so doing, to reduce its impact on our health and the environment. The plan was prepared under Article 23 of Directive 2008/50/EC and under Directive 2016/2284. It contains emission projections and can be consulted at <https://beslissingenvlaamseregering.vlaanderen.be/document-view/5DB31EC95084E700080003D9>.

The aim of both climate policy and air policy is to reduce emissions of certain substances into the air, namely greenhouse gases and pollutant emissions. As most of these emissions come from the same sources, there is a close relationship between the Flemish Energy and Climate Plan and its Air Plan.

As a result, both Flemish climate policy (reduction of GHG emissions) and Flemish energy policy (energy savings and increase in renewable energy) aim to reduce the use of fossil fuels. Less consumption of liquid, solid and gaseous fossil fuels in industry, the transport sector, agriculture and heating of buildings will reduce NO_x, SO₂ and PM emissions (pollutants that are typically released during the combustion of fossil fuels). Solid biomass (a renewable fuel) is an exception as its combustion releases more emissions of certain substances than the combustion of certain fossil fuels. This is particularly the case with the heating of buildings: wood is regarded as biomass but, although the emissions from its combustion can be deducted from greenhouse gases (unlike emissions from gas and heating oil boilers), its combustion significantly increases emissions of fine particulate matter and NO_x.

The effect of climate and energy policy on NO_x, SO₂ and PM emissions is included in the calculation of the emission projections. The models used to produce the air projections are the same as the models used for the GHG projections. The same assumptions in terms of degrees of activity and consumption of fuel are therefore used.

Dimension decarbonisation – GHG emissions and removals

2.1.1. Transport sector

2.1.1.1. Underlying factors and principles

2.1.1.1.1. *Spatial planning that supports environmentally friendly mobility and sustainable accessibility*

By 2030, this means that:

- over half of the population will live in convenient locations;
- more than 60% of workplaces will be in easily accessible locations;
- vital social functions and structures will be easily and safely accessible to everyone via one or more forms of sustainable (public) transport;
- logistics flows will be organised in a sustainable way.

2.1.1.1.2. *Guiding the development of mobility*

- By 2030, the number of road kilometres will be reduced to a maximum of 51.6 billion vehicle-kilometres. This entails a reduction of 15% from 2015 for passenger cars and vans, and the increase for lorries being limited to a maximum of 14%.
- Developing a multimodal transport system:
 - For commuting, the share of sustainable modes of transport will increase to at least 40% (car use limited to a maximum of 60%; the current figure for car use is 71%).

- In the highly urbanised transport regions of Antwerp, Ghent and the Flemish periphery, the share of sustainable modes of transport will be at least 50%.
- For goods transport, 6.3 billion tonne-kilometres will be shifted from the road to alternative modes of transport (water or rail transport). The share of rail and inland waterway transport in the modal split will increase to 30%.
- The various maritime ports will make extensive use of sustainable modes of transport. The share of these modes (rail, river and estuary) will increase by around 5-10% (from 2013).
- Encouraging sustainable travel and transport behaviour:
 - In cooperation with the transport regions, we will bring about a modal shift (by developing a cost-effective and demand-oriented public transport network and by continuing the rising trend of investment in cycling policy).
 - Together with sectoral organisations, businesses and associations, we will support actions that encourage the public and business to abandon their cars in favour of alternative modes of transport and that allow them to easily switch from one mode of transport to another, thus reducing the number of road kilometres. We will also work together with the Federal Government and the other Regions on this issue.
 - With regard to goods transport, we will encourage sectoral organisations and businesses to focus on further optimising loading.
 - We will also make considerable efforts to influence 'irrational choice behaviour'.
- A Flemish integrated network of high-quality, wide and safe cycle paths and highways will connect residential centres, schools and major employment hubs and will therefore take full advantage of the high potential of cycle use for commuting to work or school.
- A regional and integral approach to basic accessibility:
 - Basic accessibility requires cooperation. An integrated approach to transport, infrastructure and spatial development is needed, in terms of both planning and investment and also operation and service.

2.1.1.3. Zero-emission, low-emission and low-carbon vehicles

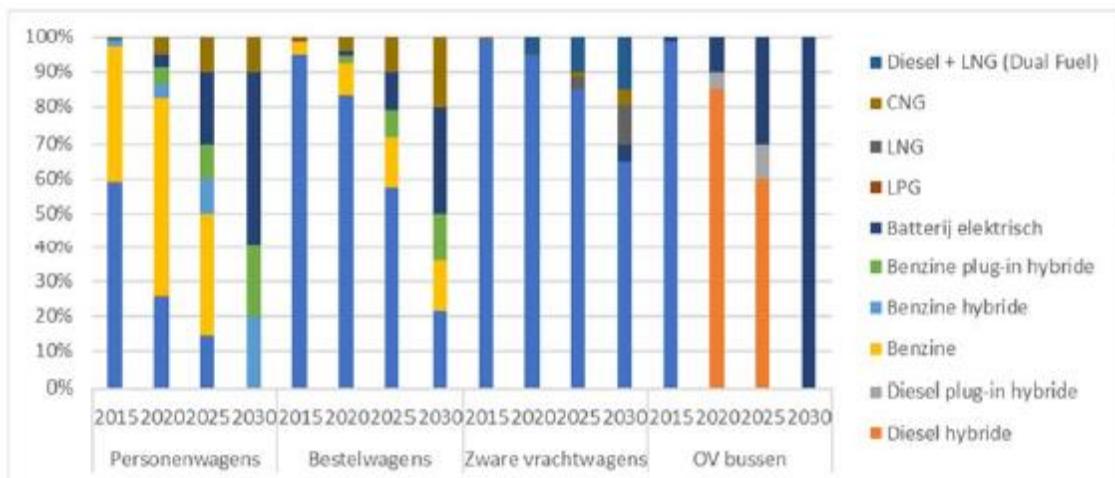
- By 2030, at least half of all new cars sold will be completely emission-free and 20% will be partly emission-free (PHEV). The rest will be low-emission or low-carbon. By 2025, the market share of zero-emission cars will be at least 20%.
- In any new procurement by De Lijn, we will authorise only zero-emission buses. In this context, the possibility of deconsolidating De Lijn will be examined. By 2035 at the latest, all buses used in Flanders will be emission-free.
- From 2025, public transport in urban environments will involve only hybrid, electric or hydrogen buses, with only zero-emission vehicles being permitted in town centres. This measure will also apply to De Lijn's subcontractors.
- By 2030, 50% of all other recently purchased buses (public transport buses, coaches and school buses) will be emission-free, low-emission or low-carbon.
- Among new heavy goods vehicles, the share of zero-emission vehicles will be at least 5% by 2030. The rest will be mainly low-emission or low-carbon.
- By 2030, at least 30% of newly purchased light commercial vehicles and vans will be zero-emission vehicles. The rest will be mainly low-emission or low-carbon.
- We will encourage emission-free distribution so that, from 2025, only zero-emission vehicles will be used in town centres for deliveries.

2.1.1.4. Recycled carbon fuels and biofuels

- If combustion engine technology continues to be used, every effort will be made to use recycled carbon fuels and biofuels.

2.1.1.2. General comments

In the WAM scenario, the strategic measures involve reducing the number of vehicle-kilometres calculated as described in Chapter **Error! Reference source not found.**. For passenger transport and light-duty vehicles, this will reduce the number of vehicle-kilometres by 15% from 2015 (**Error! Reference source not found.**). For heavy goods vehicles, the number of vehicle-kilometres will be 14% higher in 2030 than in 2015. Bus traffic will remain stable to 2030.



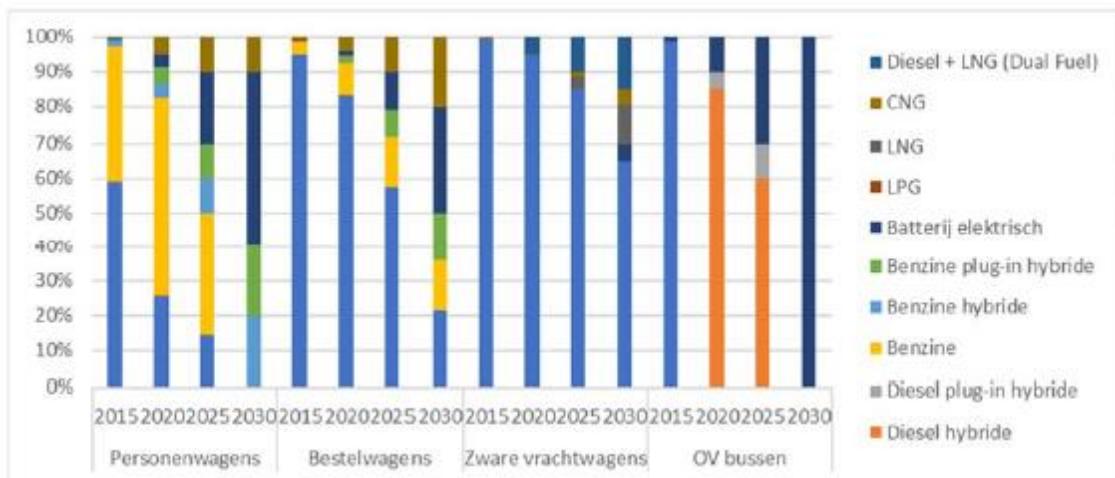
Personenwagens	Passenger cars
Bestelwagens	Vans
Zware vrachtwagens	Heavy goods vehicles
OV bussen	Public transport buses
Diesel + LNG (Dual Fuel)	Diesel + LNG (Dual Fuel)
CNG	CNG
LNG	LNG
LPG	LPG
Batterij elektrisch	Battery electric
Benzine plug-in hybride	Petrol plug-in hybrid
Benzine hybride	Petrol hybrid
Benzine	Petrol
Diesel plug-in hybride	Diesel plug-in hybrid
Diesel hybride	Diesel hybrid

Graph 2-1 summarises the assumptions made with regard to greening of the vehicle fleet in the WAM scenario. The trends in the fuel technology shares are based on the ambitions indicated in the Flemish CPT Action Plan, which sets out the Flemish ambitions to 2020, and in the draft CPT Vision 2030, and also on the assumption that, in 2030, all new cars sold will be low-carbon vehicles, with at least half being zero-emission vehicles.

Efficiency improvements have also been taken into account for both cars (10% reduction in consumption from construction year 2020) and heavy goods vehicles (5% reduction in consumption from construction year 2020). In addition, the incorporation of biofuels has been taken into account in line with the following growth trajectory: 9% on average over the period 2020-2024, 12% on average over the period 2025-2029, and 14% in 2030, as agreed in the draft NECP. Aside from the benefit in climate terms, this will also help to achieve the renewable energy target. As regards the climate and in support of our industrial transition, we will ask the

Federal Government to impose, from 2025, an incorporation rate of at least 1.8% of recycled carbon fuels (RCFs, e.g. those resulting from industrial waste gases). In our exemplary role, we will use fuels with a higher RCF incorporation rate in the captive fleets of the Flemish Government.

Graph 2-1. Breakdown of fuel technologies in new vehicles by vehicle category over the period 2015-2030



Personenwagens	Passenger cars
Bestelwagens	Vans
Zware vrachtwagens	Heavy goods vehicles
OV bussen	Public transport buses
Diesel + LNG (Dual Fuel)	Diesel + LNG (Dual Fuel)
CNG	CNG
LNG	LNG
LPG	LPG
Batterij elektrisch	Battery electric
Benzine plug-in hybride	Petrol plug-in hybrid
Benzine hybride	Petrol hybrid
Benzine	Petrol
Diesel plug-in hybride	Diesel plug-in hybrid
Diesel hybride	Diesel hybrid

* In 2030, 50% of new cars sold will be zero-emission vehicles.

* PT = public transport.

* From 2019, in any new procurement by De Lijn, we will authorise in Flanders only zero-emission buses.

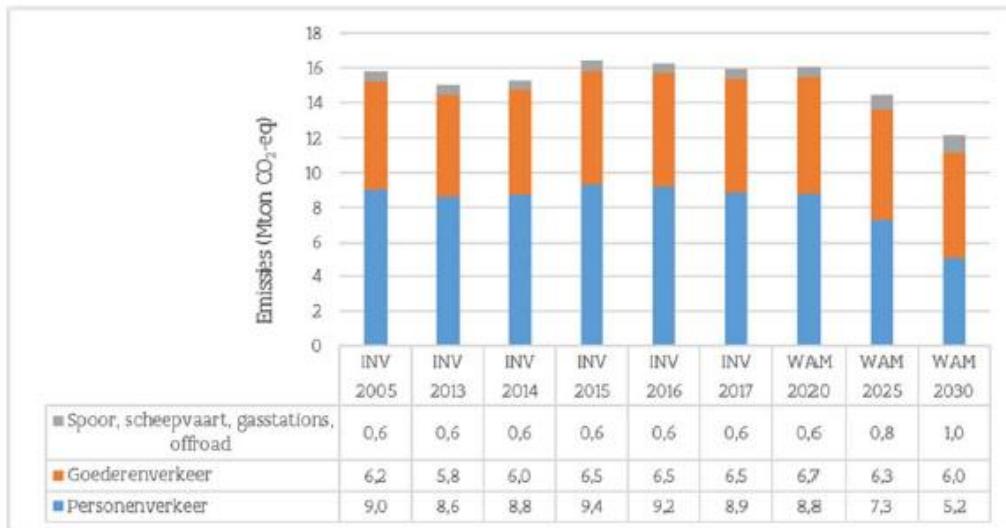
Emissions from other modes of transport are calculated in the WAM scenario by taking account of the fact that, in the future, those modes will absorb part of the growth. The following assumptions have been made, in line with the scenarios developed in the draft Mobility Plan for Flanders:

- The projections for inland navigation in Belgium indicate 100% growth in the number of tonne-kilometres between 2013 and 2030.
- The projections for rail (diesel trains) indicate 140% growth in goods transport and 45% growth in passenger transport between 2013 and 2030 and a constant distribution between diesel and electric rail traffic.

Overall in the transport sector, the WAM scenario points to a 23% reduction in GHG emissions between 2005 and 2030 (Table 2-1). However, significantly different trends are evident for road passenger and goods transport (Graph 2-2). Due to the reduction in traffic volumes and considerable greening of the vehicle fleet, a 43% reduction in emissions is predicted for passenger transport over the period 2005-2030. As for goods transport,

the increase in vehicle-kilometres and relatively limited greening of the fleet will result in a reduction in emissions of only 3% between 2005 and 2030.

Graph 2-2. Overview of actual emissions and WAM projections in the transport sector (including fuel surplus) 2005-2030



Emissies (Mton CO ₂ -eq)	Emissions (Mt CO ₂ eq)
Spoor, scheepvaart, gasstations, offroad	Rail, shipping, petrol stations, off-road
Goederenverkeer	Goods transport
Personenverkeer	Passenger transport
INV	INV
WAM	WAM

Table 2-1. Actual emissions and WAM projections in the transport sector 2005-2030

	2005	2013	2014	2015	2016	2017	2020	2025	2030
GHG emissions in the transport sector (Mt CO ₂ eq)	15.8	15.0	15.3	16.4	16.3	15.9	16.1	14.5	12.2
Trend in GHG emissions compared with 2005 (%)		-5%	-3%	+4%	+3%	+1%	+1%	-8%	-23%

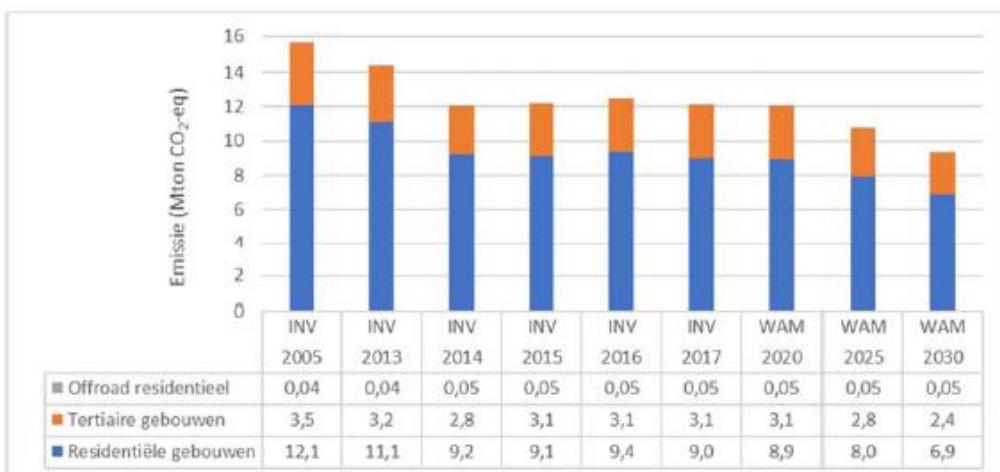
2.1.2. Buildings sector

The WAM scenario for residential buildings has been aligned with the WAM scenario for energy efficiency and renewable energy.

The WAM scenario for tertiary buildings has been aligned with the WAM scenario for energy efficiency and renewable energy.

Overall in the buildings sector, the WAM scenario points to a 40% reduction in GHG emissions between 2005 and 2030. The reductions in the tertiary sector and the residential sector are 32% and 43% respectively by 2030 in the WAM scenario.

Graph 2-3. Overview of actual emissions and WAM projections in the buildings sector 2005-2030



Emissies (Mton CO ₂ -eq)	Emissions (Mt CO ₂ eq)
Offroad residentieel	Residential off-road
Tertiaire gebouwen	Tertiary buildings
Residentiële gebouwen	Residential buildings
INV	INV
WAM	WAM

Table 2-2. Actual emissions and WAM projections in the buildings sector 2005-2030

	2005	2013	2014	2015	2016	2017	2020	2025	2030
GHG emissions (Mt CO ₂ eq)	15.7	14.4	12.0	12.2	12.5	12.2	12.1	10.8	9.4
Trend in GHG emissions compared with 2005 (%)		-8%	-23%	-22%	-20%	-22%	-23%	-31%	-40%

2.1.3. Agricultural sector

The GHG reductions that are feasible in the longer term have been calculated or estimated for a number of measures in the WAM scenario. This has involved theoretical estimates or calculations of the impact of measures. For some of the measures described, the research is already well-advanced, which therefore offers greater certainty as regards the reductions. This is particularly the case with enteric emissions from dairy cattle, environmentally friendly manure management and storage in the case of dairy cattle and pigs, energy savings and renewable energy. As regards other efforts that have the potential to reduce emissions, further research will allow these to be more accurately quantified in the future. This is the case with increased efficiency of nitrogen, closed cycles and recovery of by-products, limitation of food waste, cooperation in the supply chain and smart farming. These climate efforts have been estimated. The WAM scenario for energy emissions has been aligned with the WAM scenario for energy efficiency and renewable energy.

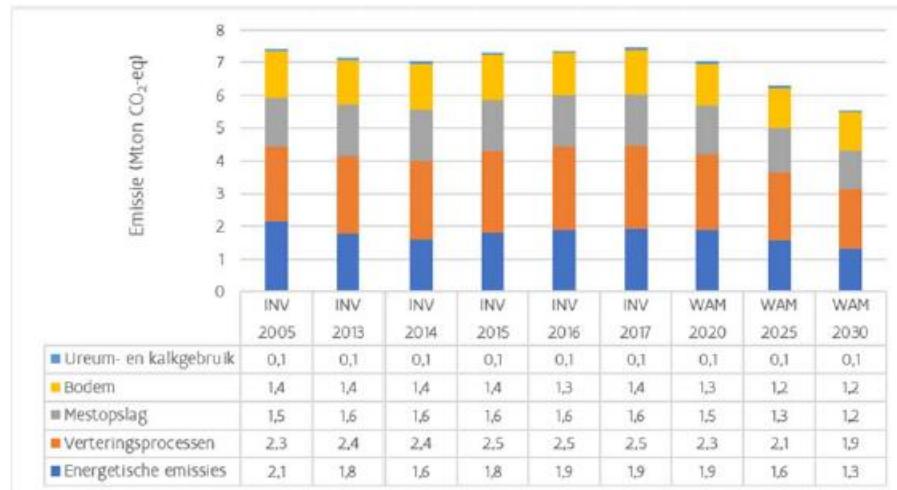
Livestock trends, as referred to in Chapter 4, have also been taken into account in the WAM scenario.

Based on the above approach for the WAM scenario, GHG emissions from the agricultural sector total 5.5 Mt CO₂eq in 2030, i.e. a 25% reduction from 2005 (Table 2-3):

- Enteric emissions reduce by 0.44 Mt CO₂eq (i.e. 19%) between 2005 and 2030.
- Emissions from manure management reduce by 0.31 Mt CO₂eq (i.e. 21%) between 2005 and 2030.
- Increased nitrogen efficiency (less N in fodder and precision fertilisation) and less nitrogen fertilising reduce soil emissions by 0.27 Mt CO₂eq (i.e. 19%) between 2005 and 2030.
- Energy savings and the use of renewable energy reduce energy emissions by 0.86 Mt CO₂eq (i.e. 40%) between 2005 and 2030.

In addition, efforts will be made to recover by-products, reduce food waste, improve the sustainability of the fisheries sector, ensure cooperation in the supply chain and develop open space. These measures may be difficult to allocate to a specific heading of the emissions inventory, but in general should lead to a further reduction of 0.14 Mt CO₂eq by 2030 for the entire agricultural sector. They are not taken into account in the overview.

Graph 2-4. Overview of actual emissions and WAM projections in the agricultural sector 2005-2030



Emissie (Mton CO ₂ -eq)	Emissions (Mt CO ₂ eq)
Ureum- en kalkgebruik	Urea and lime
Bodem	Soil
Mestopslag	Manure storage
Verteringsprocessen	Digestive processes
Energetische emissies	Energy emissions
INV	INV
WAM	WAM

Table 2-3. Actual emissions and WAM projections in the agricultural sector 2005-2030

	2005	2013	2014	2015	2016	2017	2020	2025	2030
Total GHG emissions in the agricultural sector (Mt CO ₂ eq)	7.4	7.2	7.0	7.3	7.4	7.5	7.0	6.3	5.5
Trend in GHG emissions compared with 2005 (%)		-4%	-5%	-2%	-1%	1%	-5%	-15%	-25%

2.1.4. Non-ETS industrial sector

The WAM scenario for non-ETS industry has been aligned with the WAM scenario for energy efficiency and renewable energy. Over and above the WEM scenario, the WAM scenario predicts a further 10% reduction in greenhouse gases in non-ETS industry by 2030 by continuing to green energy carriers. We will therefore encourage further electrification and use of biogas, sustainable biomass, hydrogen and synthetic fuels.

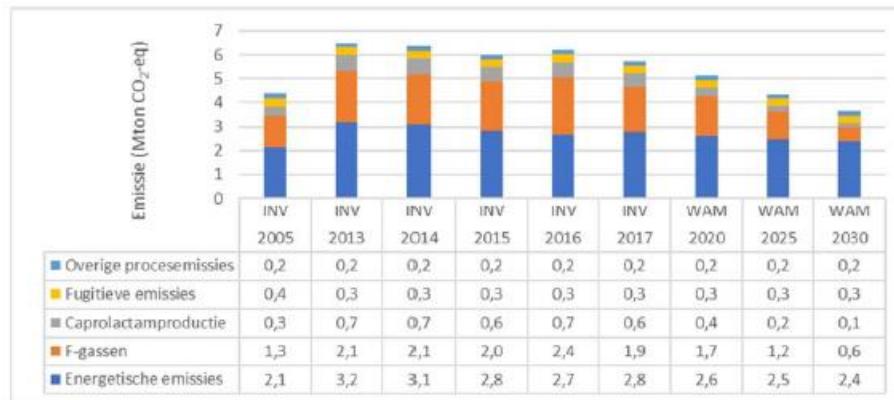
There will be a 12% increase in energy-related GHG emissions in non-ETS industry between 2005 and 2030 (Graph 2-5) in the WAM scenario.

In the policy scenario, the projections for nitrous oxide emissions from caprolactam production take account of the full implementation of all the measures set out in Chapter **Error! Reference source not found.** If an

additional end-of-pipe measure should prove to be technically and economically feasible, nitrous oxide emissions may reduce by 55% between 2005 and 2030.

The WEM scenario takes account of the implementation of the Flemish Action Plan allowing F-gas emissions to be limited to 1.0 Mt CO₂eq in 2030. The WAM scenario also takes account of the implementation of additional measures, as set out in Chapter **Error! Reference source not found.**, which would reduce F-gas emissions to a maximum of 0.6 Mt CO₂eq. Overall for the non-ETS industrial sector, greenhouse gases are projected to reduce by 16% between 2005 and 2030 in the WAM scenario (Table 2-4).

Graph 2-5. Overview of actual emissions and WAM projections in the industrial sector 2005-2030



Emissie (Mton CO ₂ -eq)	Emissions (Mt CO ₂ eq)
Overige procesemissies	Other process emissions
Fugitieve emissies	Fugitive emissions
Caprolactamproductie	Caprolactam production
F-gassen	F-gases
Energetische emissies	Energy emissions
INV	INV
WAM	WAM

Table 2-4. Actual emissions and WAM projections in the non-ETS industrial sector 2005-2030

	2005	2013	2014	2015	2016	2017	2020	2025	2030
Total GHG emissions in the industrial sector (Mt CO ₂ eq)	4.4	6.5	6.3	6.0	6.2	5.7	5.1	4.4	3.6
Trend in GHG emissions compared with 2005 (%)		+49%	+46%	+38%	+43%	+31%	+18%	+0%	-16%

2.1.5. Waste sector

A WAM scenario has been prepared for waste incineration only. As soon as the gradual phase-out approach mentioned above has been developed, the reduction in incineration capacity (and in associated GHG emissions) can be expected to reduce the combustible waste supply and treatment capacity. The WAM scenario therefore predicts a 10% reduction in the capacity of residual waste treatment facilities during the current period of the household waste and similar industrial waste plan (to 2022). By 2030, the reduction will be 25%. The WEM scenario (see point 1.2.1.5) does not predict any reduction in capacity.

In general, the following assumptions have been used in the WAM scenario:

- By 2022, 220 kt of waste can be avoided through prevention and selective collection in accordance with the Implementation Plan for household waste and similar industrial waste (HAGBA).

- By 2030, we want to be selectively collecting and treating more organic and biological waste in industrial residual waste.
- By 2030, we will further raise the level of ambition. We will make every effort to keep the 50% fraction of recyclable waste in household waste and similar industrial wastes separate from residual waste.
- By 2030, the plastics sorting and recycling capacity in Flanders should be quadrupled compared with 2015.
- In 2030, landfill emissions will be 81% lower than in 2005.

Overall, the WAM scenario predicts a 50% reduction in emissions in the waste sector over the period 2005-2030. In 2030, landfill emissions will be 81% lower than in 2005.

Graph 2-6. Overview of actual emissions and WAM projections in the waste 2005-2030



Emissies (Mton CO ₂ -eq)	Emissions (Mt CO ₂ eq)
Composteren	Composting
Niet-ETS energie	Non-ETS energy
Afvalwaterbehandeling	Wastewater treatment
Stortplaatsen	Landfills
Afvalverbranding	Waste incineration
INV	INV
WAM	WAM

Table 2-5. Actual emissions and WAM projections in the waste sector 2005-2030

	2005	2013	2014	2015	2016	2017	2020	2025	2030
Total GHG emissions in the waste sector (Mt CO ₂ eq)	2.8	2.4	2.3	2.3	2.2	2.3	2.1	1.8	1.4
Trend in GHG emissions compared with 2005 (%)		-17%	-19%	-18%	-21%	-20%	-27%	-38%	-50%

Macroeconomic and other impacts of the planned policies and measures

An impact analysis of the main strands of the draft Flemish Energy Plan 2021-2030 and of the draft Flemish Climate Policy Plan 2021-2030 was carried out in 2019 through a limited study mission ⁽³⁰⁾ on behalf of the Department of the Environment.

⁽³⁰⁾ PWC, Impactanalyse van de uitvoering van het Europees Clean Energy pakket voor Vlaanderen, final report September 2019.

Table: Summary of the impact analysis results (source: PWC, 2019)

Objectives	Indicators									
	Environmental impacts			Macroeconomic impacts			Social impacts			
	Emissions	Land use	Investment cost	Valued added	Energy system cost	Budget impact	Competitiveness	Purchasing power	Fuel poverty	Employment
A. Transport										
Reduction in the number of road kilometres to a maximum of 51.6 billion in 2030 compared with 2015	-	0	+	+	n/a	-	n/a	n/a	n/a	n/a
Low-carbon and zero-emission vehicles	-	0	+	0	n/a	+	n/a	n/a	n/a	n/a
B. Buildings										
<i>Residential</i>										
Faster and deeper renovation	-	0	+	+	n/a	+	0	n/a	0/-	+
Reduction in fossil fuels	-	NA	+	NA	n/a	+	NA	-/0	n/a	+
<i>Tertiary buildings</i>										
Faster and deeper renovation	-	0	+	+	n/a	+	0	n/a	n/a	+
Reduction in fossil fuels	-	NA	+	NA	n/a	+	NA	-/0	n/a	+
C. Non-ETS industry										
Reduction in greenhouse gases in the non-ETS industrial sector of 21% by 2030 compared with 2015	-	NA	n/a	n/a	NA	+	n/a	n/a	NA	n/a
D. Waste										
Reduction in the capacity of waste treatment facilities	-									
E. Agriculture										
Reduction in enteric emissions through an agricultural sector Green Deal	-	-	NA	-	NA	NA	-	-	NA	n/a
Manure management emissions will be reduced	-									
Increased nitrogen efficiency	-	n/a	NA	n/a	NA	NA	n/a	n/a	NA	n/a
Reduction in energy emissions	-	n/a	+	NA	n/a	+	NA	NA	NA	NA
F. Waste										
Reduction in the capacity of residual waste treatment facilities	-									
G. LULUCF										
Effects of the LULUCF targets in the policy on space, nature and materials	n/a	-								
H. Renewable energy										
Increase in renewable energy	-	+		+			n/a	n/a	n/a	n/a

Symbols and abbreviations	Definition
+	Significant increase
-	Significant reduction
n/a (not available)	There is an impact on this indicator, but it cannot be generally determined whether the final impact is + or -

NA (not applicable)	No direct impact
Grey shading	Already discussed or no data available

The study examined the environmental impacts (air pollutant emissions and land use), macroeconomic impacts (investment costs, budget impact, energy system cost, value added, competitiveness) and social impacts (employment, purchasing power and fuel poverty) based on the objectives and sub-objectives of the two draft plans. The above table provides an overview of the main objectives of the draft plans and of the impacts of those objectives on a series of indicators.

This overview generally shows that the envisaged energy and climate policy will make a significant contribution, in all sectors, to air quality by reducing air pollutant emissions. The impact analysis predicts that there will be little or no impact on land use in the traditional sectors. The Green Deal in the agricultural sector and the measures in the LULUCF sector that may reduce land use are an exception to this. On the other hand, greater use of renewable energy may increase the spatial footprint.

It is in the transport and buildings sectors that the greatest impact on the various indicators can be seen. As a result, for transport, significant further reductions in air pollutant emissions are predicted, such as an additional reduction of 31% in NO_x compared with the BAU (business-as-usual) scenario. To achieve the stated GHG emission reduction targets in the transport sector, additional investment costs of EUR 13.2 billion to EUR 16.4 billion will be needed over 10 years (up to 2030). Switching to zero-emission vehicles and sustainable modes of transport may increase value added and employment in the sector. Reducing the number of road vehicle-kilometres may have the opposite effect on these indicators. The net effects on value added, employment, purchasing power and competitiveness have not been calculated.

Likewise, for buildings, total GHG and air pollutant emissions are predicted to fall sharply compared with the BAU scenario. Total additional investment costs for objectives in the residential construction sector are estimated to be in a range of EUR 15.6 billion to EUR 23.4 billion for the period 2021-2030. An increase in the rate of renovation and more sustainable heating systems are included in these costs. The investment costs for increased sustainability are roughly EUR 1.5 billion to EUR 2.4 billion for the period 2021-2030. As regards tertiary buildings, these additional investment costs are estimated to be in a range of EUR 9.3 billion to EUR 13.5 billion over 10 years (up to 2030) (for 100% renovation) or EUR 4.7 billion to EUR 7 billion in the other scenario (for 50% renovation). This brings the total additional investment costs for the entire buildings sector to EUR 20 billion to EUR 37 billion for the period 2021-2030. Due to an increased rate of renovation and greater sustainability, which is vital, activities in the construction sector are predicted to grow. According to the estimates, the value added of the construction sector should rise to EUR 5.6 billion to EUR 8.6 billion by 2030. The study estimates that this could increase employment in the construction sector by 82,799 to 124,198 jobs over the period 2021-2030 (through an increase in the supply of labour in this sector).

In agriculture, the stated GHG emission reduction objectives risk having a negative impact on value added, which can, however, be limited by finding cost-effective solutions such as in the Green Deal Agriculture.

As regards industry, the impact on investment costs will largely depend on the structure of EPAs. No calculation has been made in this respect due to a lack of data. The potential impact is not therefore examined further on.

Overview of investment needs

2.1.6. Existing investment flows and forward investment assumptions with regard to the planned policies and measures

Investment costs of Flemish energy policy

The following estimates primarily concern investment costs for new projects during the period 2021-2030 because this information is required by the Governance Regulation. Replacement costs for existing projects that will end during this period have also been taken into account. The calculations are based on the power needed for generation, as indicated in the tables of the Flemish Energy and Climate Plan and the projects described in

the text. The investment costs per unit of power or per project have been determined using the most relevant and up-to-date sources, namely the investment costs indicated in reports on unprofitable parts (with regard to investment costs for green electricity generation from wind power, solar power, biomass and biogas). The expected reduction in investment costs (which are considerable for solar and wind power) over the period 2021-2030 has been taken from the ASSET study.

As regards green heat, the calculation is based on the number of installations or projects described in the text. The investment costs have been estimated based on various sources (solar map, quotations for different types of heat pump, current geothermal energy projects, SDE+ documents of PBs).

With regard to district heating systems, the estimated growth corresponds to the rate of investment in projects that have been supported in the last three years, which is why the known investment costs of supported projects have also been included.

(million EUR)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
green electricity										
onshore wind	125	124	123	121	120	119	118	116	115	114
PV	319	316	312	309	306	321	317	314	311	307
biomass	26	26	26	26	26	26	26	26	26	26
Biogas	68	68	68	68	68	68	68	68	68	68
Sub-total	539	534	530	525	521	534	530	525	520	516
green heat										
solar water heaters	24	24	24	24	24	24	24	24	24	24
heat pumps	69	76	83	89	96	103	110	116	123	130
geothermal energy	15	15	15	15	15	15	15	15	15	15
household biomass	0	0	0	0	0	0	0	0	0	0
other biomass	15	15	15	15	15	15	15	15	15	15
district heating systems	71	71	71	71	71	71	71	71	71	71
Sub-total	194	201	208	214	221	228	235	241	248	255
Total	733	735	737	740	742	762	764	766	769	771

The total investment cost for the period 2021-2030 is estimated at EUR 7.5 billion.

2.1.7. Costs and benefits of Flemish climate policy

2.1.7.1. Total investment costs of the Flemish mitigation policy

It is clear that major investments will need to be made in all sectors in order to achieve this plan. In the long term, some of these investment costs will be offset by future energy savings delivered by the energy and climate policy.

The impact analysis carried out by PWC (2019) has estimated the investment costs (for both the private sector and the public sector) needed to achieve the objectives of the draft Flemish climate plan and the draft Flemish energy plan (³¹) (over and above the BAU scenario). The estimated investment costs for transport, buildings and renewable energy are indicated in the summary table below (these costs could only be estimated to a very limited extent for the industrial and agricultural sectors and are not therefore indicated).

³¹ This estimate has not been adjusted following the changes made to the Flemish Energy and Climate Plan. It should therefore be interpreted as an approximation with a wide margin of uncertainty.

Table: Estimate of investment costs over the period 2021-2030 in billion EUR/year (source: PWC, 2019)

sector	min.	max.
Transport	1.32	1.64
Residential buildings	1.56	2.34
Tertiary buildings	0.47	1.35
Renewable energy	1.9	1.9
Total	5.25	7.23

These investment needs have also been estimated by the ‘Stroomgroep Financiering’. When converted into additional investment costs over and above the current costs, the investment needed in the Flemish Energy and Climate Plan 2021-2030 has been estimated at a total of EUR 5.6 billion to EUR 11.6 billion per year (32).

In addition to the costs of implementing this plan, there are also considerable benefits for Flanders. The main benefits are as follows.

- Significant improvement of air quality in Flanders and, as a direct corollary, better health for all Flemish residents. This will translate into a reduced number of premature deaths attribute to poor air quality. The objectives and measures of this climate plan have been aligned with the Air Policy Plan 2019, which identifies the effects on air quality and health.
- A contribution to the reduction of road accidents and traffic jams through the mitigation policy in the transport sector.
- Considerable health benefits due to increased indoor comfort and an adapted food model.
- Net job creation: a study of the macroeconomic impact of the low-carbon transition in Belgium (33) estimates that this may result in net job creation in Belgium.

2.1.7.2. Budget costs of the mitigation policy for the Flemish Government

As this Flemish Energy and Climate Plan is implemented, the various policy areas will calculate the cost and impact of the measures. The methods of financing the measures will also be defined.

In addition to the budget costs of the mitigation measures, there are also other costs: contributions to international climate finance; compensation of indirect emission costs for industry, and also, potentially, costs to use and purchase flexibility mechanisms in order to achieve the Flemish climate targets.

2.1.7.3. Use and purchase of flexibility

The European Effort Sharing Regulation (ESR) and the LULUCF Regulation provide for various forms of flexibility that Member States can use to achieve their targets in the period 2021-2030. In addition to keeping some forms of flexibility (banking, borrowing and trading emission allocations) from the period 2013-2020, certain mechanisms have been abolished (purchase of rights from CDM and JI projects) and new mechanisms have been established (ETS flexibility, flexibility between the national target for non-ETS sectors and the (new) national target for the LULUCF sector). The ESR and the LULUCF Regulation impose quantitative, and sometimes also qualitative, limits on the use of these various flexibility instruments. The distribution of access to these forms of

³² See the final report of the ‘Stroomgroep Financiering’ of 16 October 2019:

https://www.energiesparen.be/sites/default/files/atoms/files/Stroomgroep_financiering_achtergrondrapport_finaal.pdf

We cite the total investment costs in the minimum and maximum scenarios, from which we have deducted the current costs, and excluding the green and blue infrastructure costs (which relate more to adaptation than mitigation).

³³ Study carried out at the request of the Federal Government by CLIMACT, UCL, Oxford Economics and the Federal Planning Bureau in 2016.

flexibility between the regions forms part of the intra-Belgian burden-sharing exercise with regard to the climate targets for the period 2021-2030.

2.1.7.4. Contributions to international climate finance

Overview

The aim of international climate finance is to support developing countries in their initiatives against climate change caused by humans. Under the United Nations Framework Convention on Climate Change (³⁴), developed countries must take the lead in providing international climate finance and have committed to jointly mobilise USD 100 billion per year by 2020. A new collective international target will be set by 2025, which will be more than USD 100 billion per year. The amount and associated conditions of this new target will be negotiated by 2025.

For the period 2016-2020, Belgium has committed to annual financing of EUR 50 million. Under the cooperation agreement of 12 February 2018 between the Federal Government, the Flemish Region, the Walloon Region and the Brussels Capital Region on burden-sharing with regard to the Belgian energy and climate targets for the period 2013-2020 (³⁵), Flanders must contribute EUR 14.5 million every year to international climate finance.

Strategy and targets

Given the international situation, the Flemish Government will prepare a Flemish international climate finance strategy (Vlaamse Internationale Klimaatfinancieringsstrategie – VIKS) 2021-2030 after an agreement is reached within Belgium on burden-sharing for the period 2021-2030. We will confirm our international climate ambitions by contributing to contribute to international climate finance, and we will prioritise these resources for those projects in which Flemish businesses are involved.

2.1.7.5. Compensation of indirect emission costs for industry

Under the previous Climate Policy Plan for the period 2013-2020 and within the limits of the European State aid rules, the Flemish Government decided to grant compensation to businesses that risk becoming uncompetitive as a result of the indirect CO₂ costs in the price of electricity and that threaten to relocate to countries with less stringent CO₂ emission reduction targets. Since 2014, eligible businesses have been able to submit a claim for compensation to the VLAIO (Flanders Agency for Innovation and Entrepreneurship).

The measure is pre-financed by the Hermesfonds (fund for accompanying economic and innovation policy) from the 'Indirect emission costs compensation' budget item. The Hermesfonds pays the compensation in the year after that in which the costs are incurred. Over the period 2016-2018, the total annual amount of aid was around EUR 40 million. Given the increase in the CO₂ price, this figure will have to be revised upwards in the next few years.

Following the recent reform of the emissions trading system, it has been established that Member States can continue to grant aid after 2020 to compensate for indirect emission costs in order to guard against carbon leakage. Any change in the maximum level of this compensation over the period 2021-2030 will depend on the designation of the eligible sectors and the aid parameters that will be laid down in the new State aid rules to be established in 2020.

In accordance with State aid rules, we will extend the current scheme and offer the maximum authorised compensation in line with the Energy Standard and financed by the Climate Fund.

³⁴ www.unfccc.int

³⁵ Burden-Sharing cooperation agreement: https://www.cnc-nkc.be/sites/default/files/content/ac_bs_2013-2020.pdf

2.1.8. Financing of the Flemish mitigation policy

2.1.8.1. Role of public funding versus private funding

The private sector already currently funds most of the energy and climate investments. However, for a number of investments, government intervention will be needed in order to overcome market failures and a lack of initiative on the part of the private sector, for example because initial investments are high and payback periods are long, because the risk is perceived as too high or because the costs and benefits of the initiative are borne by others (think about the renovation of rental property). This is also the case for investments where significant economies of scale are possible (e.g. public transport offer, energy network infrastructure, set-up of data and knowledge sharing platforms). Government intervention is also clearly necessary to support climate investments by groups that have insufficient financial resources.

More private climate finance can be encouraged through a clear, stable and strong policy framework, with the first step in this direction being to establish and implement this plan. We also want to facilitate cooperation between private operators and support financial instruments used for climate purposes (e.g. green bonds, investments funds, etc.). To this end, we will in particular help to draft the EU Action Plan for Financing Sustainable Growth (of 8 March 2018), which aims to improve labelling of sustainable investments, offer advice to investors on the sustainability potential of a project, and ensure transparency within businesses and investment groups with regard to their sustainability strategy.

2.1.8.2. Possibilities within existing Flemish Government budgets

Each government minister is responsible, as far as they are able, for ensuring that standard policies are compatible with the climate (protection against the effects of climate change). They must also take the necessary steps within their area to ensure a faster climate transition. All sectors must accept responsibility for achieving the common goal described in the Flemish Energy and Climate Plan. Each government minister must also formulate targeted and supported measures contributing to the Flemish energy and climate targets. The initiatives announced in the plan will be converted into a specific budgeted policy.

2.1.8.3. Use of European funding channels

There is a vast range of European funding instruments (e.g. specific funds such as the ERDF and Interreg, LIFE, Horizon 2020, CEF, European financial instruments such as those offered by the European Investment Bank for instance) that can be used to meet the European climate targets. In this respect, Flanders aims to ensure that:

1. climate stakeholders in Flanders – both public and private – make maximum use of EU instruments to fund Flemish climate policy, resulting in more (innovative) projects and initiatives being implemented to help achieve the Flemish Climate Policy Plan, the Flemish Energy and Climate Plan 2021-2030 and the Flemish Climate Vision 2050;
2. climate mitigation projects carried out under EU support instruments continue to have maximum impact after the project term;
3. climate issues and climate resilience issues are mainstreamed in the EU budget after 2020 (e.g. for agriculture, transport, etc.).

We will develop a strategy to leverage European funds for both public and private investment in projects helping to achieve the Flemish energy and climate targets. To this end, we will use all available options in the new EU budget 2021-2027 and provide Flemish resources for co-financing European projects. Flanders will therefore make better and wider use of the available European funds.

2.1.8.4. Flemish Climate Fund: estimate of the funds available in the period 2021-2030

The Flemish Climate Fund can play an important role in addition to the aforementioned funding options. This fund was set up in 2012 in the form of an organic budget fund and therefore provides the financial framework needed to pursue an ambitious long-term climate policy.

Over the period 2021-2030, Flemish annual revenue resulting from the region's share of Belgian auction revenues under the European emissions trading system is estimated at around EUR 200 million per year (36).

However, it is difficult to predict how these auction revenues will develop as both the price of auctioned allowances and European auctioned volumes are very hard to estimate at the moment for the trading period 2021-2030.

- Market analysts generally expect the price to steadily increase over the next few years as a result, in particular, of recent measures to reinforce the emissions trading system, which we called for in Flanders.
- Auctioned volumes will depend on other uncertain parameters: how Brexit will pan out, the impact of the market stability reserve, and the extent to which the number of auctioned allowances will reduce to prevent the cross-sectoral correction factor from being applied.
- According to the recent European Commission proposal for the EU budget 2021-2027, 20% of Member State revenues will flow back to the EU budget. This proposal would therefore have a negative impact on Flemish revenue.

2.1.8.5. Flemish Climate Fund: priority use of funds in 2021-2030

The decree creating the Flemish Climate Fund sets out the purposes for which it can be used:

- internal Flemish climate policy with a view to achieving the GHG reduction targets;
- purchase of emission allowances (if the Flemish GHG reduction targets cannot be achieved using internal measures);
- compensation for the loss of competitiveness of Flemish businesses as a result of climate policy (compensation for indirect emission costs);
- international climate finance.

Over the last few years, we have gained experience of using the Flemish Climate Fund for the Flemish mitigation policy, through the first round of funding in the period 2013-2014 and the second round of funding in the period 2016-2019. The Progress Report 2016-2017 assessed this use (and commented on it in detail in an annex). The Flemish Mitigation Plan 2013-2020 detailed the allocation method for the first round of funding. The main findings from these two rounds of funding are as follows.

- All sectors still have more potential for cost-effective reduction, which can be exploited through a targeted policy.
- In the sub-sector of Flemish public buildings (which accounts for only 3% to 5% of Flemish non-ETS emissions), the Flemish Climate Fund is used to a considerable extent.
- Given the limited resources of the Flemish Climate Fund, it would be advisable in the future to focus more on measures with a good cost-efficiency ratio and a significant leverage effect. In this respect, we take account of the fact that measures with a very short payback period should also be implemented without any additional financial support from the Flemish Climate Fund.
- Projects benefiting from Flemish Climate Fund support need to be closely monitored, not only to justify the use of the funds, but also to maximise the learning effects.

³⁶This rough estimate is based on the assumption that the Flemish share of Belgian auction revenues over the period 2013-2020 (52.76%) will remain unchanged over the period 2021-2030.

- By compensating for *indirect carbon leakage*, the Flemish Climate Fund has helped to safeguard our industry's competitiveness.

Over the period 2021-2030, Flemish annual revenue is estimated at around EUR 200 million per year. This is a relatively small amount compared with the expected total costs of climate policy. However, the Flemish Climate Fund can play an important role if it is used for measures with a significant leverage effect.

That is why we will focus on optimising how the Flemish Climate Fund functions. We will use the fund in non-ETS sectors to help achieve our GHG reduction target for 2030. We will ensure that the co-financing principle is always applied, as is the case with many European funds. This means that GHG reduction measures cannot be fully funded by the Flemish Climate Fund, but must also be partly funded by private resources or other public funds. This will ensure that the fund has a leverage effect and greater impact. The resources provided by the fund for a measure may be proportionally higher if the measure funded has a higher cost-efficiency ratio.

The Flemish Climate Fund will also be used for investments in public spatial planning that can help to achieve the 'no net loss' objective in relation to carbon losses due to land use.

We will develop innovative financing tools (working capital, joint funding, etc.) to encourage private investment. The Flemish Climate Fund can be used as co-financing for this purpose.

2.1.9. Sector or market risk factors or barriers in the national or regional context

iii. Analysis of additional public finance support or resources to fill gaps identified under point ii

1. CURRENT SITUATION AND PROJECTIONS WITH EXISTING POLICIES AND MEASURES

Projected evolution of main exogenous factors influencing energy system and GHG emission developments

i. Socioeconomic forecasts

In Wallonia	2015	2020	2025	2030	2035	2040
Population on 1 January (in thousands) ⁽³⁷⁾	3,590	3,675	3,745	3,818	3,887	3,946
Number of households (in thousands)	1,548	1,610	1,658	1,710	1,759	1,798

The demographic trend, which is based on projections by the Federal Planning Bureau, has been used to determine the growth in the number of households (and therefore the need for housing).

ii. Sectoral changes expected to impact the energy system and GHG emissions

The trend in economic activity is based on activity variables ⁽³⁸⁾ specific to each industrial sub-sector (compound annual growth rate). Closures of facilities and new investments are included.

iii. Global energy trends, international fossil fuel prices, EU ETS carbon price, technology cost developments

In constant euros 2013/toe ⁽³⁹⁾	2020	2025	2030	2035
Oil (Brent)	75	85.1	93.8	97.8
Coal	14.3	17.1	20.5	21.7
Gas	48.3	52.2	56.8	60.6

In constant euros 2013 €/t CO ₂ ⁽⁴⁰⁾	2020	2025	2030	2035
EU ETS Carbon price	15	22.5	33.5	42

Degree days: Consumption in the residential and tertiary sectors is standardised on the basis of 1,870 *degree days* (average 1991-2015).

Decarbonisation

1.1.1. GHG emissions and removals

i. Current trends in GHG emissions and ETS, ESD, LULUCF and various energy sector targets

According to the inventory submitted in March 2019, in 2017 Wallonia emitted 35.3 Mt CO₂eq, or 31% of Belgium's annual emissions (excluding the forestry sector). This inventory is drawn up in accordance with the 2006 IPCC guidelines and the applicable global warming potential (GWP) for the period 2013-2020 ⁽⁴¹⁾.

³⁷ Federal Planning Bureau.

³⁸ Fairly conservative assumptions.

³⁹ Values recommended by the European Commission. Ton Oil Equivalent: 1 toe = 41,868 GJ.

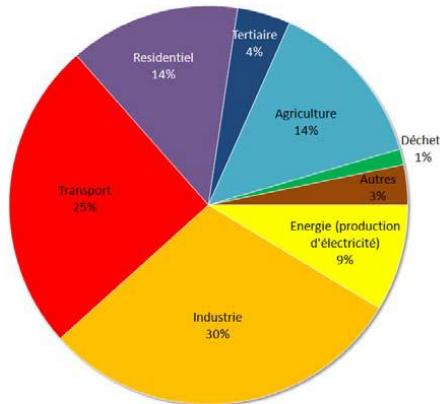
⁴⁰ Idem.

⁴¹ Applicable GWPs: CH₄ = 25 and N₂O = 298. The GWPs for fluorinated gases are also audited.

The Walloon inventory of GHG emissions is combined with the inventories for the Flemish Region and the Brussels Capital Region to make up the Belgian inventory, which is reported by Belgium on an annual basis under the Kyoto Protocol and European commitments (Effort Sharing Decision No 406/2009/EC).

Figure 1 shows the breakdown of total GHG emissions by type of gas and by main sector.

Figure 1: Breakdown of GHG emissions by sector in Wallonia in 2017 (source: AwAC)



Residentiel	Residential
Tertiaire	Tertiary
Agriculture	Agriculture
Déchets	Waste
Autres	Other
Energie (production d'électricité)	Energy (electricity generation)
Industrie	Industry
Transport	Transport

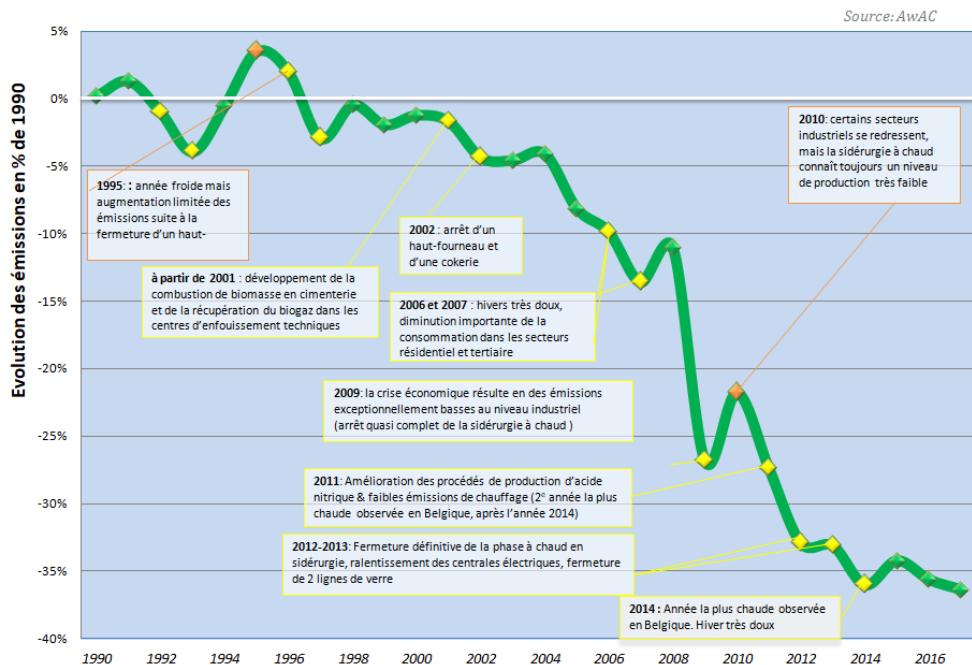
CO₂, which accounts for 82% of total GHG emissions, is emitted in particular during combustion processes in various sectors: industry, transport, tertiary and residential heating, and power plants. CH₄, which accounts for 8% of total emissions, is emitted by agriculture (78%), the waste sector (10%) and natural gas distribution systems (compressors and leaks; 7%), with the remainder being emitted by combustion processes as a whole. N₂O, which accounts for 8% of total emissions, is chiefly emitted by agriculture (81%), the chemical industry (4%) and combustion processes (9%). Finally, fluorinated gases account for 2% of total emissions and are emitted during the manufacture and use of certain products (refrigeration, insulating foams, etc.).

Figure 2: Breakdown of GHG emissions by type of gas in 2017 (source: AwAC)



Based on the latest available estimates, anthropogenic GHG emissions (excluding the forestry sector) in Wallonia in 2017 were 36.9% lower than in 1990.

Figure 3: Trend in total GHG emissions in Wallonia, including the ETS and ESD sectors (source: AwAC)



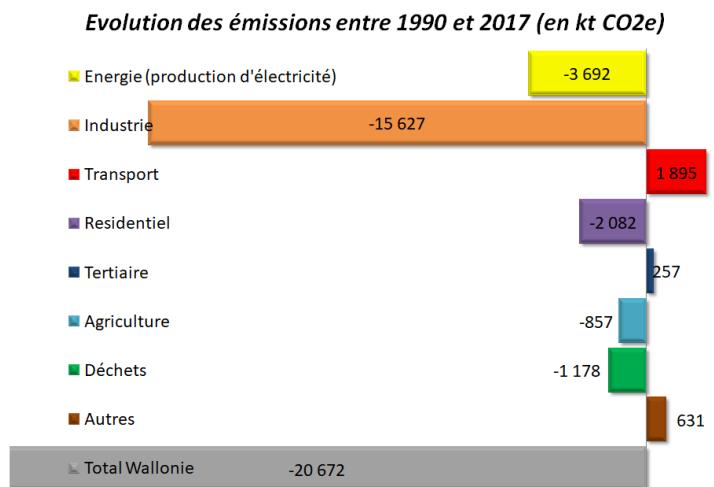
Source: AwAC	Source: AwAC
Evolution des émissions en % de 1990	Trend in emissions (in %) compared with 1990
1995: année froide mais augmentation limitée des émissions suite à la fermeture d'un haut- [text missing]	1995: cold year, but limited increase in emissions due to the closure of a [blast furnace]
à partir de 2001 : développement de la combustion de biomasse en cimenterie et de la récupération du biogaz dans les centres d'enfouissement techniques	from 2001: development of biomass combustion in cement works and of biogas recovery at landfill sites
2002 : arrêt d'un haut-fourneau et d'une cokerie	2002: shutdown of a blast furnace and a coking plant
2006 et 2007 : hivers très doux, diminution importante de la consommation dans les secteurs résidentiel et tertiaire	2006 and 2007: very mild winters; significantly reduced consumption in the residential and tertiary sectors
2009 : la crise économique résulte en des émissions exceptionnellement basses au niveau industriel (arrêt quasi complet de la sidérurgie à chaud)	2009: the economic crisis leads to exceptionally low industrial emissions (the hot working steel industry comes to a virtually complete halt)
2010 : certains secteurs industriels se redressent, mais la sidérurgie à chaud connaît toujours un niveau de production très faible	2010: some industrial sectors recover, but the hot working steel industry still produces very little
2011 : Amélioration des procédés de production d'acide nitrique & faibles émissions de chauffage (2 ^e année la plus chaude observée en Belgique, après l'année 2014).	2011: improvement in nitric acid production processes and low heating emissions (2nd hottest year observed in Belgium, after 2014).
2012-2013 : Fermeture définitive de la phase à chaud en sidérurgie, ralentissement des centrales électriques, fermeture de 2 lignes de verre	2012-2013: permanent shutdown of the hot working phase in the steel industry, slowdown at power plants, closure of 2 float lines
2014 : Année la plus chaude observée en Belgique. Hiver très doux	2014: hottest year observed in Belgium. Very mild winter

The overall trend conceals significant differences in the various sectors. The industrial and electricity generation sectors have seen reductions in total emissions of 28% and 7% respectively, while the increase in transport-related emissions has caused total emissions to rise by 3%.

The main factors behind these sectoral trends are as follows:

- energy: switch from coal to natural gas or wood, closure of coking plants;
- industry: closures in the steel industry, increased use of gas or alternative fuels, sectoral and ETS agreements, increase in value added despite this reduction;
- residential and tertiary: increase in building stock, higher consumption of electricity, limited switch to natural gas, insulation, milder climate;
- transport: increase in the number of cars, engine size and vehicle-kilometres;
- agriculture: reduction in and changes to livestock, reduction in mineral fertilisers;
- waste: recovery and use of biogas at landfill sites.

Figure 4: Trend in GHG emissions by sector in Wallonia (kt CO₂eq, between 1990 and 2017; source: AwAC)



Evolution des émissions entre 1990 et 2017 (en kt CO ₂ eq)	Trend in emissions between 1990 and 2017 (in kt CO ₂ eq)
Energie (production d'électricité)	Energy (electricity generation)
Industrie	Industry
Transport	Transport
Residentiel	Residential
Tertiaire	Tertiary
Agriculture	Agriculture
Déchets	Waste
Autres	Other
Total Wallonie	Total for Wallonia

ii. Projections of sectoral developments with existing national and Union policies and measures at least until 2030

The projections set out below are based in particular on work carried out by a consultant (ECONOTEC) using the Emission Projection Model (a technical and economic model) in the second half of 2016. The aim was to update the projections made in early 2015 for the energy generation, industrial, residential and tertiary sectors. The projections for the transport sector were modelled using the COPERT tool and may change depending on the

context or the availability of new tools (42). The model does not cover all the dimensions of the Energy Union (market, network, etc.) or take account of all impacts (jobs, prices, etc.).

Policies and measures taken into account

Only the main measures that generate investments are taken into account (e.g. the effects of soft measures such as communication are not directly included). This choice may mean that consumption and emissions are overestimated, but ensures that the resulting baseline scenario is conservative.

Existing policies and measures are included in the model using an analysis of existing data (databases, regulatory texts, etc.).

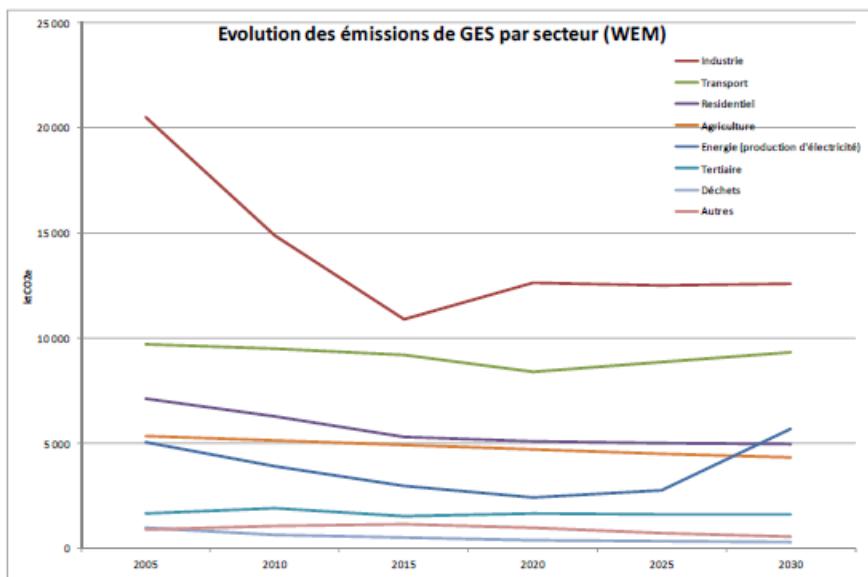
Where the end date of a measure is known, this is taken into account (e.g. green certificates). Otherwise, the measure is continued linearly to 2030 (e.g. incentives).

All the graphs below are based on historical data from the energy balances for the years 2005, 2010 and 2015 (where intermediate years are shown, they have been linearly extrapolated and do not therefore represent official data). The years 2020, 2025 and 2030 are the result of modelling and the intermediate years are extrapolated.

Greenhouse gas emissions

The graph below shows the trend in GHG emissions for all sectors since 2005, with constant-policy-based projections.

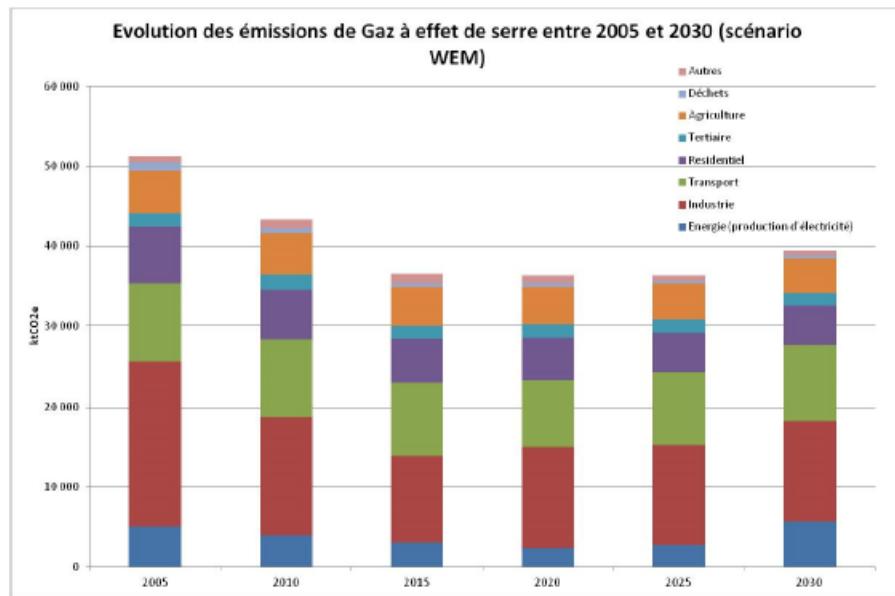
Figure 5: Trend in GHG emissions by sector in the baseline scenario (WEM), in five-year intervals



Evolution des émissions de GES par secteur (WEM)	Trend in GHG emissions by sector (WEM)
ktCO2e	kt CO ₂ eq
Industrie	Industry
Transport	Transport
Residentiel	Residential
Agriculture	Agriculture
Energie (production d'électricité)	Energy (electricity generation)
Tertiaire	Tertiary
Déchets	Waste
Autres	Other

⁴² The TIMES model (optimisation model) is being developed in Wallonia.

Figure 6: Trend in total GHG emissions (ETS + ESR) in the baseline scenario (WEM)



Evolution des émissions de Gaz à effet de serre entre 2005 et 2030 (scénario WEM)	Trend in GHG emissions between 2005 and 2030 (WEM scenario)
ktCO2e	kt CO ₂ eq
Autres	Other
Déchets	Waste
Agriculture	Agriculture
Tertiaire	Tertiary
Residentiel	Residential
Transport	Transport
Industrie	Industry
Energie (production d'électricité)	Energy (electricity generation)

Without any additional measures, the emissions of each sector will generally remain stable over the entire period to 2030. However, there may be some increases in the energy generation, industrial and transport sectors. Emissions in the energy generation sector will increase in 2025 due to the end of nuclear power and its partial replacement by gas-fired plants. There will be an increase in the industrial sector between 2015 and 2020, as it is expected that the sector will return to a level of activity comparable to the pre-crisis level in 2008. The transport sector is also expected to continue its previous growth.

1.1.2. Renewable energy

i. Current share of renewable energy in gross final energy consumption and in different sectors (heating and cooling, electricity and transport) as well as per technology in each of these sectors

‘Renewable energy sources’ are non-fossil renewable energy sources used for both electricity generation and also heat production and transport (⁴³). The most well-known, given that they form part of our everyday landscape, are wind power, solar power and wood. However, biogas and biofuels are also included in this list.

The renewable energy sources available in Wallonia can be grouped into three categories:

⁴³ Refer to Directive 2009/28/EC for a full definition.

Source électricité (E-SER)	Source chaleur (C-SER)	Transport (T-SER)
<ul style="list-style-type: none"> Hydraulique Eolien Solaire PV Biogaz Biocombustible liquide Biomasse solide Déchets organiques 	<ul style="list-style-type: none"> Solaire thermique Pompes à chaleur Géothermie Biogaz Biocombustible liquide Biomasse solide Bois 	<ul style="list-style-type: none"> Biodiesel Bioethanol Electricité SER

Electricity source (RES-E)	Heat source (RES-H)	Transport (RES-T)
<ul style="list-style-type: none"> Hydroelectric Wind Solar PV Biogas Liquid biofuel Solid biomass Organic waste 	<ul style="list-style-type: none"> Solar thermal Heat pumps Geothermal energy Biogas Liquid biofuel Sold biomass Wood 	<ul style="list-style-type: none"> Biodiesel Bioethanol RES electricity

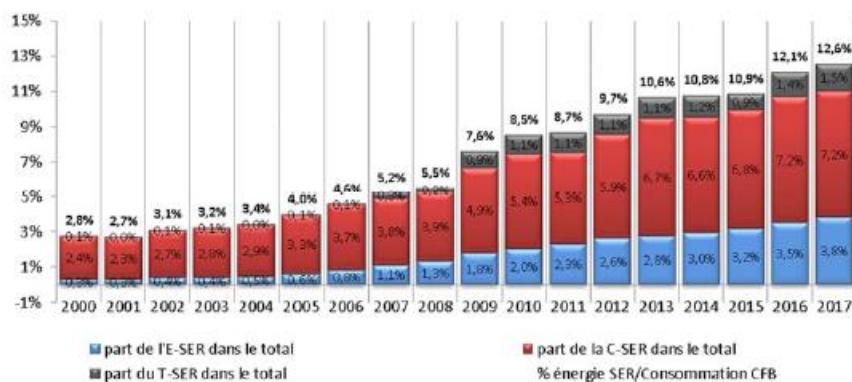
Several European Directives promoting the use of energy produced using renewable sources have been successively adopted in recent years: 2001/77/EC, 2003/30/EC, 2009/28/EC and more recently (EU) 2015/1513. Their aim is to define a minimum renewables target for each country and also the rules for calculating that target.

Belgium's renewable energy commitment at EU level (13% by 2020) was broken down between the regions and the federal level in December 2015, with Wallonia being set a target of producing 14,850 GWh from renewable energy sources by 2020.

Wallonia has, however, adopted a decree enshrining a more ambitious target of 15,600 GWh of production from renewable energy sources by 2020.

This target incorporates generation of renewable electricity, production of renewable heat and consumption of biofuels in the transport sector. The denominator takes account of final energy consumption, including grid losses and own consumption in heat or power plants. The following figures show the trend in the share of renewables in Wallonia and the target set for 2020. It should be noted that the share of renewable electricity is increasing (under 1% of the total before 2007; 3.9% in 2017), that the share of renewables in the transport sector slowed in 2015 but accelerated again in 2016 and 2017, and finally that renewable heat makes the largest contribution to the overall total at 7.2%.

Figure 7: Trend between 2000 and 2016 in the share of gross renewable energy in total gross final energy consumption within the meaning of Directive 2009/28/EC



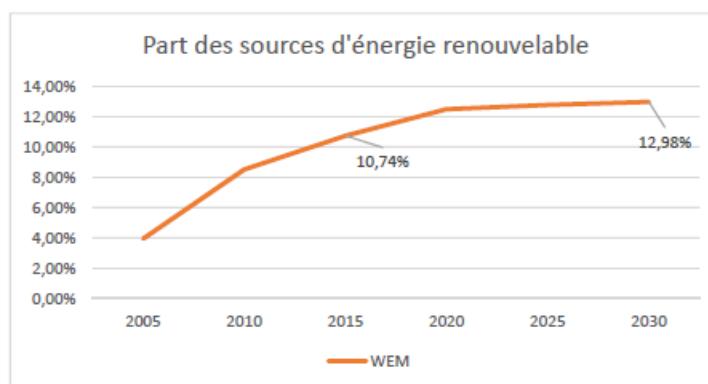
part de l'E-SER dans le total	Share of RES-E in the total
part du T-SER dans le total	Share of RES-T in the total
part de la C-SER dans le total	Share of RES-H in the total
% énergie SER/Consommation CFB	% Renewable energy/Gross final consumption

Having achieved 12.6% in 2017, Wallonia has exceeded the Burden Sharing targets set for Belgium as a whole, i.e. 15,341 GWh with a target of 14,850 GWh.

ii. Indicative projections of development with existing policies and measures for the year 2030

The share of renewable energy sources (RES) increases from 10.74% ⁽⁴⁴⁾ in 2015 to 12.98% in 2030 in a constant-policy scenario. The rate of development varies by sector and subsector.

Figure 8: Trend in the share of renewable energy sources in the WEM scenario



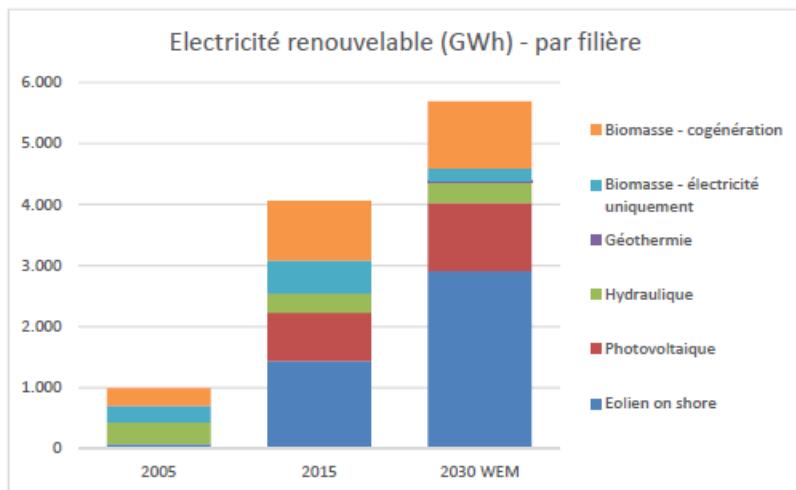
Part des sources d'énergie renouvelable	Share of renewable energy sources
WEM	WEM

With regard to the generation of **renewable electricity**, the green certificates mechanism is taken into account up to 2024 and results in increasing renewable electricity generation up to that year, after which it stabilises (if the green certificates support mechanism is not continued after 2024), except for small-scale photovoltaic systems.

All existing renewable installations in 2014 are assumed to continue operating over the projection period, except for the AWIRS 4 biomass plant, which is expected to shut down after 2020.

⁴⁴ 12.6% in 2017.

Figure 9: Renewable electricity generation by subsector (WEM)

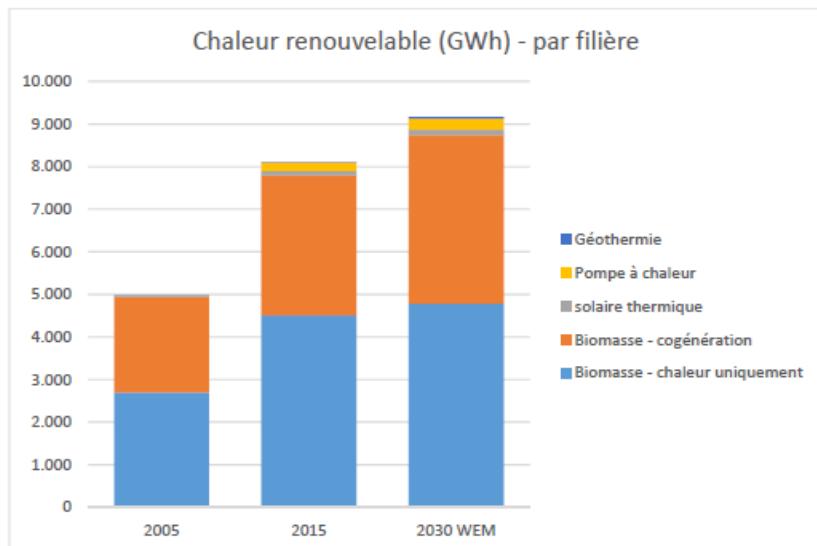


Electricité renouvelable (GWh) – par filière	Renewable electricity (GWh) – by subsector
Biomasse – cogénération	Biomass – cogeneration
Biomasse – électricité uniquement	Biomass – electricity only
Géothermie	Geothermal energy
Hydraulique	Hydroelectric power
Photovoltaïque	Photovoltaics
Eolien on shore	Onshore wind
WEM	WEM

Renewable electricity generation mainly involves wind power, biomass (whether or not through cogeneration) and photovoltaics.

The production of **renewable heat** increases slightly in each subsector. Cogeneration is encouraged through the green certificates mechanism, with the other subsectors also being developed through existing support mechanisms and energy performance obligations.

Figure 10: Production of renewable heat by subsector (WEM scenario)



Chaleur renouvelable (GWh) – par filière	Renewable heat (GWh) – by subsector
Géothermie	Geothermal energy

Pompe à chaleur	Heat pump
Solaire thermique	Solar thermal
Biomasse – cogeneration	Biomass – cogeneration
Biomasse – chaleur uniquement	Biomass – heat only
WEM	WEM

Dimension Energy efficiency

i. Current primary and final energy consumption in the economy and per sector (including industry, residential, service and transport)

The environmental impact of generating and using energy depends not only on the amount of energy consumed, but also on the type of resources used: primary or secondary, fossil or renewable.

Actual energy needs in Wallonia are represented by gross inland (energy) consumption (GIC) (45).

Unlike the more commonly used term 'final energy consumption', GIC includes losses associated with the transformation and distribution of energy, as well as the fuel consumption of power plants.

The graph below shows that overall Wallonia has consumed less energy each year since 2004, with a total reduction of 15% since 1990. This reduction in consumption is reflected in nuclear production, which fell from 65 TWh in 1990 to 58 TWh in 2017. This reduction in the nuclear share has been offset by the rise in renewables since the early 2000s, which now account for 12% of gross inland consumption.

Wallonia's level of energy self-sufficiency is therefore increasing each year.

Figure 11: Trend in gross inland consumption by energy carrier between 1990 and 2016



CIB (TWh PCI)	GIC (TWh LCV)
max en 2004	maximum in 2004
min en 2015	minimum in 2015
-16% p.r. à 1990	-16% compared with 1990
-14% p.r. à 2010	-14% compared with 2010
-0.5% p.r. à 2016	-0.5% compared with 2016
Solides	Solid fuels
Produits pétroliers	Oil products
Gaz naturel	Natural gas
Nucléaire	Nuclear
Electricité	Electricity
Autres	Other
CIB total	Total GIC

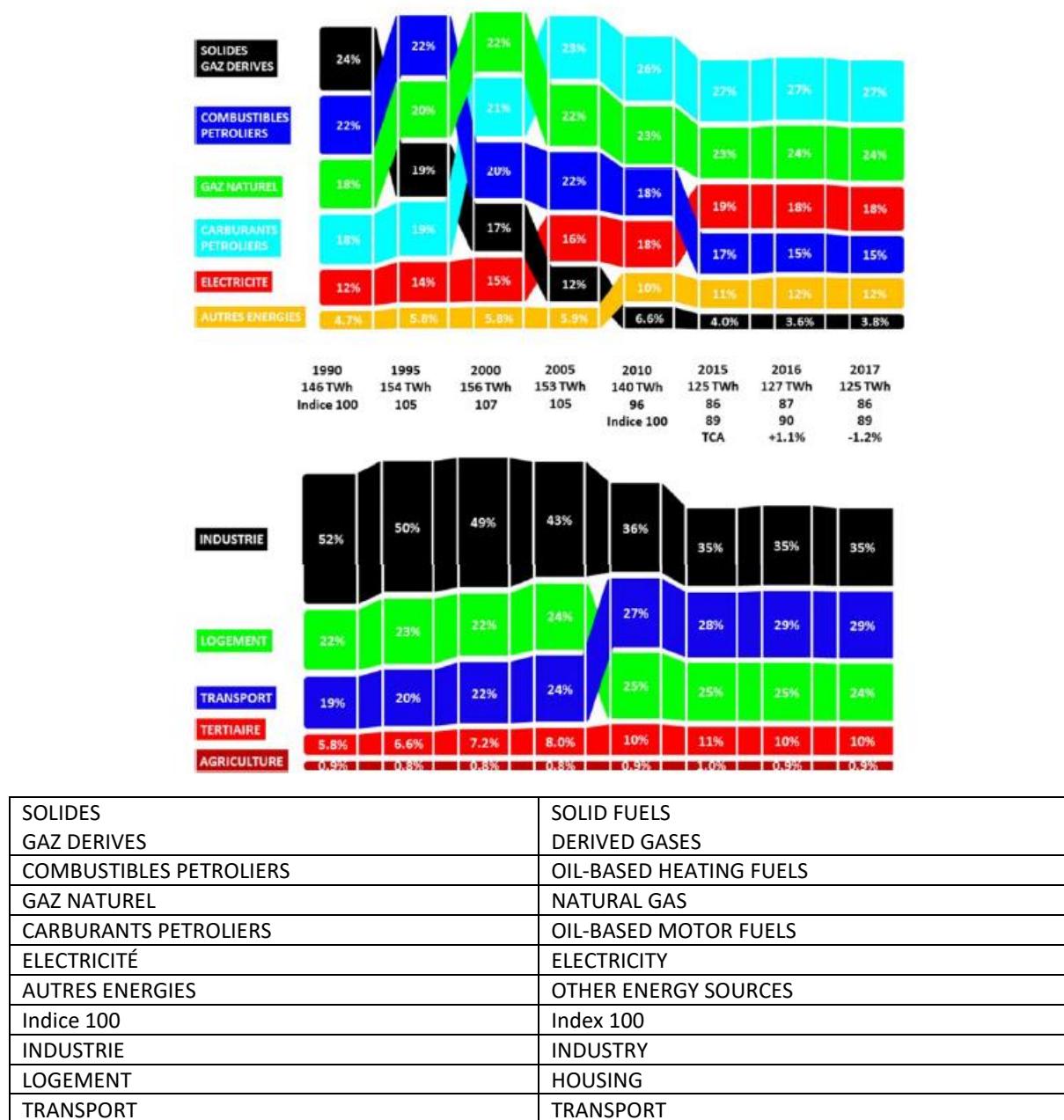
⁴⁵ The term 'gross domestic consumption of energy' corresponds to the total energy demand in a geographical area.

However, the graph shows that 2015 was the first year with a net import balance for electricity since 1990. This means that Wallonia did not generate more electricity than it needed in 2015 and that overall it purchased more electricity from its neighbours than it sold to them. In 2017, Wallonia once again recorded a net export balance for electricity of 6 TWh.

In parallel with the changing energy needs in Wallonia, the trend in final consumption reveals the links between the economic sectors responsible for that consumption and the consumption by energy carrier.

For example, different sources of energy are used for transport purposes and for manufacturing industrial products. Changes in the breakdown by economic sector therefore change the breakdown by energy carrier. This is illustrated in the two graphs below.

Figure 12: Trend in total final consumption (46) by economic sector and energy carrier



⁴⁶ Total final consumption includes non-energy uses, i.e. energy used as a raw material in manufacturing processes.

TERTIAIRE	TERTIARY
AGRICULTURE	AGRICULTURE

It is apparent from the second graph that industry, transport and buildings (tertiary and housing combined) account for the bulk of consumption.

In chronological terms, it is clear that, although industry continues to be the most energy-intensive sector in Wallonia, it now accounts for only 35% of final consumption, whereas this figure was 52% in 1990. This fall has led to a reduction in the consumption of solid fuels (first graph), from 24% in 1990 to just 4% in 2017, which were primarily used in the steel industry. In addition, given the high level of CO₂ emissions associated with this type of fuel, the industries using it have prioritised its elimination and/or replacement.

The transport sector, which accounted for only 19% of energy consumption in 1990, currently consumes 29% of the energy used in Wallonia.

This trend in the sector's share is confirmed by the first graph, which shows that the share of oil-based motor fuels increased from 18% in 1990 to 27% in 2017.

The 2% difference in 2017 relates to biofuels and renewable electricity used in the transport sector.

Oil-based heating fuels have followed the same trend as solid fuels, albeit to a lesser extent. These two families of fuels have been partly replaced by natural gas and electricity.

The use of electricity has increased more than natural gas in the residential sector, even though the latter seems to be a more appropriate substitute fuel for many applications. This is particularly because housing density is low in several areas of Wallonia, which limits development of the natural gas distribution system.

These data also highlight the region's continuing dependence on oil-based products, which form the energy source in 42% of cases.

ii. Current potential for the application of high-efficiency cogeneration and efficient district heating and cooling

A. Estimated potential primary energy savings

Based on defined economic potential, primary energy is calculated using a conversion factor of 2.5 for electricity and 1 for other energy carriers.

With regard to cogeneration, this results in primary energy savings of around 15% of technical potential, i.e. 4,155 GWh.

Primary energy savings for waste energy are 93.12 GWh.

Total primary energy savings are estimated at around 4,288 GWh.

This figure could increase in the event of more favourable economic parameters encouraging investments in cogeneration and recovery of high-temperature waste heat in electricity generation.

Demand for heating and cooling could be met through high-efficiency cogeneration, including domestic micro-cogeneration, and through district heating and cooling systems.

Demand for heating that could be met through high-efficiency cogeneration, including domestic micro-cogeneration, and through district heating and cooling systems is included under substitutable heating. This relates to applications operated at temperatures between 50°C and 250°C.

Substitutable heating requirements are identified in the following table by sector (housing, tertiary and industry) and by use (DHW = domestic hot water).

Sector	Process heat (high t°)	Heating	Space heating	DHW	Cooking	Other uses	TOTAL	Total heating requirements	Substitutable heating	Share of substitutable heating
Tertiary	-	6,923.6	-	785.1	7.4	5,895.3	13,611.3	7,716.0	7,708.6	56.6%
Housing	-	20,180.8	2,245.7	3,608.3	878.2	4,187.5	31,100.5	26,913.1	26,034.9	83.7%
Industry	19,585.2	11,319.0	-	-	-	10,725.7	41,629.9	30,904.2	11,319.0	27.2%
Total	19,585.2	38,423.4	2,245.7	4,393.4	885.5	20,808.5	86,341.7	65,533.2	45,062.5	52.2%

Table 1: Heating requirements

Total heating requirements (65.5 TWh) account for 76% of total energy consumption in the three sectors, which illustrates the importance of these needs in the energy balance. Over half (52.2%) of final energy consumption in the three sectors is substitutable heating requirements, i.e. a total of 45 TWh. Housing accounts for the largest share of this figure (26.0 TWh, 58%), followed by industry (11.3 TWh, 25%) and finally the tertiary sector (7.7 TWh, 17%).

Cooling needs are 20.8 GWh for housing, 935 GWh for the tertiary sector (including 540 GWh of substitutable cooling, i.e. requirements that can be met by district cooling systems) and 830 GWh for industry (including 128 GWh of substitutable cooling).

According to the information available at the time of the study, there are no facilities in Wallonia capable of producing recoverable cooling that can be routed through a distribution system or consumed on site. The only sectors with cooling potential the chemical and food industries.

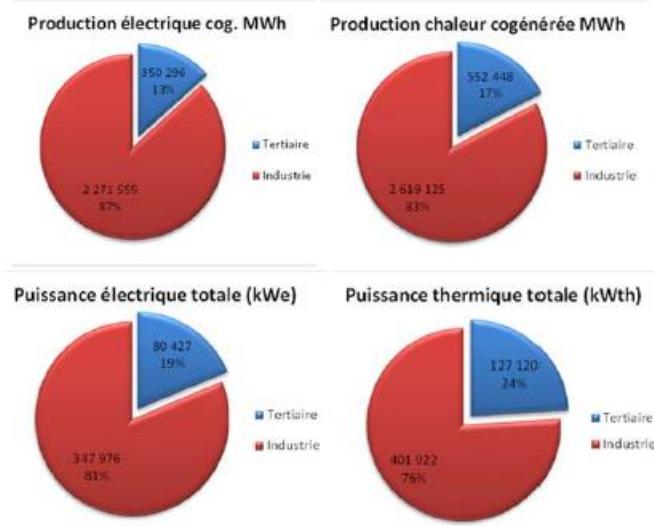
B. Estimated potential

❖ Cogeneration potential

Technical potential of cogeneration

The reporting methodology based on the requirements set out in Directive 2004/8/EC on the promotion of cogeneration was used together with the most recent available data in order to assess the technical potential of cogeneration. This exercise revealed that the potential thermal power is 529 MWth, of which 76% is in the industrial sector, with the corresponding thermal production being estimated at 3,172 GWh. The potential electrical power is 428 MWe, of which 81% is in the industrial sector, with the corresponding electricity generation being 2,621 GWh.

Figure 19: Cogeneration potential



Production électrique cog. MWh

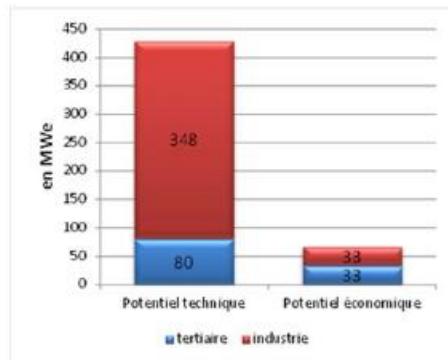
Cogenerated electricity in MWh

Production chaleur cogénérée MWh	Cogenerated heat in MWh
Puissance électrique totale (kWe)	Total electrical power (kWe)
Puissance thermique totale (kWth)	Total thermal power (kWth)
Tertiaire	Tertiary
Industrie	Industry

Economic potential of cogeneration

The following graph clearly illustrates that economic potential is around 15%, i.e. very low compared with technical potential, given the constraints of a two-year payback period for industry and a five-year payback period for the tertiary sector, without any support through green certificates.

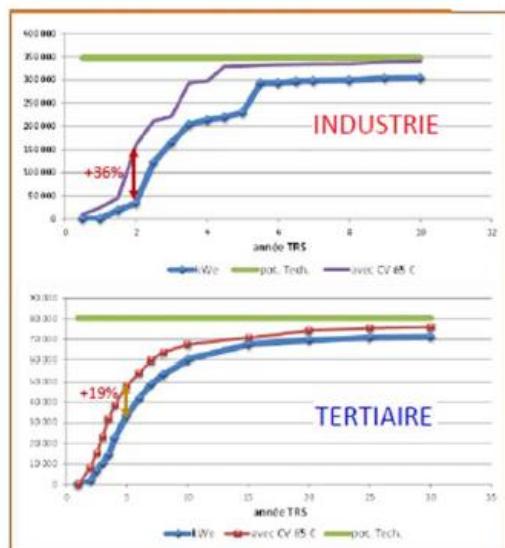
Figure 14: Economic potential of cogeneration



en MWe	in MWe
Potentiel technique	Technical potential
Potentiel économique	Economic potential
tertiaire	tertiary
industrie	industry

It should be noted that cogeneration potential depends on various external or economic factors that can direct investments, such as the price per tonne of CO₂, support mechanism or choice of payback period.

Figure 15: Simple payback period of cogeneration



INDUSTRIE	INDUSTRY
TERTIAIRE	TERTIARY
année TRS	Simple payback period in years
kWe	kWe
pot. Tech.	Technical potential
avec CV 65 €	with €65 green certificate

❖ ***Industrial waste heat potential***

Technical potential of industrial waste heat

The technical potential of recovering waste energy has been assessed for heating temperatures below and above 100°C and amounts to 2,627.6 GWh.

Table 12: Waste heat potential

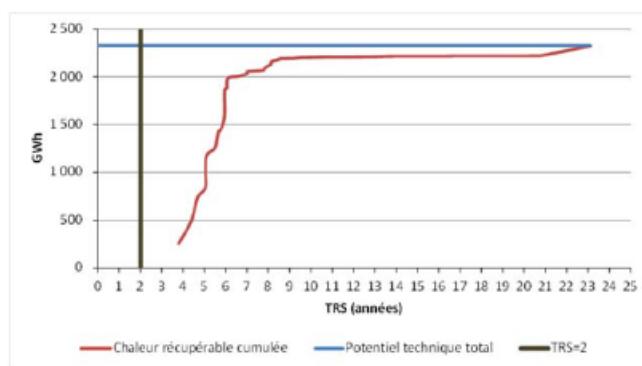
Industrial sector	t°>100°C	t<100°C	Total
STEEL	246.0	0.0	246.0
NON-FERROUS METALS	0.0	0.0	0.0
CHEMICALS	828.5	50.0	878.5
NON-METALLIC MINERALS	1 245.7	0.0	1,245.7
FOOD	7.8	187.7	195.6
TEXTILES	0.0	0.0	0.0
PAPER	0.0	22.1	22.1
METALWORKING	3.1	0.0	3.1
OTHER INDUSTRIES	0.0	36.5	36.5
INDUSTRY TOTAL	2,331.2	296.4	2 627.6

Economic potential of industrial waste heat

- High temperature

Based on the method and assumptions detailed in the study report, the figure below shows the simple payback period according to the cumulative heat potential at high temperature and total technical potential at high temperature.

Table 3: Economic potential of waste heat



GWh	GWh
TRS (années)	Simple payback period (years)
Chaleur récupérable cumulée	Cumulative recoverable heat
Potential technique total	Total technical potential
TRS=2	Simple payback period=2 years

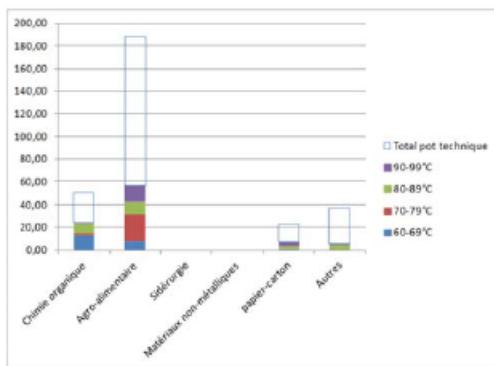
With a simple payback period constraint of two years or less, the economic potential is zero. Payback periods for systems recovering waste heat are currently very long. Given current energy prices, the ORC (Organic Rankine Cycle) subsector is not profitable without aid.

- Low temperature

The total economic potential is estimated at 93.12 GWh/year, which is equivalent to 31% of the total technical potential for the sectors studied.

The figure below shows the results for each sector and the share of technical potential that would be economically viable.

Figure 16: Technical potential of waste heat



Total pot technique	Total technical potential
Chimie organique	Organic chemistry
Agro-alimentaire	Agri-food
Sidérurgie	Steel
Matériaux non-métalliques	Non-metallic materials
Papier-carton	Paper and cardboard
autres	Other

❖ **Energy efficiency potential of district heating and cooling system infrastructures**

Wallonia has 46 district heating systems, but no district cooling systems. Most (67%) of these systems are owned by public and rural bodies, as for the most part they were constructed under the Wood Energy and Rural Development Plan aimed at supporting the development of rural municipalities. Among these systems, 42 are powered by biomass, 2 by natural gas, 1 by deep geothermal energy and 1 by waste energy. These 46 systems annually produce 402 GWh and distribute 190 GWh of energy. They have a total length of 69.55 km, with over 90% of them having a length of less than 500 m.

Technical potential

Qualitative estimates of the technical potential of district heating systems are based on a bottom-up approach which assumes that conditions are favourable to the development of a district heating system. When the study was conducted, data were available at municipality level and could not therefore be used to extrapolate favourable conditions at district or street level, for example.

Detailed data about heating requirements have been built up over time through the EPB legislation, in relation to new housing or housing being renovated under planning permission, or through the housing energy certification system. Likewise, the future energy certification system for non-residential buildings will enable detailed information to be gathered about heating and cooling needs in the tertiary sector.

Economic potential

District heating systems offer development potential in terms of recovering waste heat and using renewable energy. However, new district heating systems must be able to adapt to changing conditions (loss of a source of waste heat, extension of the system, greater density) through a hub-and-spoke arrangement, variable flow rates, possibilities of adding extra power to the system, etc.

There must be a minimum heating requirement before a district heating system can be envisaged. In view of the energy performance of new housing units, joint projects with other infrastructure (housing + offices/crèches/residential homes/hospitals/etc.) are essential.

District heating systems can make financial sense in the long term, but each investment decision must be examined on a case-by-case basis using the results of a feasibility study.

C. Strategies, policies and measures that can be adopted to 2030 in order to harness potential

The following cumulative financial support is available for cogeneration in Wallonia:

- investment aid;
- production aid in the form of green certificates for high-efficiency cogeneration, i.e. where CO₂ is reduced by at least 10% compared with the benchmarks;
- tax deduction by the Federal Government.

The following cumulative support is available from the Walloon Government for the recovery of waste heat and for district heating and cooling systems:

- investment aid;
- tax deduction by the Federal Government.

This financial support will be kept in place for as long as possible, taking into account Wallonia's budget priorities and the need for compliance with EU State aid rules, so that project owners can plan for the long term and make accurate profitability calculations.

In order to help develop cogeneration, district heating and cooling systems and waste heat recovery, Wallonia has already proposed the following measures.

- Sectoral agreements targeted at the most energy-intensive businesses. These agreements are based on a commitment to improve energy efficiency and reduce CO₂ emissions between 2005 and 2020, and require businesses to carry out a comprehensive audit of their facilities with the aim of systematically identifying potential for the on-site recovery of waste heating and cooling. The feasibility of fossil and biomass cogeneration is studied wherever possible.

- A renewable energy and energy efficiency service with the following tasks:

- advise the target audience on cogeneration techniques, methods for recovering waste energy and options for installing district systems;
- offer tailored advice to project owners;
- help managers in the same sector to exchange best practices in relation to waste energy recovery;
- make information tools and calculations available in order to ensure the success of projects;
- train multipliers in these techniques and methods (both basic and advanced training).

- An obligation to study new installations or installations to be renovated with an installed capacity of over 20 MWth (in line with the requirement under Article 14(5) of Directive 2012/27/EU).

- Wallonia is preparing to review its auditor approval systems with a view to improving their quality and further formalising them in relation to the audit methodologies used.

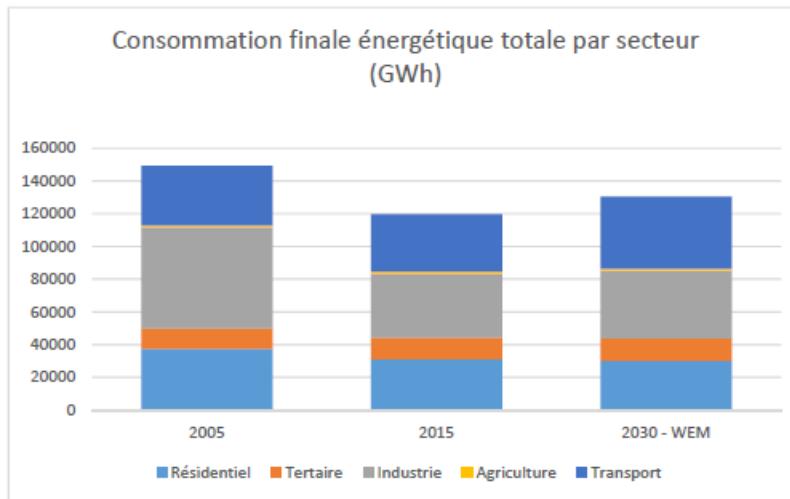
- Following an analysis, Wallonia plans to reduce the energy market barriers for low-voltage cogenerated electricity so that producers can resell any surplus that they have not used themselves.

- It is planned to adapt the categories of environmental permits so that the development of cogeneration projects involving biomass gasification can be encouraged due to these facilities not being regarded as Class 1, which seems an inappropriate categorisation given the actual impact of wood gasification technology on the environment (see point 3.1.2.(i)).

iii. Projections considering existing energy efficiency policies, measures and programmes as described in point 1.2. for primary and final energy consumption for each sector at least until 2030

Final energy consumption shows an upward trend between 2015 and 2030, mainly due to transport.

Figure 17: Trend in final energy consumption by sector



Consommation finale énergétique totale par secteur (GWh)	Total final energy consumption by sector (GWh)
Résidentiel	Residential
Tertiaire	Tertiary
Industrie	Industry
Agriculture	Agriculture
Transport	Transport
WEM	WEM

Despite this increase, **primary energy consumption** falls to 2030 due to the closure of nuclear power plants, which will be partly replaced by CCGT and renewable electricity plants and relatively high imports.

iv. Cost-optimal levels of minimum energy performance requirements resulting from national calculations, in accordance with Article 5 of Directive 2010/31/EU

Articles 4 and 5 of Directive 2010/31/EU on the energy performance of buildings require Member States to set minimum energy performance requirements with a view to achieving the cost-optimal balance between the investments involved and the energy costs saved throughout the lifecycle of the building.

A methodology framework for calculating cost-optimal levels of minimum energy performance requirements has been provided by the Commission so that Member States can compare their results.

The results of this comparison and the data used to reach these results should be regularly reported to the Commission (no longer than five years). These reports should enable the Commission to assess and report on the progress of Member States in reaching cost-optimal levels of minimum energy performance requirements.

The first report (COZEB I) was submitted in 2013, with the second (CO II) in July 2018; these reports must be acknowledged by the Government.

Conclusions of CO II

As stipulated in the guidelines, the gap (expressed in %) between the cost-optimal levels and the current requirements is calculated for each reference building. The gaps are weighted on the basis of their individual representativeness. The total of these weighted gaps divided by the number of buildings in the category in question gives the weighted average gap between the requirements and the cost-optimal level of each building. Checks are then carried out to ensure that this weighted average gap is not less than -15% (gaps greater than -15% are shown in red in the tables below), i.e. that the requirements are not lacking in ambition. However, the Commission allows requirements that are more ambitious than the cost-optimal level to be set.

❖ Existing buildings

Wall insulation

Table 4 - Cost-optimal level of windows - Existing buildings

Windows			
Category of reference buildings	Requirement 2017/2021	CO	Weighted average gap
Existing single-family houses	1.5	1.43	-5%
Existing apartment blocks		1.43	-5%
Existing offices		1.47	-2%
Existing educational buildings		1.43	-5%

The weighted average optimal U of windows is around 5% more efficient than the Umax 2017 requirement (1.5 W/m²K) across all segments (REP, NEP). This requirement is remarkably close to the cost-optimal (CO) improvement level and does not therefore need to be tightened up.

Table 5 – Cost-optimal level of walls - Existing buildings

Walls			
Category of reference buildings	Requirement 2017/2021	CO	Weighted average gap
Existing single-family houses	0.24	0.22	-13%
Existing apartment blocks		0.22	-11%
Existing offices		0.18	-33%
Existing educational buildings		0.24	0%

The weighted average optimal U of walls is close to the Umax 2017 requirement in force (0.24 W/m²K) for existing buildings, with the exception of existing offices for which the weighted average gap is -33%. The optimal values obtained for the reference buildings are, however, systematically lower than the 2017 requirement level. The conclusions on the requirement levels for walls of new buildings could therefore also be applied to existing buildings subject to major renovation.

Table 6 - Cost-optimal level of roofs - Existing buildings

Roofs			
Category of reference buildings	Requirement 2017/2021	CO	Weighted average gap
Existing single-family houses	0.24	0.22	-9%
Existing apartment blocks		0.235	-2%
Existing offices		0.22	-10%
Existing educational buildings		0.2	-19%

The weighted average optimal U of roofs is close to the Umax 2017 requirement in force (0.24 W/m²K) for existing buildings, with the exception of existing educational buildings for which the weighted average gap is -19%. The optimal values obtained for the reference buildings are, however, systematically lower than the 2017 requirement level. The conclusions on the requirement levels for walls of new buildings could therefore also be applied to existing buildings subject to major renovation.

Table 7 - Cost-optimal level of floors - Existing buildings

Floors			
Category of reference buildings	Requirement 2017/2021	CO	Weighted average gap
Existing single-family houses	0.24	0.23	-7%
Existing apartment blocks		0.42	16%
Existing offices		0.26	6%
Existing educational buildings		0.24	0%

The weighted average optimal U of floors is remarkably close (or slightly less demanding, in the case of existing offices and existing apartment blocks) to the Umax 2017 requirement in force (0.24 W/m²K). This requirement is close to the cost-optimal improvement level and does not therefore need to be tightened up.

❖ *New buildings*

Wall insulation

Table 8 - Cost-optimal level of windows - New buildings

Windows			
Category of reference buildings	Requirement 2017/2021	CO	Weighted average gap
New single-family houses	1.5	1.42	-6%
New apartment blocks		1.43	-5%
New offices		1.43	-5%
New educational buildings		1.43	-5%

The weighted average optimal U of windows is around 5% more efficient than the Umax 2017 requirement (1.5 W/m²K) across all segments (REP, NEP). This requirement is remarkably close to the cost-optimal improvement level and does not therefore need to be tightened up.

Table 9 - Cost-optimal level of walls - New buildings

Walls			
Category of reference buildings	Requirement 2017/2021	CO	Weighted average gap
New single-family houses	0.24	0.2	-20%
New apartment block		0.15	-60%
New offices		0.22	-9%
New educational buildings		0.2	-20%

The weighted average optimal U of exterior walls of new buildings is systematically more efficient than the Umax 2017 requirement (0.24 W/m²K). Based on the criteria and the need to review the requirement levels by building element from 2021 onwards, the level could be increased so that it is in line with, or higher than, the cost-optimal level.

Table 10 - Cost-optimal level of roofs - New buildings

Roofs			
Category of reference buildings	Requirement 2017/2021	CO	Weighted average gap
New single-family houses	0.24	0.18	-36%
New apartment blocks		0.2	-20%
New offices		0.2	-20%
New educational buildings		0.2	-20%

The weighted average optimal U of new roofs is systematically more efficient (around 20% for offices, schools and apartment blocks, and up to 36% for single-family houses) than the Umax 2017 requirement in force (0.24 W/m²K). Based on the criteria and the need to review the requirement levels by building element from 2021 onwards, the level could be increased so that it is in line with, or higher than, the cost-optimal level.

Table 11 - Cost-optimal level of floors - New buildings

Floors			
Category of reference buildings	Requirement 2017/2021	CO	Weighted average gap
New single-family houses	0.24	0.24	0%
New apartment blocks		0.24	0%
New offices		0.24	0%
New educational buildings		0.24	0%

The weighted average optimal U of floors is the same as the Umax 2017 requirement in force (0.24 W/m²K). This requirement is in line with the cost-optimal improvement level and does not therefore need to be tightened up.

Overall performance indicators

Table 12 - K-level

K-level			
Category of reference buildings	Requirement 2017/2021	CO	Weighted average gap
New single-family houses	35	27	-31%
New apartment blocks		31	-13%
New offices		41	15%
New educational buildings		32	-13%

Table 13 - E_{spec}

E _{spec}			
Category of reference buildings	Requirement 2017	CO	Weighted average gap
New single-family houses	115	82	-50%
New apartment blocks		63	-83%
Category of reference buildings	Requirement 2021	CO	Weighted average gap
New single-family houses	85	82	-11%
New apartment blocks		63	-35%

Table 14 - E_w level

E_w level			
Category of reference buildings	Requirement 2017	CO	Weighted average gap
New single-family houses	65	46	-52%
New apartment blocks		39	-67%
New offices		64	-2%
New educational buildings		48	-37%
Category of reference buildings	Requirement 2021	CO	Weighted average gap
New single-family houses	45	46	-6%
New apartment blocks		39	-15%
New offices		64	30%
New educational buildings		48	5%

As regards the overall performance indicators (E_{spec} , K and E_w) that apply to new residential buildings (new single-family houses, new apartment blocks), the weighted average cost-optimal levels are significantly more efficient than the requirements in force in 2017. This is an indication that the construction methods and heat production systems currently available on the market allow residential housing to be built that is generally more efficient and less costly (over a period of 30 years) than housing that strictly complies with the overall performance requirements of the EPB regulations.

The weighted average optimal E_w of 46 and E_{spec} of 82 kWh/m²/year of new single-family houses are remarkably close to the requirement levels (E_w 45 and E_{spec} 85 kWh/m²/year) stipulated for 2021.

As regards the overall performance indicators (K and E_w) that apply to new non-residential buildings, the weighted average optimal E_w of offices (E_w 64) and the requirement level in force in 2017 for this segment (E_w 65) are almost exactly the same.

For new schools, the weighted average optimal E_w of 48 is significantly more efficient than the 2017 requirement and very close to the 2021 requirement (E_w 45) stipulated for this segment. This is an indication that buildings in this segment can be constructed with a much higher level of efficiency than required by the current regulations while achieving cost-optimal levels. This trend is confirmed by the recent rise in the number of educational buildings constructed on the basis of passive-energy or very-low-energy standards.

The weighted average optimal K of both offices (K41) and schools (K32) is not more than 15% below the 2017/2021 requirements (K35) as regards insulation of the building envelope.

It can be concluded from these results that the overall requirement levels for new buildings in 2017 are lacking in ambition with regard to the current cost-optimal levels. Tightening the requirements in 2021 to achieve NZE (Nearly Zero Energy) performance will reduce this gap and the requirements will then be cost-optimal in accordance with the current results.

However, these results will be reviewed every five years, as stipulated by the Directive, which will allow changes in construction costs due to technological advances to be taken into account.

Dimension internal energy market

i. Current situation of electricity and gas markets, including energy prices (47)

Despite hopes to the contrary, market liberalisation, which profoundly changed the energy landscape, did not directly reduce overall bills. In the specific case of electricity and natural gas, it actually coincided with a marked rise in fossil fuel prices (oil and natural gas) that fed through to consumer prices. During the first few years following liberalisation, the regional and national markets continued to be dominated by the historical operator.

Since then, however, the Walloon Energy Commission (Commission Wallonne pour l'Energie – CWaPE) has observed an increase in competition at regional level in terms of both the supply and the generation of electricity, which has been a factor in the recent changes in electricity and natural gas prices.

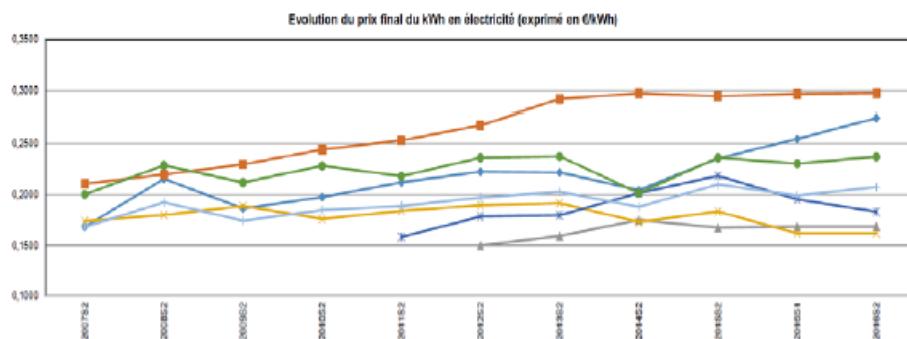
Residential

Competition and any competition-related impacts on price levels can only affect the unregulated component of the price, i.e. the energy component. This amounts to around 50% of the bill for a residential customer in the case of natural gas and 30% in the case of electricity.

In June 2017, the most expensive component of electricity bills was distribution (37.6%), followed by energy (32.5%).

- Electricity

Table 15 - Trends in residential electricity prices



Evolution du prix final du kWh en électricité (exprimé en €/kWh)	Trends in final electricity prices in kWh (expressed in EUR/kWh)
Belgique - données Eurostat - client type DC (2 500 kWh<Consommation<5 000 kWh)	Belgium – Eurostat data – consumption band DC (2,500 kWh<consumption<5,000 kWh)
Allemagne - données Eurostat - client type DC (2 500 kWh<Consommation<5 000 kWh)	Germany – Eurostat data – consumption band DC (2,500 kWh<consumption<5,000 kWh)
France - données Eurostat - client type DC (2 500 kWh<Consommation<5 000 kWh)	France – Eurostat data – consumption band DC (2,500 kWh<consumption<5,000 kWh)
Pays-Bas - données Eurostat - client type DC (2 500 kWh<Consommation<5 000 kWh)	Netherlands – Eurostat data – consumption band DC (2,500 kWh<consumption<5,000 kWh)
Royaume-Uni - données Eurostat - client type DC (2 500 kWh<Consommation<5 000 kWh)	United Kingdom – Eurostat data – consumption band DC (2,500 kWh<consumption<5,000 kWh)
Pour la moyenne pondérée des fournisseurs designés - client type DC (3 500 kWh/an dont 1 600 kWh en heures pleines et 1 900 kWh en heures creuses) à partir de 2011 (avant 2011: client type DC1: 3 500 kWh/an) - données simulateur	For the weighted average of the designated suppliers – consumption band DC (3,500 kWh/year, including 1,600 kWh at peak rate and 1,900 kWh at off-peak rate) from 2011 (before 2011: consumption band DC1: 3,500 kWh/year) – simulated data
Pour la moyenne pondérée des produits meilleurs marchés - client type DC (3 500 kWh/an dont 1 600 kWh en heures pleines et 1 900 kWh en heures	For the weighted average of the cheapest products – consumption band DC (3,500 kWh/year, including 1,600 kWh at peak rate and 1,900 kWh at off-peak

⁴⁷ Report CD-17g17-CWaPE-0030 on the analysis of electricity and natural gas prices in Wallonia (residential customers) over the period from January 2007 to June 2017.

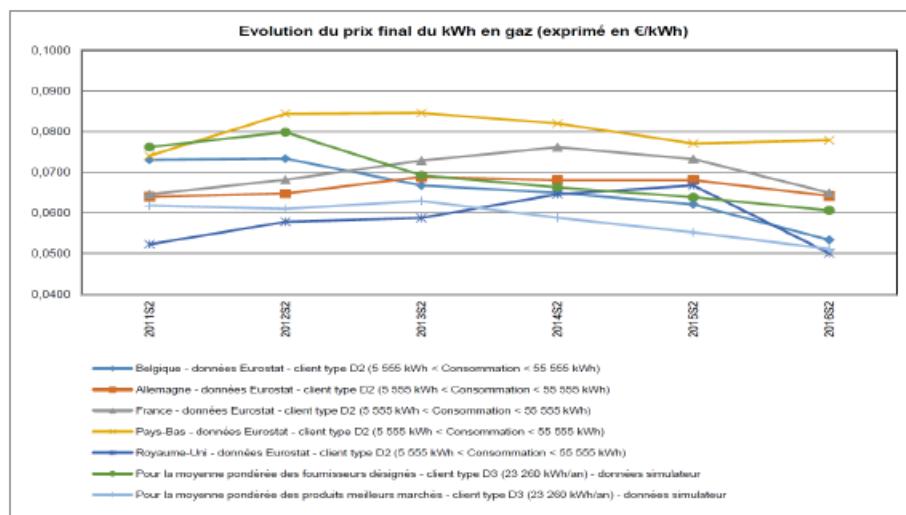
creuses) à partir de 2011 (avant 2011: client type DC1: 3 500 kWh/an) - données simulateur	rate) from 2011 (before 2011: consumption band DC1: 3,500 kWh/year) – simulated data
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In the first half of 2016, prices started to drop from their December 2015 level, but then rose again during the second half of the year (this increase continued in early 2017).

However, prices then dropped to a degree in the second quarter of 2017. These changes in the energy component can be partly explained by changing prices on the wholesale markets, in particular the Belpex indicator.

- Gas

Table 16 - Trends in residential gas prices



Evolution du prix final du kWh en gaz (exprimé en €/kWh)	Trends in final gas prices in kWh (expressed in EUR/kWh)
Belgique - données Eurostat - client type D2 (5,555 kWh<Consommation<55,555 kWh)	Belgium – Eurostat data – consumption band D2 (5,555 kWh<consumption<55,555 kWh)
Allemagne - données Eurostat - client type D2 (5,555 kWh<Consommation<55,555 kWh)	Germany – Eurostat data – consumption band D2 (5,555 kWh<consumption<55,555 kWh)
France - données Eurostat - client type DC (5,555 kWh<Consommation<55,555 kWh)	France – Eurostat data – consumption band DC (5,555 kWh<consumption<55,555 kWh)
Pays-Bas - données Eurostat - client type D2 (5,555 kWh<Consommation<55,555 kWh)	Netherlands – Eurostat data – consumption band D2 (5,555 kWh<consumption<55,555 kWh)
Royaume-Uni - données Eurostat - client type D2 (5,555 kWh<Consommation<55,555 kWh)	United Kingdom – Eurostat data – consumption band D2 (5,555 kWh<consumption<55,555 kWh)
Pour la moyenne pondérée des fournisseurs designés - client type D3 (23 260 kWh/an) - données simulateur	For the weighted average of the designated suppliers – consumption band D3 (23,260 kWh/year) – simulated data
Pour la moyenne pondérée des produits meilleurs marchés - client type D3 (23 260 kWh/an) - données simulateur	For the weighted average of the cheapest products – consumption band D3 (23,260 kWh/year) – simulated data

During 2016 and early 2017, gas bills issued by the designated suppliers were sometimes lower in price and sometimes higher, depending on variations in the energy component.

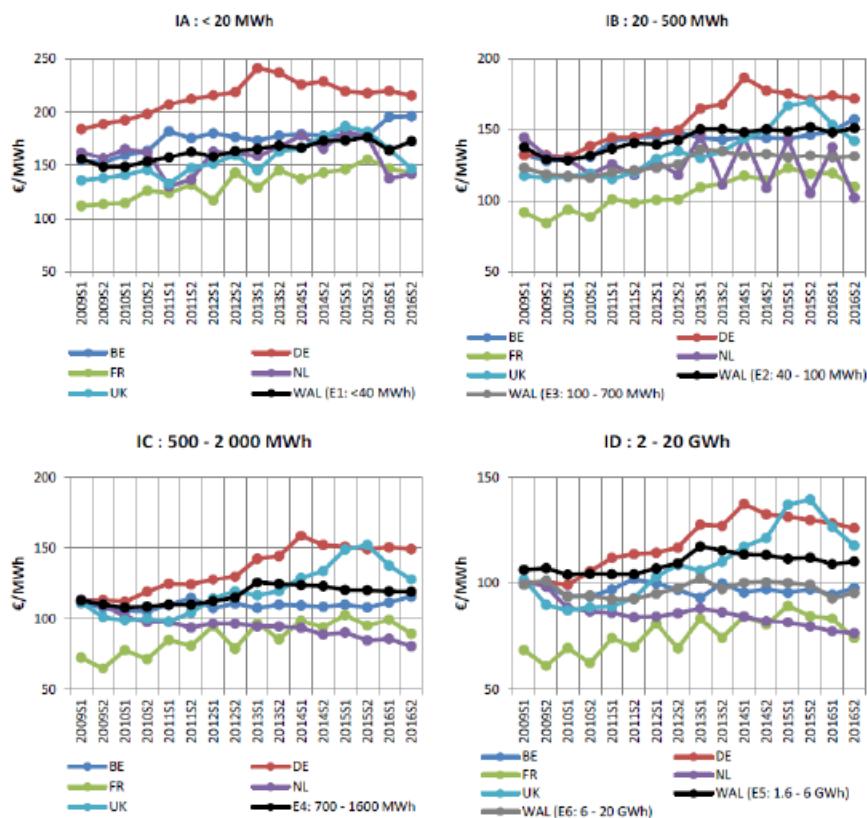
The downward trend in prices during 2016 continued despite a temporary increase in the third quarter. This reduction was partly due to the downward trend in prices on wholesale markets.

Professional

The production, import and supply of electricity and natural gas are subject to competition.

- Electricity

Figure 18: International comparison of electricity prices



The dominant components of the electricity price are the energy component and the distribution component. For consumption band E1 (annual electricity consumption below 40 MWh), the energy component accounts for 31% of the electricity price and the distribution component for around 37%.

Although the energy component of bills has fallen sharply, the other components have increased. The renewable energy support mechanism has not only increased final bills directly through the renewable energy contribution, but also indirectly through the transmission component surcharge introduced in 2012 to allow Elia to meet its obligations to buy back surplus green certificates on the Walloon market.

It should be noted, however, that the Decree of 11 December 2013 partly exempts certain businesses from the Elia green certificate surcharge, mainly those businesses in consumption bands E4 to E6.

In 2009/2010 electricity prices in Wallonia (all-inclusive price excluding VAT) moved closer to the prices charged by our direct neighbours; since then, the trend has reversed and the gap is growing.

The highest prices for consumption bands IA (<20 MWh/year) to ID (from 2 to 20 GWh/year) are charged in the United Kingdom and Germany. Consumers in Germany are paying the price for their country's strong energy policy and energy transition, including the phase-out of nuclear power. A study carried out recently by PWC in relation to larger consumers (i.e. with a different scope to this report) highlighted the fact, however, that some industrial electricity-intensive customers in Germany can benefit from substantial reductions giving them a competitive advantage over their Belgian and European neighbours.

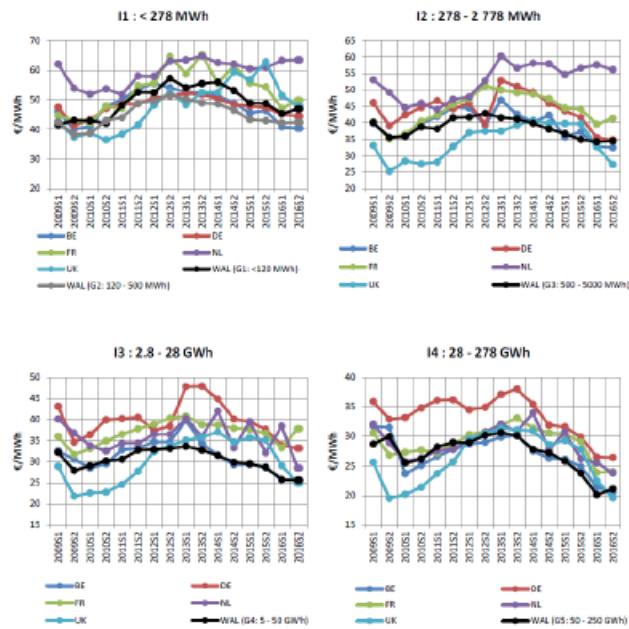
At the other end of the scale to consumers in Germany and the United Kingdom, customers in France and the Netherlands benefit from the lowest tariffs. The prices charged in Wallonia fall somewhere between these two extremes.

- Gas

Over the last 12 months, prices have fallen (by 0.3% for G5 up to 11% for G4), which can be attributed to a price drop on the wholesale market.

The energy component (including transmission) and, to a lesser extent, the distribution component form the bulk of the natural gas price. For consumption band G1 (annual gas consumption below 120 MWh), the energy component accounts for 55% of the gas price and the distribution component for 41%.

Figure 19: International comparison of gas prices



It appears that the prices charged in Wallonia are competitive and often at the lower end of the price scale.

As the study carried out by PWC in relation to larger consumers recently confirmed, gas commodity prices are similar from one country to another. Although the costs associated with transmission, distribution and taxes make up only a small share of final bills, they are key elements in international comparisons. The study also highlighted the fact that the vast majority of prices charged in Wallonia are lower than those in neighbouring countries.

Dimension research, innovation and competitiveness

i. Current situation of the low-carbon-technologies sector and, to the extent possible, its position on the global market

Wallonia has not yet adopted any legislation specifying research objectives in the energy sector. The available budgets and calls for projects are updated on a regular basis in order to guarantee free competition between the different research goals.

However, the following calls for projects form an exception to this rule:

- ERABLE (2011), which related to energy generation methods and energy efficiency;
- RELIABLE (2012), which related to smart grids;
- ENERGINSERE (2013), which related to energy storage;
- calls for projects in 2015 and 2016 aimed at funding research projects in connection with the International Energy Agency (IEA) and supporting regional energy projects.

These calls for projects had a total budget of EUR 26.5 million and were mainly prompted by European initiatives to boost research activity in the field of technology.

More specifically, research in Wallonia is supported through the Decree of 3 July 2008 on support for research, development and innovation in Wallonia and its implementing decrees. This legislation serves as a general framework for supporting research and outlines the arrangements for valuing research projects at regional level, which is vital for obtaining research grants). All support is researched through the mechanisms identified in the decree. A total annual budget of around EUR 340 million (2016) is earmarked within the Walloon Region's budget for the various types of support (subsidy, co-financing or repayable advances).

Coordination with European research programmes is firstly ensured by the Department for Research Programmes within the Walloon Public Service for Research, whose Directorate for Federal and International Programmes manages the programmes that are co-financed by the EU (ERA-NET, ERA-NET+, etc.). Secondly, 'Horizon 2020' calls for projects are promoted by the National Contact Point (NCP) for Wallonia, whose tasks are carried out under contract by the employers' organisation, the Union wallonne des Entreprises (Walloon Union of Companies).

The annual budget earmarked for European co-financing programmes is around EUR 7 million for all research areas combined. In terms of energy, the ERA-NET 'Smart Grids', 'Solar' and 'Smart Cities' programmes and the 'NEWA', 'SOLAR-ERA.NET Cofund 2' and 'REGSys' programmes have been supported by the Walloon Region.

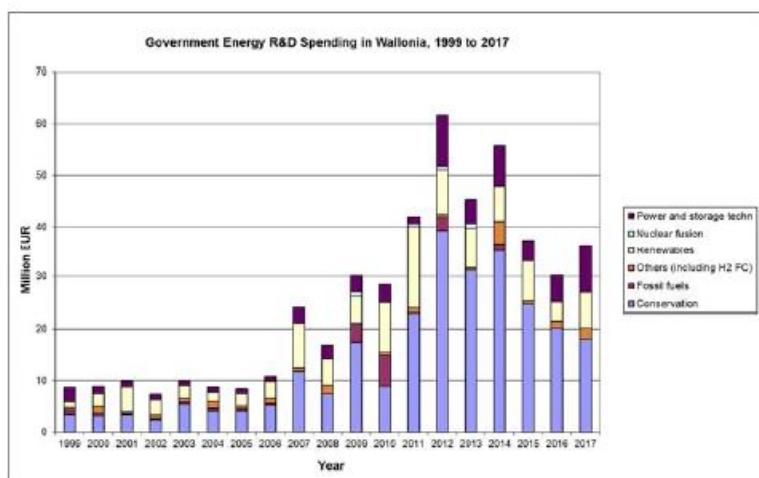
Wallonia has also taken part in the 'Urban Europe' call for projects and the 'Fuel Cells and Hydrogen' Joint Technology Initiative.

Likewise, MecaTech (2006) and GreenWin (2010) Clusters have been established under the Marshall Plan with the aim of assisting technological development stakeholders and supporting research and innovation projects in the fields of mechanical engineering and green chemistry.

TWEED (Technology of Wallonia for Energy, Environment and Sustainable Development), Cap Construction and Eco-Construction clusters promote innovation and economic development among the relevant stakeholders.

ii. Current level of public and private research and innovation spending on low-carbon-technologies, current number of patents, and current number of researchers (⁴⁸)

Figure 20 - Wallonia's public research and development spending in the field of energy by type (1999-2017)



Public spending, which was less than EUR 10 million between 1999 and 2006, rose to almost EUR 60 million in 2012 and has now stabilised at between EUR 35 million and EUR 40 million.

⁴⁸ Trends in public research, innovation and competitiveness spending (source: data collected for the IEA's Energy RD&D Budget/Expenditure Statistics).

The majority is aimed at energy efficiency, which has accounted for around two thirds of the total since 2012. This involves the energy efficiency of all sectors (industry, residential, transport, other).

Around 250 FTE researchers are working in universities, colleges and research institutions. The research budget of private operators is difficult to assess, but could be around EUR 200 million per year.

Existing policies and measures are based on the Decree of 3 July 2008 on support for research, development and innovation in Wallonia, under which themed calls for projects, aid 'information points' and bottom-up funding of research presented by businesses are organised. This allows the Walloon research, innovation and competitiveness budget to be maintained at around EUR 43 million per year (2012-2017 average).

iii. Description of energy subsidies, including for fossil fuels

Calculating subsidies for fossil fuels is the subject of much debate and many different methods. There are two types of subsidy in Belgium:

- direct funding of fossil fuels;
- tax rebates.

Fossil fuel subsidies are relatively limited at regional level. Aid for residential gas condensing boilers has recently been abolished.

An exhaustive survey has also been carried out as part of the reporting under the relevant directives (RES, EE and grid).

2. IMPACT ASSESSMENT OF PLANNED POLICIES AND MEASURES

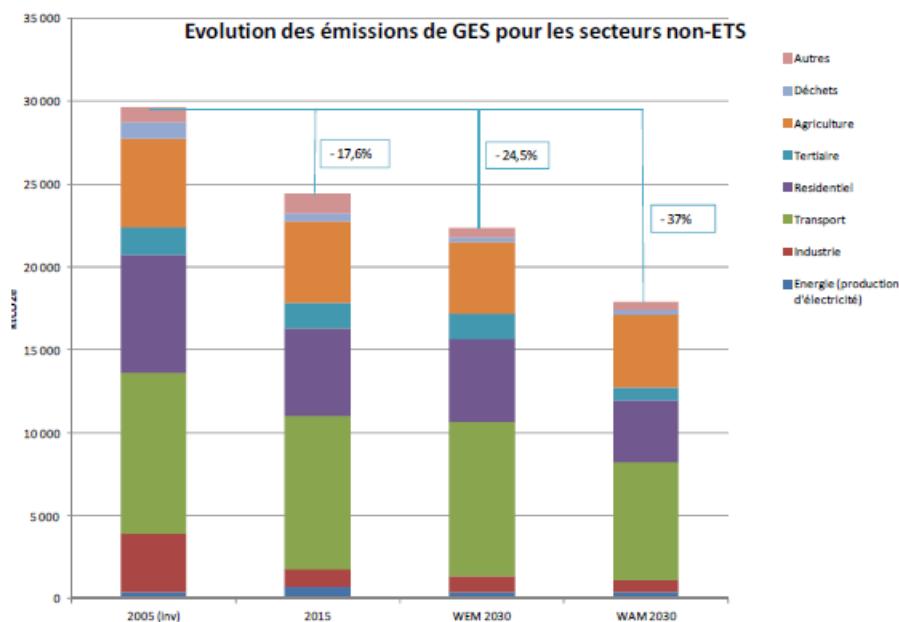
Impacts of planned policies and measures described in section 3 on energy system and GHG emissions, including comparison to projections with existing policies and measures (as described in section 4)

i. Projections of the development of the energy system and GHG and air pollutant emissions under the planned policies and measures

The WAM (49) scenario in Wallonia takes into account the impact of the measures described in Chapter 3 of this document.

A. Greenhouse gas emissions

Figure 21 - Trends in non-ETS GHG emissions



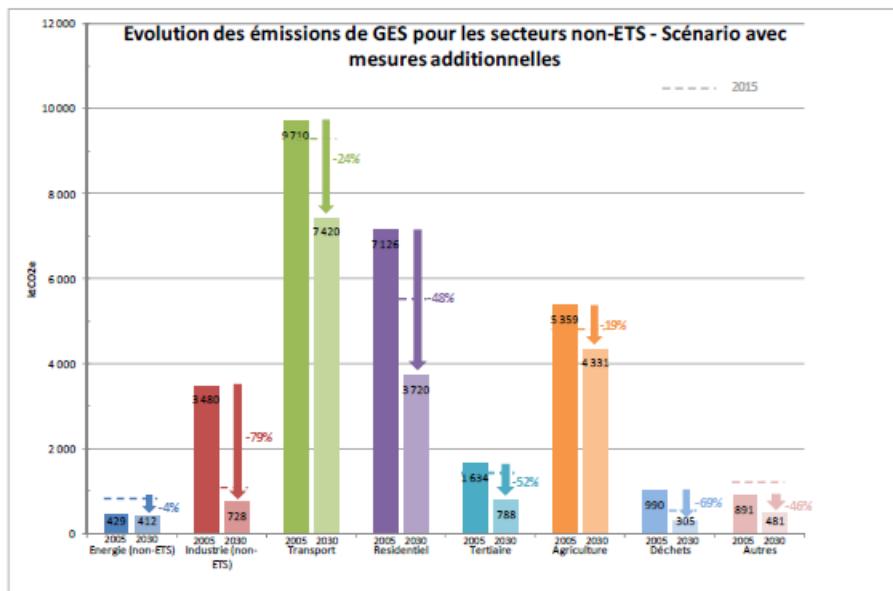
Evolution des émissions de GES pour les secteurs non-ETS	Trends in GHG emissions in non-ETS sectors
Autres	Other
Déchets	Waste
Agriculture	Agriculture
Tertiaire	Tertiary
Residentiel	Residential
Transport	Transport
Industrie	Industry
Energie (production d'électricité)	Energy (electricity generation)
ktCO2e	kt CO ₂ eq
2005 (inv)	2005 (inventory)

According to the projections, the reduction in GHG emissions in non-ETS sectors is estimated at -37% compared with 2005. The baseline scenario predicts a reduction of 24.5% compared with 2005.

Compared with 2005, emissions fall by 79% in the non-ETS industrial sector (2,700 kt CO₂, bearing in mind that most of this reduction occurred between 2005 and 2015), by 48% in the residential sector (3,406 kt CO₂), by 52% in the tertiary sector (846 kt CO₂) and by 24.6% in the transport sector (2,289 kt CO₂). The agriculture sector reduces its emissions by 1,000 kt CO₂, i.e. 19% compared with 2005.

⁴⁹ With Additional Measures.

Figure 22 - Sectoral trends in non-ETS GHG emissions (WAM)

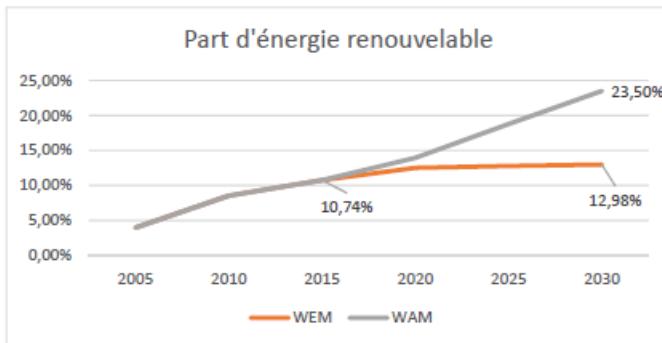


Evolution des émissions de GES pour les secteurs non-ETS - Scénario avec mesures additionnelles	Trends in GHG emissions in non-ETS sectors - Scenario with additional measures
Energie (non-ETS)	Energy (non-ETS)
Industrie (non-ETS)	Industry (non-ETS)
Transport	Transport
Residentiel	Residential
Tertiaire	Tertiary
Agriculture	Agriculture
Déchets	Waste
Autres	Other
ktCO2e	kt CO ₂ eq

B. Renewables

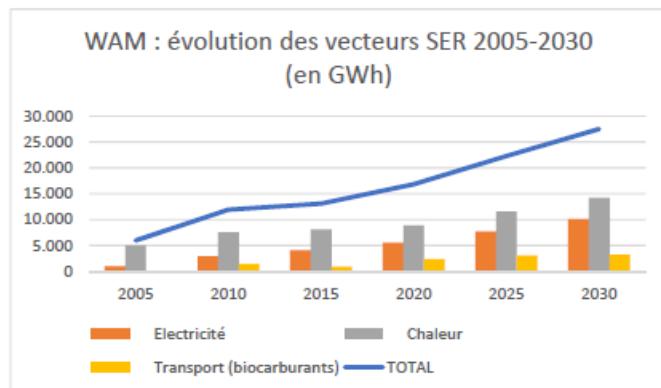
By implementing new measures aimed at developing renewables, Wallonia plans to produce around 27.5 TWh of renewable energy, i.e. 23.5% of estimated gross final consumption in 2030.

Figure 23 - Trends in the share of renewables in Wallonia



Part d'énergie renouvelable	Share of renewables
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Figure 24 - Trends in renewable energy sources 2005-2030 - Wallonia



WAM: évolution des vecteurs SER 2005-2030 (en GWh)	WAM: Trends in renewable energy sources 2005-2030 (in GWh)
Electricité	Electricity
Chaleur	Heat
Transport (biocarburants)	Transport (biofuels)
TOTAL	TOTAL

Table 17 – Renewable energy indicators in Wallonia

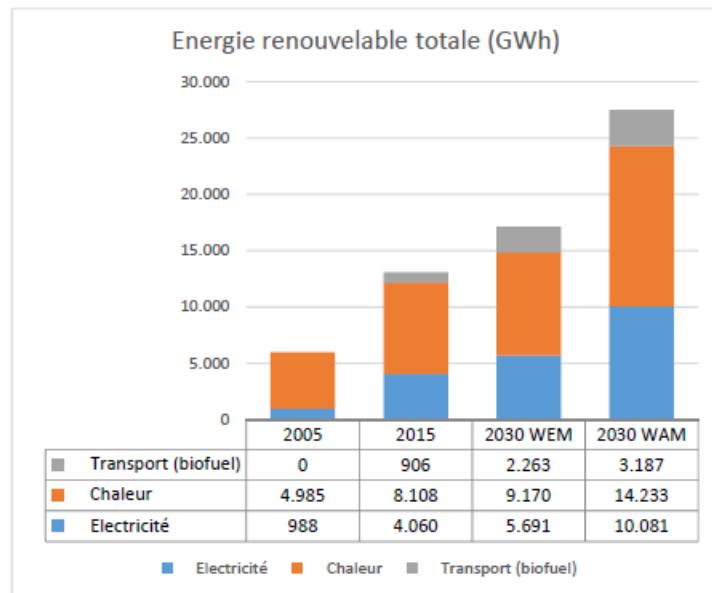
GWh	Achieved 2015	Achieved 2016	Target 2020	Target 2030 WEM (⁵⁰)	Target 2030 WAM (⁵¹)
Electricity	4,060	4,463	5,555	5,691	10,081
Heat	8,108	8,706	8,900	9,170	14,233
Transport*	906	1,596	2,382	2,263	3,187
Final renewable consumption	13,073	14,765	16,837	17,124	27,501
Gross final consumption	121,700	124,194	120,770	131,955	117,032
Share of RES in final consumption	10.74%	11.89%	13.94%	12.98%	23.50%

* biofuels and biogas only (RES electricity in transport included in 'electricity').

⁵⁰ WEM: With Existing Measures.

⁵¹ WAM: With Additional Measures.

Figure 25 - Trends in renewables in Wallonia

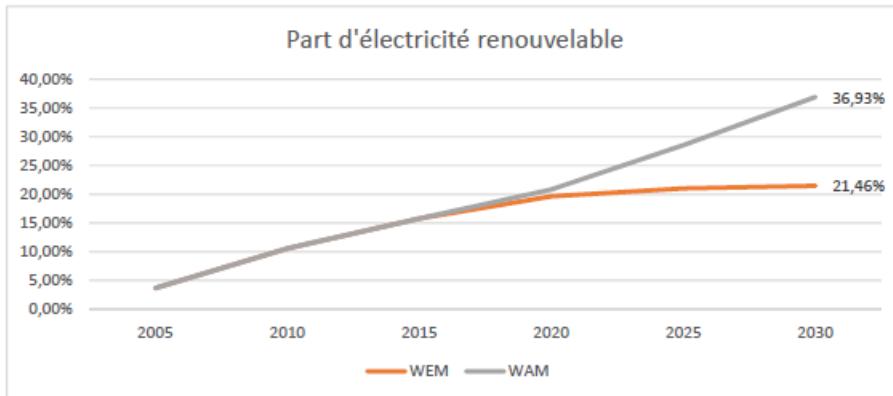


Energie renouvelable totale (GWh)	Total renewables (GWh)
Transport (biofuel)	Transport (biofuels)
Chaleur	Heat
Electricité	Electricity
TOTAL	TOTAL

Renewable electricity

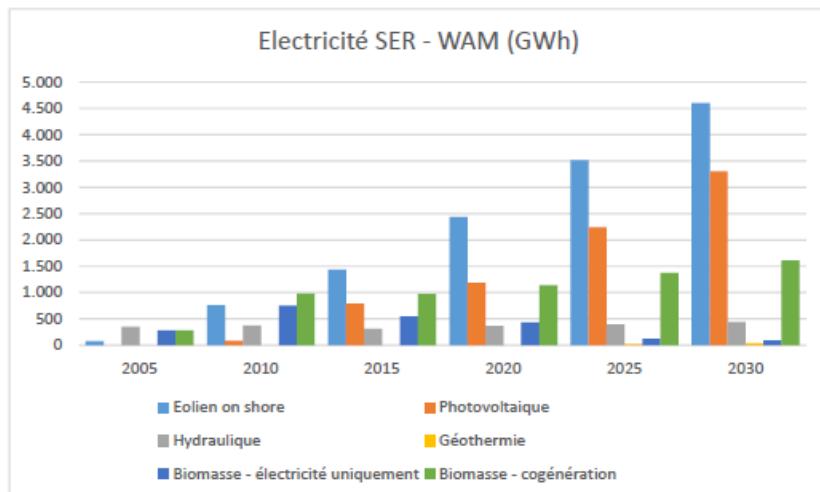
The share of renewable electricity in the gross final consumption of electricity is 37%.

Figure 26 - % of renewable electricity in the final consumption of electricity



Part d'électricité renouvelable	Share of renewable electricity
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Figure 27 - Trends in the generation of renewable electricity by technology



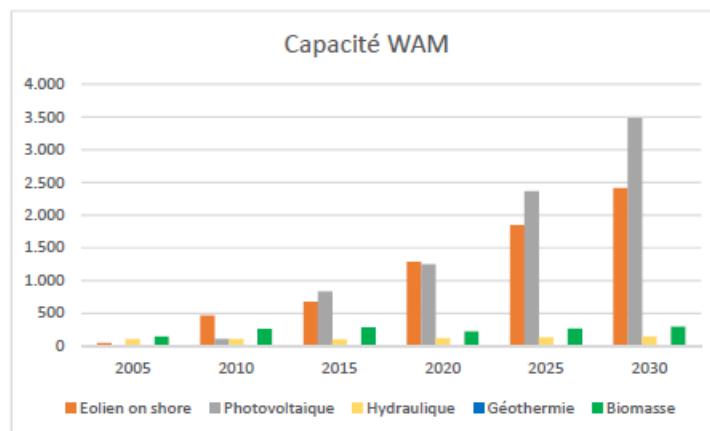
Electricité SER - WAM (GWh)	Renewable electricity – WAM (GWh)
Eolien on shore	Onshore wind
Photovoltaïque	Photovoltaics
Hydraulique	Hydroelectric
Géothermie	Geothermal energy
Biomasse - électricité uniquement	Biomass – electricity only
Biomasse - cogénération	Biomass – cogeneration

The subsectors contributing the most are onshore wind and photovoltaics, at 46% (4,600 GWh) and 33% (3,300 GWh) respectively of the total GWh generated. Hydroelectric remains stable at 4% of the electricity generated, with cogenerated biomass accounting for 16%.

The installed capacity in each subsector will need to be increased in order to achieve the targets set.

In particular, 1,136 MW will need to be installed between 2020 and 2030 in terms of wind energy and 2,228 MW for photovoltaics.

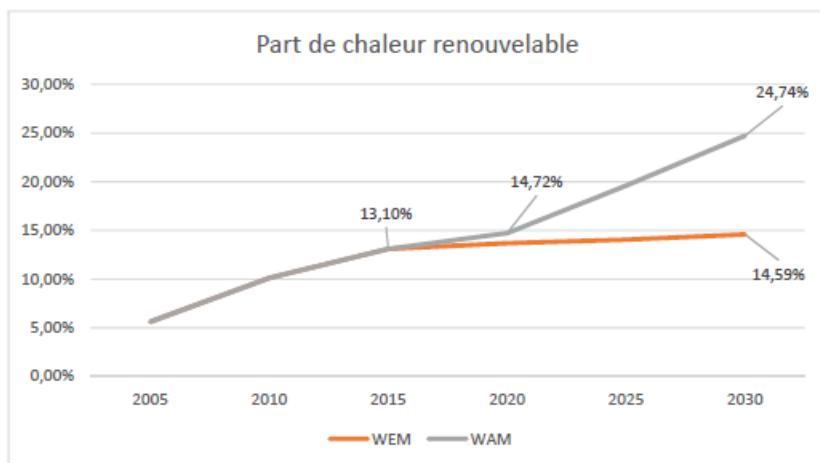
Figure 28 - Estimated renewable electricity generation capacity in the WAM scenario (MW)



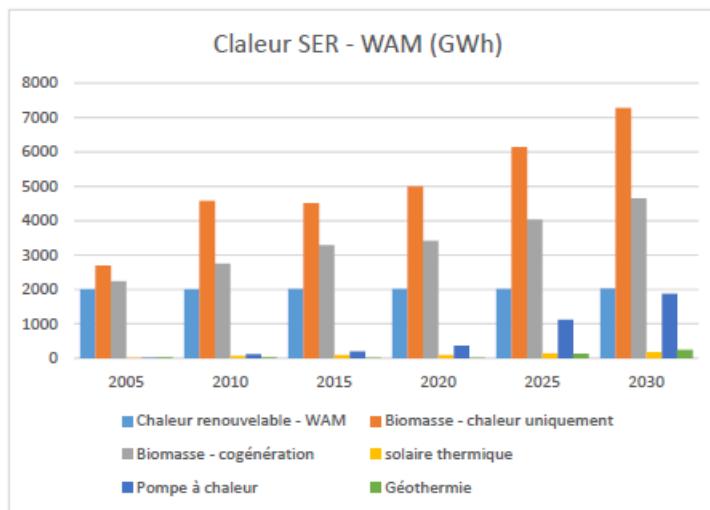
Capacité WAM	WAM capacity
Eolien on shore	Onshore wind
Photovoltaïque	Photovoltaics
Hydraulique	Hydroelectric
Géothermie	Geothermal energy

Renewable heat

The share of renewable heat in final heat consumption is 24.74%.

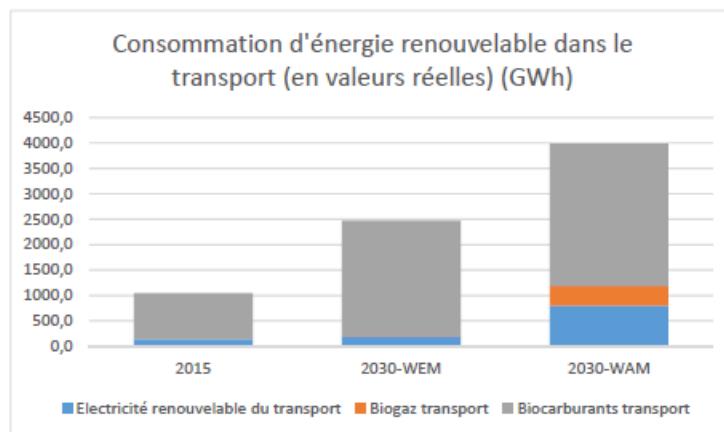
Figure 29 - % of renewable heat in heat consumption

Biomass (all subsectors combined) accounts for 83% of renewable heat production in 2030. An increase in the popularity of heat pumps is also evident, which account for 13% of heat production in 2030 (compared with 4% in 2020).

Figure 30 - Trends in renewable heat production by technology

Renewable transport

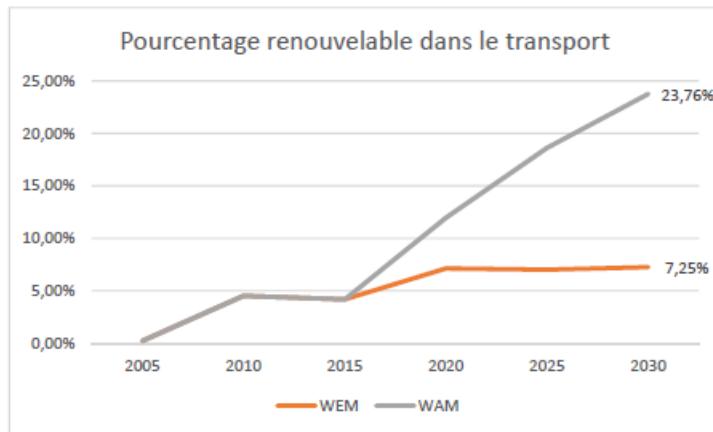
Figure 31 - Consumption of renewable energy in transport (actual values – GWh)



Consommation d'énergie renouvelable dans le transport (en valeurs réelles) (GWh)	Consumption of renewable energy in transport (in actual values) (GWh)
Electricité renouvelable du transport	Renewable electricity in transport
Biogaz transport	Biogas in transport
Biocarburants transport	Biofuels in transport

The share of renewables in transport, within the meaning of the Renewable Energy Directive (52), including the share of renewable electricity, biofuel and biogas, is estimated at 24% in 2030.

Figure 32 - Percentage of renewables in transport (Renewable Energy Directive calculation method)



Pourcentage renouvelable dans le transport	Percentage of renewables in transport
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C. Energy efficiency

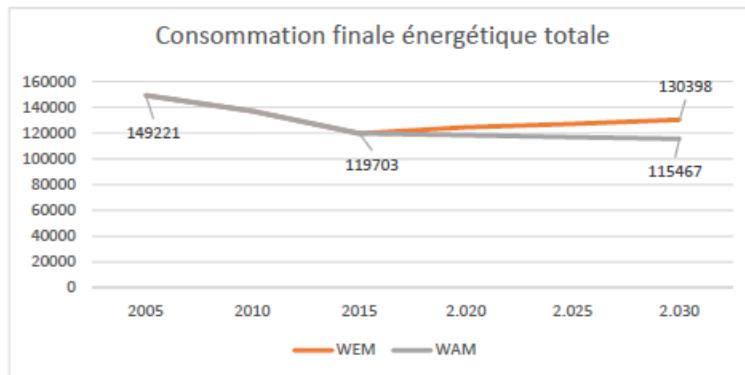
1. Final consumption

Final consumption in 2030 in the WAM scenario is estimated at 115 TWh, compared with 130 TWh in the WEM scenario. The reduction in final consumption compared with 2005 is estimated at 22%. The sectors contributing

⁵² By applying the adjustment factors for electricity and biofuels.

the most are the residential sector (-30% compared with 2005) and the industrial sector (-35% compared with 2005 for the entire industrial sector (ETS and non-ETS)).

Figure 33 - Trends in final consumption - Wallonia

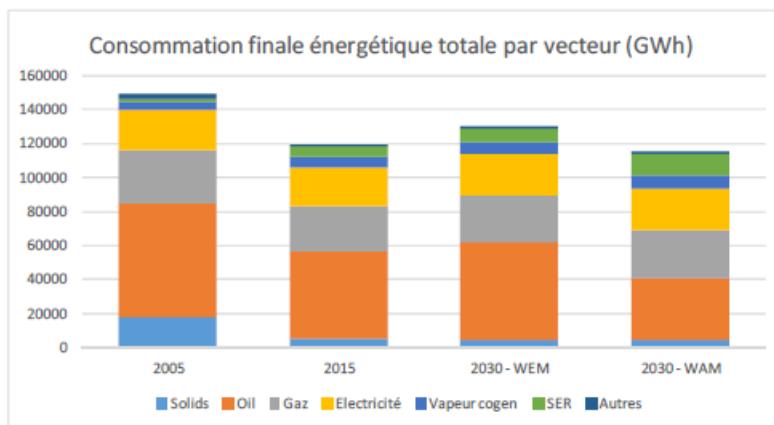


Consommation finale énergétique totale Total final energy consumption

The reduction in final consumption between 2020 and 2030 is estimated at 2%, taking into account demographic changes and economic growth.

The share of oil products reduces by 46% between 2005 and 2030, while the share of renewables increases by a factor of 10.

Figure 34 - Final consumption by energy carrier



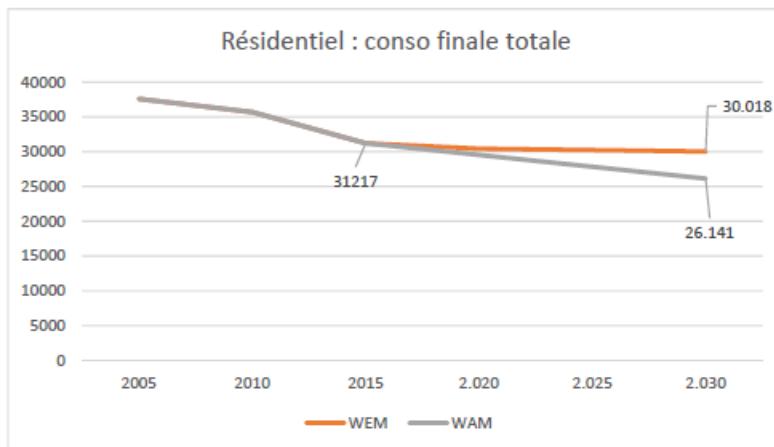
Consommation finale énergétique totale par vecteur (GWh)	Total final energy consumption by energy carrier (GWh)
Solids	Solid fuels
Oil	Oil
Gaz	Gas
Electricité	Electricity
Vapeur cogen	Steam cogeneration
SER	RES
Autres	Other

Residential

Final consumption in the residential sector falls by 11% between 2020 and 2030, mainly due to renovation strategy measures. Compared with 2005, the reduction in consumption is 30%, chiefly due to measures already taken in this sector.

Compared with a scenario without additional measures (WEM), the reduction is 13%.

Figure 35 - Final consumption in the residential sector

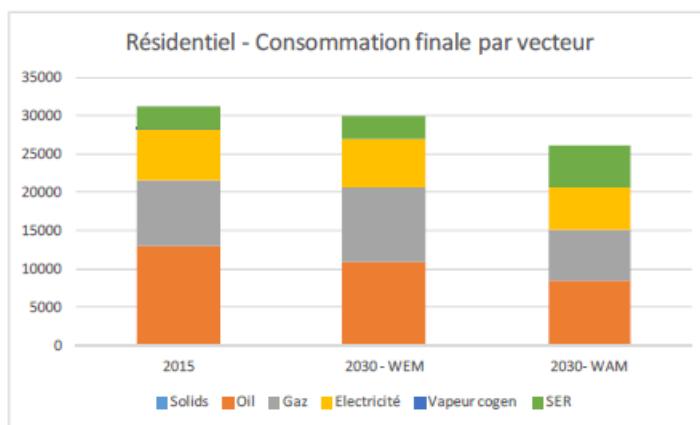


Résidentiel: conso finale totale

Residential sector: total final consumption

An 85% increase in the share of renewables is observed in this sector between 2015 and 2030, while the share of all other energy carriers falls (-35% for oil products and -23% for gas in particular).

Figure 36 - Final consumption in the residential sector by energy carrier



Résidentiel - Consommation finale par vecteur

Residential sector – Final consumption by energy carrier

Solids

Solid fuels

Oil

Oil

Gaz

Gas

Electricité

Electricity

Vapeur cogen

Steam cogeneration

SER

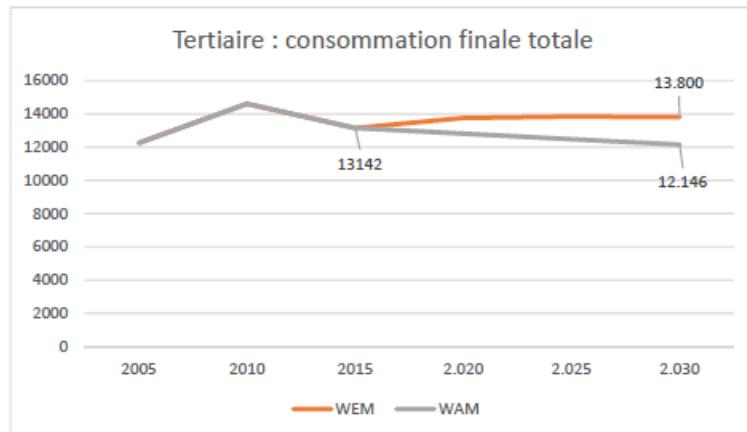
RES

Tertiary

The reduction in consumption in the tertiary sector between 2020 and 2030 is estimated at 5%. The measures implemented in this sector, particularly through the renovation strategy, will have a greater impact in the 2030-2040 period. Between 2020 and 2040, the reduction in consumption in this sector is estimated at 11.6%.

Compared with the baseline scenario, the estimated reduction is 12%.

Figure 37 - Final consumption in the tertiary sector



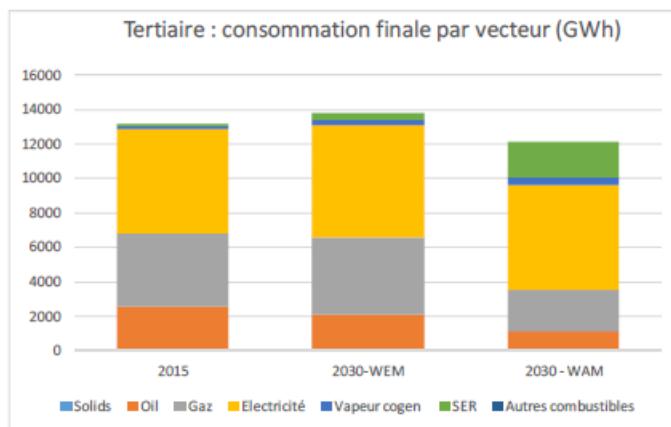
Tertiaire: consommation finale totale

Tertiary sector: total final consumption

In 2030, the share of renewables in the tertiary sector is 18 times higher than in 2015. The share of cogenerated steam increases by 140%.

Other energy carriers are reduced (-56% for oil products and -43% for gas).

Figure 38 - Final consumption in the tertiary sector by energy carrier



Tertiaire: consommation finale par vecteur (GWh)

Tertiary sector: final consumption by energy carrier (GWh)

Solids	Solid fuels
Oil	Oil
Gaz	Gas
Electricité	Electricity
Vapeur cogen	Steam cogeneration
SER	RES
Autres combustibles	Other fuels

Transport

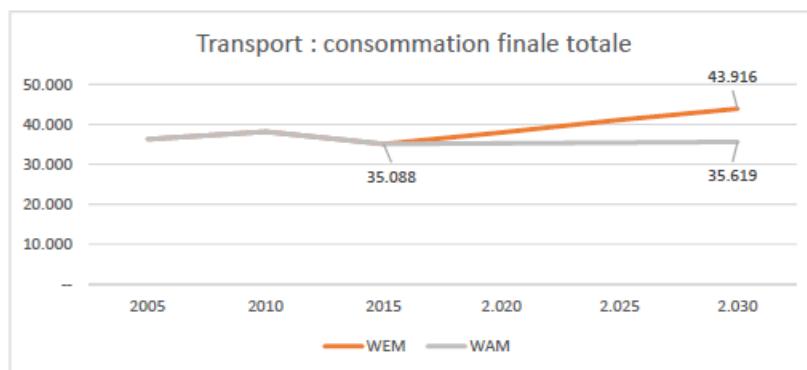
Final consumption in the transport sector increases by 1% between 2020 and 2030.

Compared with the baseline scenario, it reduces by 19%.

Overall, final consumption in the road sector falls by 1% between 2020 and 2030. Final energy consumption in the other sectors increases by 5% for aviation, 10% for rail and 105% for inland navigation.

Between 2005 and 2030, the overall reduction of 2% (or 687 GWh) breaks down into a 12% reduction in consumption in the road sector and a 17% reduction in the rail sector, with a 152% increase in the aviation sector and a 56% increase in the inland navigation sector.

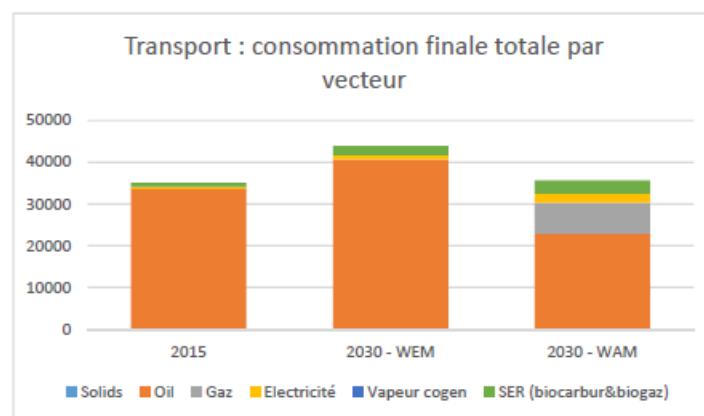
Figure 39 - Final consumption in the transport sector



Transport: consommation finale totale	Transport: total final consumption
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Between 2015 and 2030, the final consumption of oil products falls by 32%, whilst the share of gas and electricity and the share of biofuels both increase.

Figure 40 - Final consumption in the transport sector by energy carrier



Transport: consommation finale totale par vecteur	Transport sector: total final consumption by energy carrier
Solids	Solid fuels
Oil	Oil
Gaz	Gas
Electricité	Electricity
Vapeur cogen	Steam cogeneration
SER (biocarbur&biogaz)	RES (biofuels & biogas)

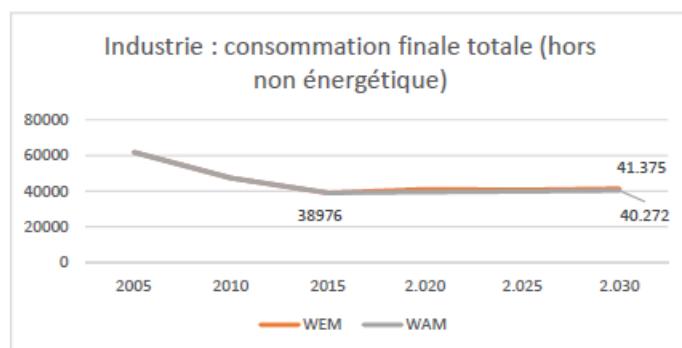
Industry

Between 2005 and 2030, final consumption in the industrial sector is estimated to fall by 35%. There was a marked drop in consumption between 2005 and 2015, due in particular (but not exclusively) to the closure of several energy-intensive industrial operations in Wallonia; the upturn in this sector therefore has the effect of increasing final energy consumption (estimated at +1% between 2015 and 2020).

Taking economic growth into account, final consumption in the industrial sector increases by 2% between 2020 and 2030 across all sectors (ETS and non-ETS).

With additional measures, consumption is estimated to fall by 3% compared with the baseline scenario.

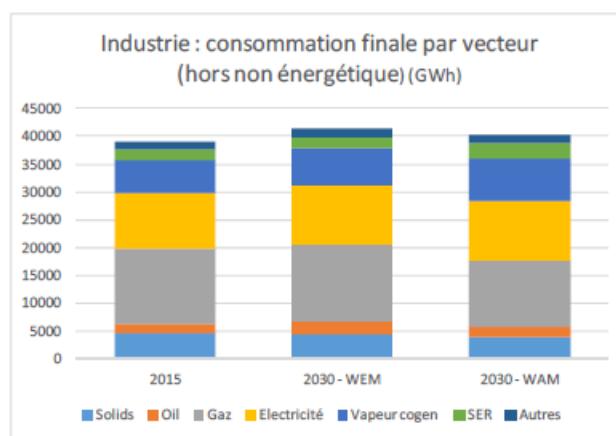
Figure 41 - Final consumption in the industrial sector



Industrie: consommation finale totale (hors non énergétique)	Industrial sector: total final consumption (excluding non-energy consumption)
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Between 2015 and 2030, the final consumption of renewables, cogenerated steam and electricity increases by 57%, 27% and 6% respectively. The share of gas drops by 12%, and the share of solid fuels by 17%. Consumption of oil products, however, increases by 30%.

Figure 42 - Final consumption in the industrial sector by energy carrier



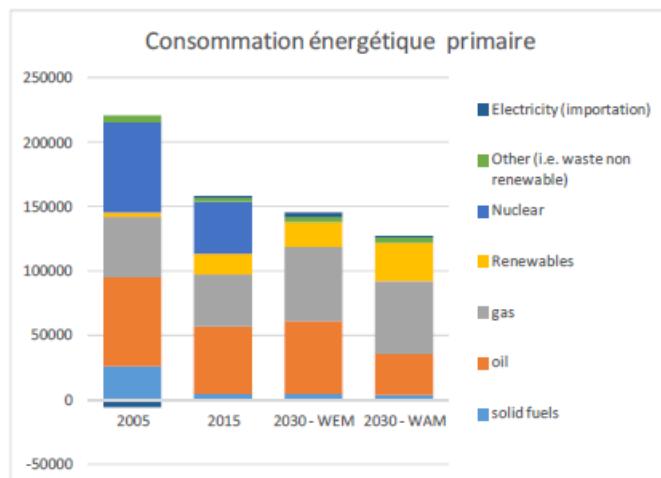
Industrie: consommation finale par vecteur (hors non énergétique) (GWh)	Industrial sector: final consumption by energy carrier (excluding non-energy consumption) (GWh)
Solids	Solid fuels
Oil	Oil
Gaz	Gas
Electricité	Electricity

Vapeur cogen	Steam cogeneration
SER	RES
Autres	Other

2. Primary consumption

Primary consumption depends on estimated electricity generating capacity. The figures here assume that the nuclear phase-out will be completed in line with the current schedule, and that Wallonia's imports will be limited.

Figure 43 - Wallonia's primary energy consumption (GWh)



Consommation énergétique primaire	Primary energy consumption
-----------------------------------	----------------------------

Primary energy consumption reduces by 36% compared with 2005 and by 15% compared with 2015. Primary consumption of oil products falls sharply. This reduction is offset by an increase in primary consumption of gas and renewables. Imports of electricity in the WAM scenario are assumed to remain relatively limited (1,600 GWh).

Macroeconomic and, to the extent feasible, the health, environmental, employment and education, skills and social impacts, including just transition aspects of the planned policies and measures

When preparing this plan, Wallonia did not have access to any appropriate tools for assessing in detail the socioeconomic impacts of its various measures.

The following analysis is therefore mainly based on a review of Belgian and European literature. Those studies do not therefore precisely model the assumptions made in the Walloon plan, but are generally aimed at achieving the European objectives.

A. Impacts on economic growth

A Belgium-wide study⁽⁵³⁾ suggests that emission reduction measures do not substantially affect economic growth and may even lead to a slight increase in GDP if appropriate policies are adopted.

⁵³ CLIMACT (2016), 'Macroeconomic impacts of the low carbon transition in Belgium'. This study was carried out by CLIMACT, in collaboration with Professor Th. Bréchet, the Federal Planning Bureau and Oxford Economics, at the request of the Climate Change Service of the Federal Public Service for Public Health, Food Safety and Environment.

It aimed to study the macroeconomic impacts of a low-carbon transition to 2050, with particular emphasis on growth, competitiveness, employment and co-benefits.

According to the Federal Planning Bureau, the macroeconomic impacts particularly depend on how any public revenue from the auctioning of ETS allowances is used and whether a carbon tax is introduced for non-ETS sectors⁽⁵⁴⁾. When combined with recycling of carbon revenues, the measures may lead to a slight increase in GDP. For example, such revenues can be reinvested in developing technology associated with the energy transition or in infrastructure, particularly to encourage use of public transport.

At sectoral level, the impact of climate measures on value added is estimated to be relatively limited and slightly different depending on the sector (Federal Planning Bureau Note). The energy production sector is the worst affected. For all other sectors, where carbon revenues are recycled, the estimated impacts are negligible or positive, with the construction sector seeing the most benefits.

Climate change measures should also enable a series of costs to be avoided, such as those connected with air pollution and its effects on health, traffic congestion and road traffic accidents⁽⁵⁵⁾.

Lastly, productivity (for example in offices and schools) may be positively affected by building-related measures such as improving insulation, ventilation and interior lighting⁽⁵⁶⁾.

B. Impacts on the energy system

The energy system cost is an indicator used to calculate the costs of investing in installations and equipment producing or consuming energy and also the costs of purchasing energy. Climate measures can be expected to slightly increase this cost compared with a business-as-usual scenario, due to the estimated increase in investment costs that will not be offset by the estimated reduction in energy purchase costs.

C. Impacts on business competitiveness

The impact of climate measures on business competitiveness is difficult to estimate because it depends on the international context (particularly energy and technology prices in other countries, etc.) and on the specific characteristics of the regional economic fabric. When drawing up its climate policies, Wallonia pays close attention to the potential impact on competitiveness, particularly as a result of possible increases in the energy cost. An environmental Life Cycle Assessment of products, combined with a social LCA, would allow a label prompting European products to be developed, while avoiding social dumping.

The electricity price in Belgium is expected to increase slightly compared with a business-as-usual scenario (CLIMACT). The estimated price increase is higher for solid and liquid fuels than for natural gas and electricity. However, the energy price increase is estimated to have a moderate effect on production prices due to the improved energy efficiency promoted by the plan.

D. Impacts on employment, education and skills

A Eurofound study⁽⁵⁷⁾ indicates that Belgium is the European country where climate measures have the greatest impact on employment. Based on the study's assumptions, there is a positive net effect overall, with differences between the sectors.

⁵⁴ Federal Planning Bureau (2014), Note on the 'Macroeconomic impacts of the "2030 climate and energy framework" in Belgium: preliminary analysis' and

https://www.plan.be/admin/uploaded/201504270958240.WP_1503_10941.pdf

⁵⁵ IPCC (2007), 'Fourth Assessment Report', Chap. 5.7; OECD (2015), 'The Economic Consequences of Climate Change'; OECD (2014), 'The Cost of Air Pollution, Health Impacts of Road Transport'.

⁵⁶ Seppänen O. (2006), 'Ventilation and performance in office work'; <https://www.renovermonecole.be/fr/objectifs-bien-etre>

⁵⁷ Eurofound (2019), 'Energy scenario: Employment implications of the Paris Climate Agreement', Publications Office of the European Union, Luxembourg. This study assesses the sectoral impacts on employment of a low-carbon transition, with particular emphasis on the construction sector.

However, a CLIMACT study suggests that the overall impact in the energy sector is negative, due to a general reduction in energy demand. This takes account of repercussions on the fossil fuel production and refining industries, and on the electricity generation and distribution sector. Investments in renewable energy production and energy infrastructure are often made in labour-intensive sectors. Overall, climate measures should therefore have a positive net effect on employment. An increase in the number of jobs is expected in the manufacturing sector directly connected with or forming part of the renewable energy or energy efficiency supply chain, particularly in the tertiary sector associated with these supply chains.

The largest number of new direct jobs is expected in the construction sector, with the impact on workers in this sector meriting particular attention. Transport is expected 'to be affected asymmetrically: the reduced demand for the maintenance of private vehicles should be offset by positive effects connected with the roll-out of public transport services, for example' (CLIMACT).

An inventory of those sectors in which technology will need to evolve must be produced. Several issues will also need to be closely examined to ensure a just transition. There may be several reasons for misalignment⁵⁸ (+Eurofound).

- *Timing reasons*: jobs may not be lost and created at the same time. A faster transition will in all likelihood lead to more friction, with workers being left jobless and certain requirements for new skills not being met.
- *Spatial reasons*: jobs may be lost and created in different areas that are far apart.
- *Sectoral reasons*: jobs may be lost and created in different sectors.
- *Educational reasons*: jobs that are lost and created may be associated with different skills.

Support in terms of adapting existing jobs, providing training in new skills, and anticipating training needs in high-growth sectors such as the ecological transition sector and in sectors with high social value (energy, mobility, communication, circular economy, etc.) will therefore be needed.

E. Impacts on households

Although energy prices are expected to rise, a range of measures in the plan should reduce household gas and electricity bills, in particular building insulation, changes in energy carrier, self-consumption and behavioural change. Close attention will be paid to protecting the most vulnerable in energy poverty terms, by extending or increasing aid, carrying out awareness raising, monitoring consumption and offering support. This attention must be extendable to the lower middle classes. All energy policies will be closely examined in terms of their impact on the public. Energy is an essential resource and a fundamental right, to which access must be guaranteed for all.

As with electricity and gas, fossil fuel prices are also expected to rise (CLIMACT). The impact on households is difficult to estimate as it will depend not only on how much prices rise, but also on how individuals change their behaviour in response to the roll-out and attractiveness of alternatives to private cars, on how the alternative-fuel vehicle market develops and on how the price of such fuels changes. Measures to raise awareness of soft mobility and encourage remote working are already being implemented in Wallonia. The measures in the FAST Vision aim to encourage a modal shift, including in rural environments and suburban areas. They also cover increasing the supply of shared transport and the attractiveness of co-modality, as well as providing information and support to the public on sustainable mobility.

F. Impacts on inequalities

Individuals within society can be impacted differently by the same measure. To ensure a just and fair transition, the Walloon Government will implement the necessary measures after analysing their implications for the

⁵⁸ IRENA (2019), 'Broadening the Policy Framework to Ensure a Just and Inclusive Transition', 5th IRENA Policy Day.

energy and climate transition. Those measures will also be based on recommendations made by the Walloon Public Service and on consultations with the public and stakeholders. They will cover all the skills and sectors affected by climate policy.

In particular, there are numerous factors that can have an impact on workers or that can increase inequalities within society, such as:

- developments in the labour market, which can be confronted by a series of misalignments (noted in Section D. Impacts on employment, education and skills) affecting unemployment and hindering retraining;
- poverty, which must not be exacerbated by climate measures that must also not be more beneficial for those on high incomes (e.g. granting of incentives for the purchase of an electric vehicle);
- geographical inequalities between urban and rural environments, for example in terms of access to mobility services, resources and energy infrastructures;
- the gender issue, particularly in connection with:
 - employment, as climate change measures could reduce the number of women in employment;
 - the risk of poverty, which is slightly higher for women than for men and which is significantly higher for single-parent families, which mostly have a woman at their head;
 - representation in energy and climate processes, with women currently being under-represented even though they are generally more concerned about the climate;
 - communication actions, as men and women generally have different perceptions of sustainability, which can affect the chances of such actions being effective ⁽⁵⁹⁾;
 - North/South relations, for example in connection with the origin of biofuels: due to their frequently weaker position in various countries in the South, women are more vulnerable to the seizure of their land, which, when combined with the arrival of large multinationals, is often accompanied by threats and violence against the local population, with sexual violence and abuse of women and girls also increasing in such cases;
- social and environmental inequalities abroad as a result of actions taken on the ground (social dumping, exposure to pollution, etc.).

That is why the Walloon Government is committed to combating any form of discrimination. It will particularly include the gender dimension in mobility and town and country planning policies from the first analysis of projects to their final evaluation.

G. Impacts on health and well-being

Impacts on health

The climate measures should have both positive and negative effects on public health.

Climate change increases the risk of events such as flooding, heatwaves, droughts and fires. It is the people who are socially, economically or otherwise marginalised who are the most vulnerable to the consequences of such events. These may be, for example, pensioners who are left on their own or workers who spend most of their time outside during a heatwave (Eurofound). People on low incomes will also be particularly affected if crop yields fall.

Most of the climate measures are aimed at improving air quality (further detail is provided in the next section), which will impact on health. The Environmental Impact Report for the Walloon Air, Climate and Energy Plan 2030 (*Rapport sur les incidences environnementales du Plan Air Climat Energie à l'horizon 2030 de la Wallonie – 'RIE'*) indicates that pollutants present in the air, such as O₃, SO₂, NO₂, NH₃ and fine particulate matter, all have negative effects on the respiratory system and can also cause cardiovascular problems. Fine particulate matter

⁵⁹ The Institut pour l'égalité des femmes et des hommes (Institute for the Equality of Women and Men) has produced a manual and a checklist for this purpose, in collaboration with the Réseau des Communicateurs fédéraux (Federal Communicators Network).

is particularly harmful to health as it increases the number of premature deaths and is regarded at European level as being the issue with the greatest impact on public health. Fine and ultrafine particles, which can get into the pulmonary alveoli, are among the most dangerous: there is no evidence of a minimum threshold below which their effects on health can be ignored (⁶⁰). They mainly stem from the production of domestic heat (heating and water) in solid fuel installations (coal, wood).

Although improved building insulation reduces energy consumption, its impact on health depends on the quality of ventilation. Temperature variations are conducive to the development of respiratory and circulatory diseases. Building insulation can therefore reduce the number of hospitalisations for such diseases. However, if there is insufficient air circulation, increased airtightness can lead to the development of mould, particularly in cold and incorrectly ventilated houses, or the accumulation of indoor pollutants (released by materials for instance), with negative impacts on health (⁶¹). The EPB legislation lays down requirements in this respect. Furthermore, the Walloon Renovation Strategy should be accompanied by awareness-raising measures so that the public adopt best practices.

In the transport sector, the RIE notes that promoting soft mobility can have beneficial effects on physical condition (walking, cycling, scooters, etc.), thereby generally improving the health of anyone using this approach.

In terms of road safety, the modal shift and expected reduction in mobility needs should reduce the number of cars on the roads, which should generally limit the number of road traffic accidents. However, the RIE notes that, where cycling is not common, there is an increased risk of accidents involving cyclists. Within Europe, Wallonia has a high cyclist mortality rate per km. Measures will therefore be needed to develop appropriate infrastructure for cyclists and to increase the awareness of motorists.

Lastly, dredging of waterways will also reduce flooding risks by increasing flow capacity.

Impacts on well-being and quality of life

The climate measures should also have effects on the public's well-being and quality of life. The FAST Vision should reduce the number of cars on the roads, thus limiting congestion. The Walloon Renovation Strategy should improve both thermal comfort (improved thermal stability through more efficient control) and acoustic comfort (reduction of noise disturbance through better performing structures). It should also aid access to healthy housing, thereby greatly improving the quality of life and comfort of the most vulnerable households, while allowing them to use the savings made on their costs for basic needs.

Some measures may result in noise pollution, such as renovation work, the development of new road, rail or airport infrastructure and the installation of wind turbines. This aspect must therefore be taken into account in the relevant projects. The installation of solar panels or wind turbines may also adversely affect the public's quality of life and must therefore also be taken into account when choosing the geographical position of such projects. Under the Walloon Renovation Strategy, a district approach may be envisaged, which would have the advantage of limiting the duration of noise pollution.

H. Environmental impacts (⁶²)

This section describes the most significant environmental impacts of the measures in this plan, which have been largely taken from the Environmental Impact Report for the Walloon Air, Climate and Energy Plan 2030 (*Rapport*

⁶⁰ https://www.euro.who.int/_data/assets/pdf_file/0004/193108/REVIHAAP-Final-technical-report-final-version.pdf, page 1.

⁶¹ Frey S.E. et al. (2015), 'The effects of an energy efficiency retrofit on indoor air quality', *Indoor air* 25:210-219.

⁶² Sustainable Development Goal No 15 covers 'the conservation, restoration and sustainable use of terrestrial ecosystems and inland freshwater ecosystems'.

The Convention on Biological Diversity sets out various biodiversity objectives.

A number of strategic goals have been established, including:

- addressing the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society;
- improving the status of biodiversity by safeguarding ecosystems, species and genetic diversity;

sur les incidences environnementales du Plan Air Climat Energie à l'horizon 2030 de la Wallonie – 'RIE') (<http://www.awac.be/images/Pierre/PACE/2030/RIE%20PACE2030.pdf>).

Impacts on air quality

The NECP implementing energy and climate policy has been drawn up in parallel and in synergy with the Air Plan, which reinforces air quality policy under Directive (EU) 2016/2284 setting national targets for the reduction of certain atmospheric pollutants by 2020 and 2030 (NEC Directive). These two plans are incorporated within the Walloon Air, Climate and Energy Plan. This synergy is justified by the fact that the energy and transport sectors are two of the main sources of GHG emissions and atmospheric pollutants. These policies for better managing energy production and use, transport and mobility will reduce emissions of the main pollutants covered by the NEC Directive by [80%-85%]. The 2030 targets of the latter can be achieved only by implementing the NECP.

Taking an integrated approach to the energy, climate and air policies also allows any conflicting or counterproductive measures to be avoided or limited.

The following table, taken from the Air, Climate and Energy Plan, sets out the projections of SO₂, NO_x, VOC, PM_{2.5} and NH₃ pollutant emissions based on the measures in this plan. Given certain assumptions, Wallonia's commitments, which are based on the binding 2030 targets compared with 2005 under the NEC Directive, can be met.

Table 18 - Summary of reduction targets and projections for 2030 in absolute terms and as a percentage reduction

Pollutants	Belgian reduction target 2030	Walloon reduction target 2030	Walloon absolute ceilings 2030 (in kt)	2030 projections for Wallonia (in kt)	Estimated reduction for 2030 compared with 2005
SO ₂	66%	65%	15.4	10.76	75.8%
NO _x	59%	60%	49.4	41.72 *	66%
VOC	35%	31%	32.1	29.88 *	37%
PM _{2.5}	39%	43%	8.8	8.3	45.4%
NH ₃	13%	14%	27.0	24.23	23%

* Under the NEC Directive, livestock manure and land management activities are not taken into account when calculating the target and its achievement.

The Environmental Impact Report indicates that the pollutant emissions generated by transport mainly come from exhaust gases (NO_x, fine particulate matter, SO_x, CO, N₂O) and tyre, brake and road surface abrasion (fine particulate matter and heavy metals). The measures aimed at reducing the use of polluting vehicles or emissions from vehicles in use will have a positive impact on air quality.

This plan also aims to significantly increase the share of biomass in future primary consumption, in all sectors combined. Concerns have been raised about the marked increase in the use of biomass as a source of renewable energy because in Wallonia, as in many other countries, the burning of wood (mainly for domestic heating) is the main source (60%) of fine particulate emissions, which are particularly harmful to health, black carbon emissions, which is a short-lived climate forcing agent and therefore contributes to global warming, and carcinogenic PAH emissions (polycyclic aromatic hydrocarbons).

- reducing the direct pressures on biodiversity and promoting sustainable use.

Greater use of biomass with a view to increasing the share of renewables in energy production therefore has a particularly negative impact.

Emissions from installations should be taken into account as a priority, particularly in the residential sector and with regard to PAHs. A general framework should be proposed in order to limit pollutant emissions. Several recommendations can be made: (i) encourage the use of biomass in industry and for collective installations, rather than for small installations; (ii) favour the use of pellets (or, alternatively, wood chip or log installations that perform better in terms of air quality) and biogas, and (iii) offer advice on using boilers in order to limit pollutant emissions. The use of biomass for energy should also be consistent with the work carried out by the Walloon Government ('Biomass-Energy' strategy), taking into account the following key issues: sustainability, conflicts between uses, integration into the bioeconomy roadmap, and consistency between energy carriers.

In terms of indoor air quality, the impact of building insulation will depend on the quality of ventilation.

By contrast, reducing methane (CH_4) emissions is particularly beneficial under both plans, as methane is a significant greenhouse gas and also a precursor to tropospheric ozone, which is an atmospheric pollutant that is harmful to health and ecosystems. The impact of reducing methane is therefore not only entirely positive, but also twofold.

Impacts on biodiversity

According to the IPBES⁽⁶³⁾, we are facing a biodiversity crisis that is unprecedented in human history. Direct exploitation, climate change, pollution and the introduction of invasive exotic species are all factors that have been cited. However, changes in land use are undoubtedly the most impactful factor in terrestrial and freshwater ecosystems.

Any construction work (whether buildings, infrastructure or renewable energy production sites) or any development work (e.g. work on waterways) can cause habitats to be lost or altered, which must therefore be prevented. Work can also disturb fauna during nesting periods or while raising young, which can require schedules to be adapted. There is also the risk of such work spreading invasive exotic species, which are costly to manage⁽⁶⁴⁾.

Public lighting is a source of light pollution that affects fauna, comfort and observation of the night sky. The public service obligation with regard to municipal lighting should be accompanied by recommendations on timing and adjustment of the lighting, or orientation of light flows⁽⁶⁵⁾. A project to improve lighting on the network of greenways (RAVeL) is also envisaged. As these paths are closely linked with green spaces, the project should be studied in terms of the effects of this light pollution on fauna.

Particular attention should also be paid to three sectors at the heart of this National Energy and Climate Plan.

- The negative impacts of onshore wind farms on bats and birds are well-known⁽⁶⁶⁾. Whether for environmental, landscape integration or acoustic discomfort reasons, wind farm development has been significantly hampered by multiple appeals to the Council of State. To ensure that projects are successful, the legal framework needs to be revised and a carefully considered social acceptance campaign must be conducted. At an early stage of projects, investors should also be provided with a map of strategic sites, taking account of various exclusion factors. In some cases, visual markers, audible deterrent systems or even the shutdown of turbines during

⁶³ IPBES (2019), 'Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services', S. Díaz et al., IPBES secretariat, Bonn, Germany, pp. 5-13.

⁶⁴ France and the Grand Duchy of Luxembourg have developed resources for this purpose:

<http://www.biodiversitebati.fr/Files/Other/Biodiversite-et-chantier.pdf>

<https://www.youtube.com/watch?v=2kE0y6GnBT8>

https://environnement.public.lu/fr/publications/conserv_nature/plantes_exotiques_envahissantes/plantes_exotiques_envahissantes.html

⁶⁵ See for example: Les cahiers de BIODIV'2050 : COMPRENDRE n° 6 (2015) 'Eclairage du 21ème siècle et biodiversité'.

⁶⁶ <https://www.natagora.be/position-sur-les-eoliennes>

migratory periods could be used to reduce the risk of fauna colliding with the turbines. However, these actions require certain specific species to be targeted and a good knowledge of their ethological and biological characteristics (67).

- Photovoltaic panels have a poorly understood impact in terms of polarised light pollution, which affects aquatic insects that choose the panels as laying sites. This phenomenon can be virtually eliminated by adapting the panel design (68).

- Building insulation measures eliminate the cavities that are used by specific fauna for nesting or sheltering. However, simple fauna-friendly changes can be made during construction or renovation (69). Green roofs and walls (their impact on biodiversity will depend on the choice of species) or even agriculture projects on roofs (GROOF project) can also be envisaged, and also offer other benefits, particularly in terms of well-being. Some construction materials also have less impact on the environment than others and could therefore be favoured.

Mineral management issue

Lastly, the development of renewable energy will lead to increasing demand for minerals, the exploitation of which has significant environment impacts. It will therefore be necessary, firstly, to encourage recycling and, secondly, to use resources that can be extracted and purified in the least harmful way possible, ensuring just exploitation that respects human rights.

Overview of investment needs

i. Existing investment flows and forward investment assumptions with regard to the planned policies and measures

As Wallonia does not currently (70) have an integrated tool for assessing investment needs, certain sectors are targeted below on the basis of available data.

- The **long-term renovation strategy** approved in 2017 indicates that 'the total investment need over the period 2017-2050 has been estimated at EUR 63 billion in the residential sector' (71). In more detail, it is expected that EUR 18.8 billion will be needed up to 2030. Estimates are currently being prepared for the renovation of non-residential buildings (72).
- The following tables indicate the estimated investment needs (73) to 2030 for the **production of renewable electricity and heat**.

⁶⁷ May R.O. et al. (2015), 'Mitigating wind-turbine induced avian mortality: Sensory, aerodynamic and cognitive constraints and options', *Renewable and Sustainable Energy Reviews* 42: 170-81.

⁶⁸ Robertson B.A. et al. (2013), 'Ecological novelty and the emergence of evolutionary traps', *Trends in ecology & evolution* 28: 552-560; Száz D. et al. (2016), 'Polarized light pollution of matte solar panels: anti-reflective photovoltaics reduce polarized light pollution but benefit only some aquatic insects', *Journal of Insect Conservation* 20: 663-675.

⁶⁹ <http://www.biodiversiteetbati.fr/>

⁷⁰ Wallonia is in the process of developing a TIMES economic optimisation model. Once this model becomes operational, it will be possible to assess investment needs for the entire energy system (within the limits of the data entered in the model).

⁷¹ This figure is currently being updated for the next long-term renovation strategy, which is expected in March 2020. Initial estimates, which are yet to be refined, point to EUR 80 billion in the residential sector up to 2050.

⁷² Initial estimates point to EUR 38-45 billion for non-residential buildings up to 2050.

⁷³ Not taking account of discounting.

Table 19 - Estimated investment needs for renewable electricity production to 2030. The cost does not take account of discounting

	2030 target compared with 2014 (GWh)	2030 investment cost compared with 2014 (million EUR)
Photovoltaic	723	3,156
Wind	1,330	2,406
Hydroelectric	290	140

(Source: TIMES model)

Table 20 - Estimated investment needs for renewable heat production to 2030 and estimated additional cost by technology. The investment cost does not take account of discounting. The additional cost takes account of discounting, operating expenses and fuel costs

	2030 target compared with 2020 (GWh)	2030 investment cost compared with 2020 (million EUR)	Additional cost (million EUR)
Solar thermal	84	160	91
Heat pumps	1,507	1,140	282
Deep geothermal energy	233	438	97
Biomass	2,285	1,003	657
Cogeneration (biomass)	1,225	441	95

(Source: 2018 internal calculation file of the administration)

- The following table indicates the estimated investment needs ⁽⁷⁴⁾ to 2030 for transport-related energy infrastructure ⁽⁷⁵⁾.

Table 21 - Estimated investment needs for energy infrastructure to 2030. The cost does not take account of discounting

	2030 target	2030 investment cost compared with 2020 (million EUR)
Hydrogen stations	30	90
Charging points for electric vehicles*:		
- public	6,900	105
- B2B solutions	185,000	830
LNG stations	25	89
CNG stations	220	79

(*) The amounts indicated do not include any additional costs for increasing the power of charging points (~EUR 1,800-EUR 4,000/charging point) or for installing smart points.

(Sources: ASSET 2018 study 'Technology pathways in decarbonisation scenarios'; internal calculation file of the administration)

⁷⁴ Not taking account of discounting.

⁷⁵ The available data does not allow the transport-related infrastructure cost to be broadly estimated.

ii. Sector or market risk factors or barriers in the national or regional context

The Strategic Committee of the National Pact for Strategic Investments (PNIS) has highlighted a series of investment barriers (76).

- 'Belgium does not currently have a [detailed and complete overview of national financial assets](#)'.
- '[European rules](#) currently prevent Belgian public investment. Belgium needs to reduce its public debt, which is too high, and limit its deficit. In this context, it is difficult to allocate significant further resources to investment'.
- The [European funding](#) channel is not being 'fully utilised, particularly due to the very high number of funding opportunities and a lack of knowledge about the relevant procedures'.

The Strategic Committee has also highlighted a number of barriers in terms of [public-private partnerships \(PPPs\)](#):

- '[insufficient technical expertise](#) among project leaders, which often results in projects that are unbalanced in terms of risk-sharing or insufficiently negotiable (bankable)';
- the [complexity](#) of PPPs, 'combined with a lack of procedures specific to public investments and also cumbersome administrative and legal procedures for the underlying authorisations and plans'.

iii. Analysis of additional public finance support or resources to fill gaps identified under point ii

The PNIS Strategic Committee would generally like to see the following.

- An [improved understanding of national assets](#), through a complete inventory of public assets. This 'is valid for both the federal level and also the Communities, Regions and local authorities. It also applies to public enterprises and other associated legal entities'.
- More [coordination](#) at policy level and among experts to ensure a 'more long-term vision and improved management of public investments'. The Strategic Committee also notes that 'many countries have adopted [mechanisms and procedures](#) designed to [improve the management of public investments](#), [but that] unfortunately such practices are not sufficiently developed in Belgium. And even where such procedures do exist, they are fragmented and specific to certain contracting authorities'.
- 'Examine how the [European budgetary framework](#) could possibly be [adjusted](#) and flexibly applied to Belgium [to allow for] a temporary relaxing of constraints for a specific entity facing a spike in its investment expenditure, while complying with European budgetary limits'.
- Take advantage of the international [experience of European institutions](#) and agencies in order to improve the management of investment projects.

The Region will ensure that both regional and national and also European and private funds are used efficiently.

❖ Maximise the mobilisation of European funding sources

The PNIS Strategic Committee notes that, 'in many cases, authorities under-utilise European funds out of ignorance and a lack of support'. There are many funding opportunities, involving specific procedures. To ensure efficient mobilisation of European funds, an administrative unit providing technical support and coordination should therefore be created 'to help prepare, submit and monitor applications to European bodies and the EIB'.

⁷⁶ https://www.premier.be/sites/default/files/articles/Report_FULL-FR_WEB_FINAL.pdf

Overview of European funding opportunities

The European Union's Multiannual Financial Framework for 2021-2027 particularly emphasises the policies of combating climate change and promoting the energy transition. The Commission has mainstreamed climate action across all the EU's main expenditure programmes, and proposes that a significant proportion of the allocated funds should be used for climate objectives.

Several European-wide financial instruments and programmes are aimed at financing energy transition measures, among others:

- Structural and Investment Funds, including the following:

- The *European Regional Development Fund (ERDF)*, which, in the period 2021-2027, is set to support the achievement of five policy objectives (PO), including a greener, low-carbon Europe by promoting clean and fair energy transition, green and blue investment, the circular economy, climate adaptation and risk prevention (PO 2).
- The European Social Fund Plus (ESF+), which aims to improve employment and education and may therefore be used to manage the development of the *labour* and *retraining* market associated with the energy transition. According to the *Proposal for a Regulation of the European Parliament and of the Council on the European Social Fund Plus (ESF+)* (77), this fund could be mobilised to achieve 'a greener, low carbon Europe through the improvement of education and training systems necessary for the adaptation of skills and qualifications, the upskilling of all, including the labour force, the creation of new jobs in sectors related to the environment, climate and energy, and the bioeconomy.'
- The common agricultural policy, which may be used to fund measures in the following areas, for example:
 - *bioenergy*;
 - development of *short agri-food supply chains* in Wallonia;
 - *waste* prevention (e.g. combating food waste and losses), sorting, recycling and recovery;
 - agri-environment and climate.

- European sectoral funds, which cover the following programmes (78):

- *LIFE(+)* *Environment* and *LIFE Climate Action*, which specifically concern developing and implementing *innovative responses* to environmental and climate challenges and which, since 2014-2015, have been linked with the *Natural Capital Financing Facility* (NCFF) and *Private Finance for Energy Efficiency* (PF4EE) financial instruments. The current integrated project LIFE BE REEL aims to implement regional renovation strategies in Flanders and Wallonia.

Total budget: EUR 5.4 billion over seven years (2021-2027).

Energy budget: EUR 1 billion.

- *Horizon 2020 / Horizon Europe*, which is a research and innovation programme.

Budget: EUR 97.6 billion over seven years (2021-2027).

'Climate, Energy and Mobility' Cluster budget: EUR 15 billion.

- *ERA-NETs*, which are add-on instruments to the Horizon 2020 programme for funding transnational research and innovation (79).

- The *Connecting Europe Facility for Projects of Common Interest* aimed at interconnecting the EU and its regions in terms of *energy*, *transport* and *digital infrastructure*.

Budget of EUR 42.3 billion over seven years (2021-2027):

- energy budget: EUR 8.7 billion;
- transport budget: EUR 30.6 billion;
- digital budget: EUR 3 billion.

- *InvestEU*, which is a new investment instrument replacing the *European Fund for Strategic Investments*. It will provide an EU guarantee that should allow **public and private funds** to be mobilised for strategic investments in support of EU internal policies, in particular to promote the **energy efficiency of buildings** and their use of **renewable energy**.

Budget: EUR 15.2 billion over seven years (2021-2027).

Objective: to mobilise over EUR 650 billion of additional investment.

- The *Innovation Fund*, which is a funding programme replacing *NER 300*. Its aim is to help energy-intensive **industries** develop **innovative technologies** in the areas of renewable energy **production**, energy **storage**, and capture and use or capture and storage of carbon dioxide.

Proposed budget: EUR 10 billion over seven years (2021-2027) depending on the carbon price (as the fund will be largely resourced through the ETS).

- The *European Energy Efficiency Fund* (eeef), which is a public-private partnership aimed at encouraging small-scale renewable energy or energy efficiency projects.

- The *European Investment Fund*, which aims to help SMEs, micro-enterprises and social **enterprises** secure venture capital.

- The *European Investment Bank*, which can also support energy projects (connected with **renewable energy**, **energy efficiency**, and **competitiveness** or **security** of energy supply). The PNIS Strategic Committee notes that, 'in 2017, the EIB and the EIF invested a total of EUR 1.6 billion in Belgium in the areas of the environment, infrastructure, innovation and SMEs. The EIB acts as a catalyst in this respect, with its funding adding to the resources provided by public authorities and private funders. It also has the necessary expertise in the area of project evaluation. It therefore grants a quality label to selected projects'.

- The EU's '**carbon leakage**' measures, which are aimed at increasing business competitiveness in the ETS sector and which will be extended to 2030.

❖ **Mobilise regional and national funding sources**

The investment plans set out in the following table are examples taken in the main from the PNIS (which comes under federal jurisdiction) and the Walloon Investment Plan. They will therefore have to be reassessed in light of the Walloon Regional Policy Statement 2019-2024 and the budgetary framework that are in the process of being adopted.

⁷⁷ http://www.fse.gouv.fr/sites/default/files/widget/document/annexe_3_proposition_de_reglement_du_parlement_europeen_et_du_conseil_relatif_au_fonds_social_europeen_plus_com-2018-382-f1-fr-main-part-1.pdf

⁷⁸ Note: all the budgets mentioned are Commission proposals made in May 2018. They give a rough idea, but will have to be negotiated during the new parliamentary term.

⁷⁹ The corresponding budget is not yet known.

Overview of Investment Plans

- Renewable energy

Nationally, around EUR **19 billion** is set to be mobilised for the electricity mix through [private](#) investment. This sum will be used 'to continue developing renewable energy, including for households', 'to find a solution to further reduce the cost of renewable energy', and 'to continue guaranteeing security of supply at competitive prices'.

- Transport

In terms of [mobility](#), it is estimated that EUR **22-27 billion** will be invested [nationally](#), with around 25% coming from [private](#) investors. This sum will be used to maintain and develop integrated transport infrastructure, networks and services, develop intelligent mobility, manage transport demand and establish a support framework. [Private](#) investors are set to provide EUR **0.3 billion** of funding for the roll-out of alternative fuels, specifically for the deployment of CNG and electricity charging points and to support research into hydrogen and green gas.

In the [Walloon](#) Region, an estimated budget of EUR **1.38 billion** will be available to achieve the objectives of the Mobility Plan 2019-2024, develop multimodal platforms ('mobipôles' or mobility hubs), extend the Charleroi metro, increase the depth and width of inland waterways through dredging, and improve mobility around the airports.

- Buildings

Nationally, around EUR **17 billion** will be available for [energy efficiency](#) through the renovation of public [buildings](#). [Half](#) of this amount could come from [private](#) investment, through public-private partnerships (PPPs) and/or energy performance contracts (EPCs), which seem particularly well-suited to this type of project.

In the Walloon Region, an estimated total of EUR **755 million** will be available for all aspects of the housing sector (i.e. not limited to the fight against climate change) and could be [particularly](#) used for the energy efficiency of public and private housing. Still in Wallonia, an estimated sum of EUR **675 million** will be available for the energy sector, part of which will be allocated to the energy efficiency of school buildings (with the rest being used to develop smart grids and meters and also for the energy transition of businesses).

- Systems and storage

[Nationally](#), around EUR **17 billion** could be provided through private investment for improving transmission and distribution systems and also for developing smart grids.

In the Walloon Region, an estimated sum of EUR **675 million** will be available for the energy sector, part of which could be allocated to develop smart grids and meters (with the rest being used for the energy efficiency of school buildings and also for the energy transition of businesses).

Nationally, around EUR **5 billion** should be available through private investment for developing energy storage.

- Industry

In the Walloon Region, an estimated sum of EUR **675 million** will be available for the energy sector, part of which could be allocated to the energy transition of businesses (with the rest being used for the energy efficiency of school buildings and also to develop smart grids and meters).

- Agriculture

As regards [agriculture](#), the Walloon Investment Plan has estimated that the local economy will provide EUR **15 million** of funding for the creation of farmers' markets.

- Waste

As regards the [waste](#) sector, an estimated EUR **1.2 million** will be available in Wallonia to fund the current REGAL Plan (2015-2025), which is the Walloon Food Waste and Loss Programme.

The Walloon Waste and Resources Plan (Plan Wallon des déchets-ressources – PWD-R) adopted on 22 March 2018 details the funding needed for its implementation⁽⁸⁰⁾. This plan aims to steer Wallonia along the lines proposed by the European Commission with regard to developing the circular economy.

❖ **Mobilise private funds**

‘Some semi-public bodies, sectoral associations and non-profit associations or private individuals, and also financial institutions (banks, insurance companies, pension funds and other investment funds) have considerable financial reserves’. As a result, public-private partnerships (PPPs) allow authorities to make investments without having to significantly increase public debt. Furthermore, PPPs are particularly advantageous due to the ‘keen interest and technical expertise of many private businesses, for example in the construction and energy sectors’, and also due to the ‘possibility of budget deconsolidation depending on the precise structure of the partnership’.

This approach is key to the renovation strategy, which is why several measures have been prioritised in order to develop the legal and regulatory framework for ESCOs and EPCs in Wallonia (point 3.2.3).

This type of measure could be extended to other sectors where PPPs have a role to play, particularly in the development of transport and digital infrastructure allowing the emergence of intelligent mobility solutions⁽⁸¹⁾.

Moreover, as mentioned in point ‘3.2.10. Financing measures’, Wallonia will aim to ‘develop a tax system that offers price signals consistent with the decarbonisation objectives and the polluter-pays principle’. Taxation will therefore be a useful tool for encouraging operators to change their behaviour and adapt their investment choices in favour of activities compatible with our economy’s decarbonisation objective. This approach will take account of the financial capacity of households.

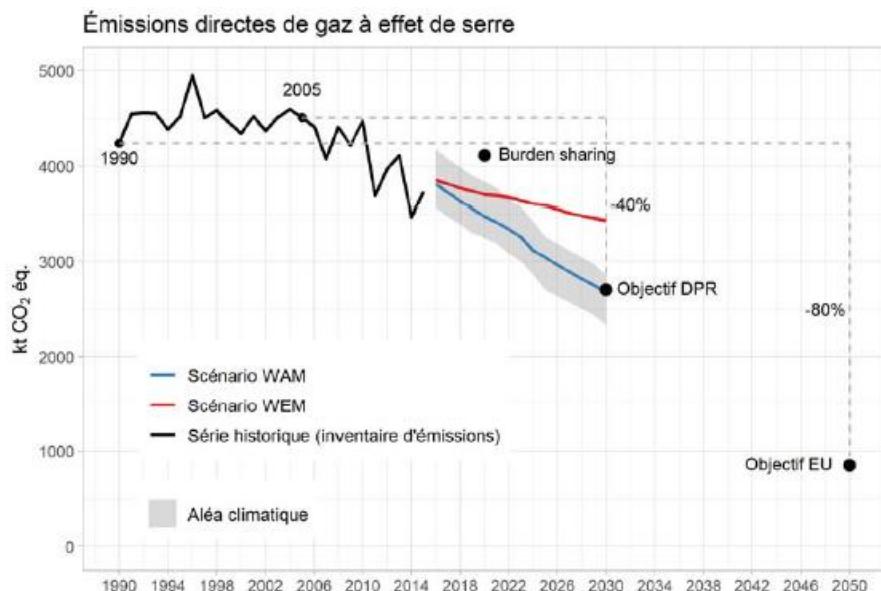
⁸⁰ http://environnement.wallonie.be/rapports/owd/pwd/PWDR_3.pdf

As an example, the estimates made indicate that implementing the actions envisaged in Book 3 of the draft PWD-R (management of household waste) should result in short-term costs estimated at ±EUR 5 million/year for the public authorities, ±EUR 18 million/year for businesses and ±EUR 3 million/year for local authority waste management associations, with a total average annual benefit estimated at around EUR 14 million/year.

⁸¹ See for example: ITS.be.

Impact of the new measures on GHG emissions

The graph below presents the results with regard to GHG emissions to 2030.



Émissions directes de gaz à effet de serre	Direct GHG emissions
kt CO ₂ éq.	kt CO ₂ eq
Objectif DPR	Regional Policy Statement target
Objectif EU	EU target
Scénario WAM	WAM scenario
Scénario WEM	WEM scenario
Série historique (inventaire d'émissions)	Historical series (emissions inventory)
Aléa climatique	Climatic uncertainty

The proposed measures come close to meeting a target of a 37% reduction in GHG emissions compared with 1990, which corresponds to a 40.1% reduction compared with 2005. The WAM scenario would lead to a transition compatible with the 2050 target (red point) of an 80% reduction in GHG emissions compared with 1990.

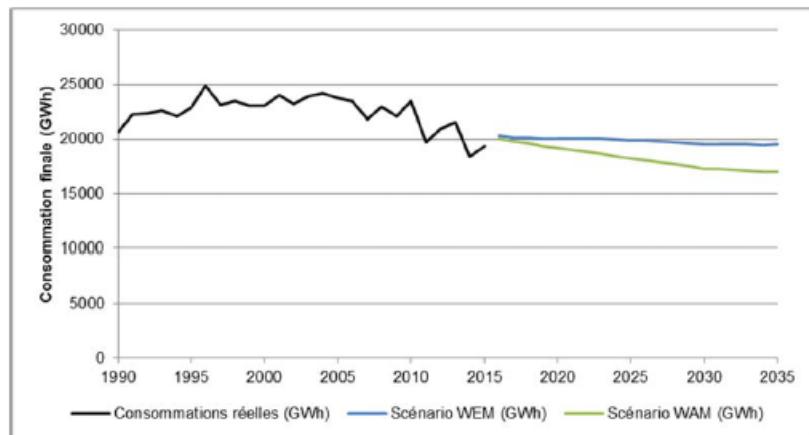
Renewable energy

The table below shows the expected trend in the use of renewable energy in the Brussels Capital Region between 2021 and 2030. Given the distribution of powers, the efforts made in Brussels solely involve the production of electricity, heat and cold from renewable sources.

Unit: GWh	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
RES-E	234.66	239.32	244.36	249.77	255.58	270.51	271.17	281.33	292.06	303.48
Solar PV	99.76	105.38	111.31	117.58	124.20	139.90	150.30	161.17	172.59	184.68
Municipal waste	112.79	111.84	110.94	110.09	109.27	108.50	107.75	107.04	106.35	105.68
Biogas	13.12	13.12	13.12	13.12	13.12	13.12	13.12	13.12	13.12	13.12
Liquid fuels	8.99	8.99	8.99	8.99	8.99	8.99	-	-	-	-
RES-H&C	136.11	138.00	139.92	144.19	148.56	153.00	152.19	157.03	162.08	167.44
Heat pumps	27.32	27.97	28.64	30.62	32.61	34.61	36.68	38.80	40.98	43.27
Solar thermal	16.72	17.84	19.04	21.29	23.63	26.04	28.60	31.28	34.11	37.12
Municipal waste	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
Biogas	28.32	28.32	28.32	28.32	28.32	28.32	28.32	28.32	28.32	28.32
Solid fuels	57.21	57.32	57.38	57.42	57.46	57.48	57.51	57.55	57.59	57.65
Liquid fuels	5.47	5.47	5.47	5.47	5.47	5.47	-	-	-	-
Total	370.77	377.32	384.28	393.97	404.15	423.50	423.37	438.36	454.14	470.92

Dimension energy efficiency

Lastly, the graph below shows that the proposed measures will reduce final energy consumption by 28.5% compared with 2005.

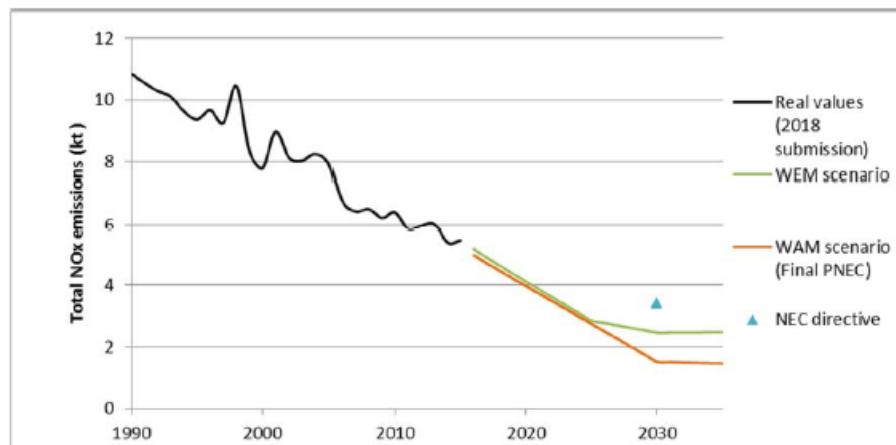


Consommation finale (GWh)	Final consumption (GWh)
Consommations réelles (GWh)	Actual consumption (GWh)
Scénario WEM (GWh)	WEM scenario (GWh)
Scénario WAM (GWh)	WAM scenario (GWh)

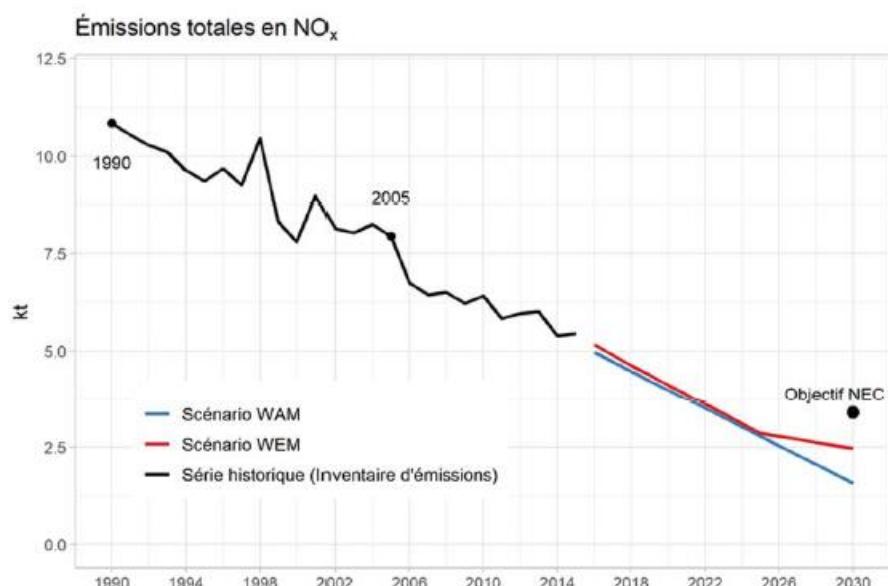
Macroeconomic and, to the extent feasible, the health, environmental, employment and education, skills and social impacts, including just transition aspects (in terms of costs and benefits as well as cost-effectiveness) of the planned policies and measures described in section 3 at least until the last year of the period covered by the plan, including comparison to projections with existing policies and measures

Impact of the new measures on the main atmospheric pollutants

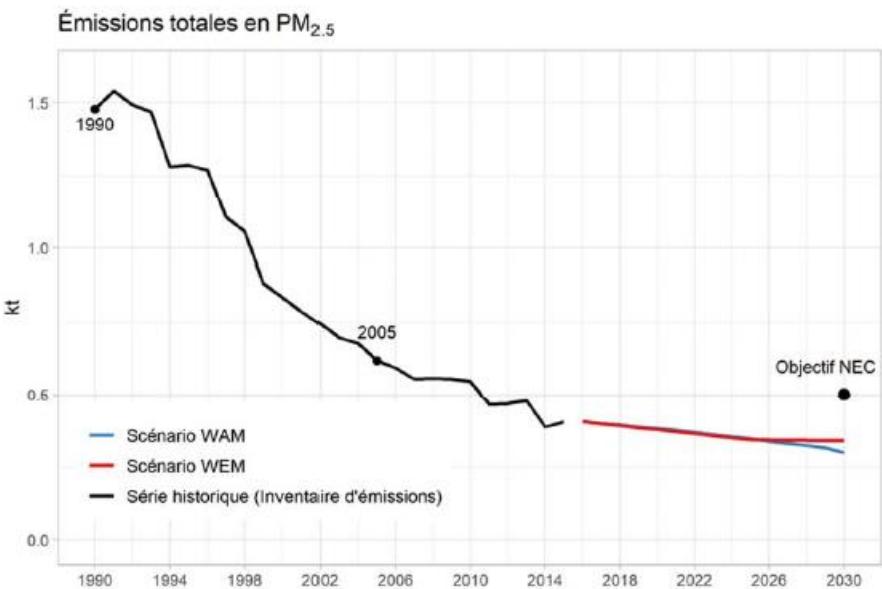
The graphs below show the results for the two most problematic pollutants in the Brussels Capital Region, namely NO_x and fine particulate matter PM_{2.5}.



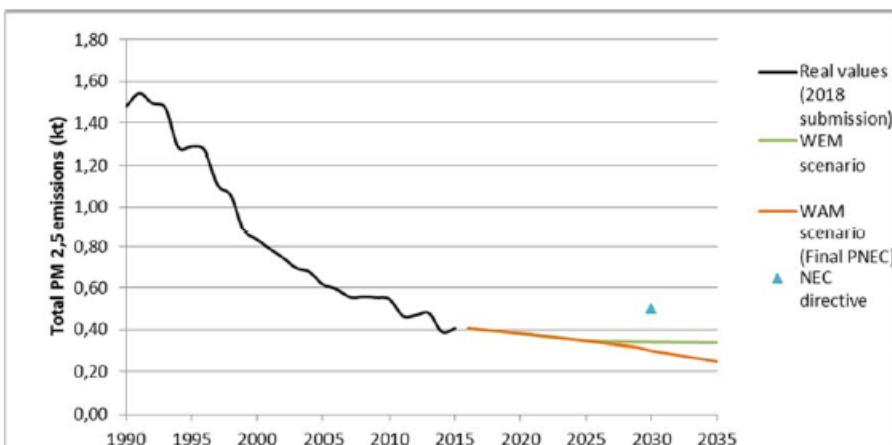
PNEC	NECP
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Émissions totales en NO _x	Total NO _x emissions
Objectif NEC	NEC target
Scénario WAM	WAM scenario
Scénario WEM	WEM scenario
Série historique (inventaire d'émissions)	Historical series (emissions inventory)



Émissions totales en PM _{2,5}	Total PM _{2,5} emissions
Objectif NEC	NEC target
Scénario WAM	WAM scenario
Scénario WEM	WEM scenario
Série historique (inventaire d'émissions)	Historical series (emissions inventory)



PNEC	NECP
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Overview of investment needs

Brussels Capital Region

Implementing the NECP measures in Brussels will require significant funding, which is a key issue. Multiple public and private funding sources will need to be mobilised.

Financing needs

The NECP is a strategy document; it has not yet been decided how various measures will be implemented. As a result, it has not been possible to estimate the total financing needs. However, the needs associated with the renovation strategy have been estimated, as the methods of implementing at least some of the measures have been determined.

By multiplying the surface areas of the types of housing by the total discounted costs (TDC) by type of housing (taken from the Cost-Optimal study), the investment needed to achieve the Region's objectives in terms of the renovation strategy is estimated at EUR 28.7 billion up to 2050, based on units to be renovated and the 2017 Cost-Optimal study.

	Apartments	Houses	Mixed-use properties	Total
Units to be renovated	252,544	196,561	31,914	479,659
New units	47,485	4,539	737	52,761
$m^2 / unit$	76	174	174	
TDC (EUR/ m^2)	612	411	542	
Investment needed	EUR 11.7 billion	EUR 14.1 billion	EUR 3 billion	EUR 28.8 billion

Regional budget funds

Substantial resources are available through regional funds allocated at least in part to energy policy.

- The **regional climate fund** created by COBRACE (Brussels Air, Climate and Energy Management Code) is intended to fully meet the requirement of Directive 2003/87/EC for Member States to use the revenue from selling allowances under the European greenhouse gas emission allowance trading scheme for certain specific purposes, such as reducing GHG emissions. The COBRACE therefore stipulates that the revenue of this fund, which mainly consists of the Brussels revenue under this scheme, will be used in particular for:
 - o measures in relation to buildings, installations and products that are aimed at reducing GHG emissions;
 - o measures in relation to transport and mobility that are aimed at reducing GHG emissions.
- The **energy policy fund** is financed by the levy calculated on the basis of available power (electricity) and meter size (gas). The revenue from this levy is allocated to the energy policy fund (95% of the revenue, which is used for the rational energy use policy of Bruxelles Environnement and for the operation of Brugel) and to the energy guidance fund (5% of the revenue, which is used by the public social welfare centres). The terms of this fund are set out in Article 2.16 of the Order creating the budget funds and reiterated in Article 26 of the Order on the organisation of the electricity market in the Brussels Capital Region.

In 2019, this fund received revenue of EUR 14,238,276.37.

- The economic transition fund is a new fund launched by the Brussels Government with a budget of EUR 10 million. This fund has been established in partnership with Finance.Brussels and the Secretary of State for the Economic Transition. Its aim is to encourage a wholesale change in methods of production and consumption in order to achieve a low-carbon economy.

The Brussels Government will also study the possibility of a single fund dedicated to the energy transition of buildings, which will combine the current contributions to the energy improvement of buildings (green certificates, energy and climate fund, renovation incentives, etc.) with other financial support. To ensure that a fair contribution to the fund is made by all the various energy carriers, a federal agreement will include heating oil suppliers among the contributors.

Financing tools

Given the challenge facing us, existing tools (such as the Brussels green loan, energy incentives, etc.) will be fully utilised and extended, with additional tools also having to be created. This approach is particularly important for the renovation strategy (see point 2.2.1.1.2).

In addition to these tools, the Brussels Government has decided to significantly increase the funding allocated to support the energy renovation of buildings. It has therefore decided to create an 'Employment-Environment-Finance' Alliance (Alliance 'Emploi-Environnement-Finances'), within which all sectoral stakeholders will work to implement the Strategy for the sustainable renovation of Brussels buildings (Stratégie de rénovation durable du bâti bruxellois). The government will also involve public and private sponsors in the Alliance so that all possible options are available for funding the transition of buildings. The government will also extend its ambitious policy of encouraging renovation, by steering public and private investment towards this goal, particularly through the next ERDF programming period and use of the third-party investor mechanism.

In order to tackle the wide range of situations (jointly owned properties, landlords, etc.), the government will implement an equally wide range of public and private funding solutions. In collaboration with public and private financial operators, it will develop innovative methods of funding suited to energy renovation, such as mortgages repayable over terms corresponding to the financial return on the planned renovation, or energy renovation loans that are repayable on transfer of ownership.

In order to take full advantage of the opportunity offered by the transfer of ownership for undertaking ambitious renovations, the government will establish a price signal linked to the property's energy efficiency at the time of transfer, through reduced registration fees or reduced inheritance or gift taxes. The reduction will depend on a comprehensive energy renovation being carried out within a set timescale and following an EPB analysis and development of an improvement strategy. More generally, the government will study how taxation can be used to encourage owners to improve the EPB class of their property.