



Belgium 2022

Energy Policy Review

INTERNATIONAL ENERGY AGENCY

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Foreword

The International Energy Agency (IEA) has conducted energy policy reviews of its member countries since 1976. This peer review process supports energy policy development and encourages the exchange of international best practices. By seeing what has worked – or not – in the real world, these reviews help to identify policies that deliver concrete results.

Throughout its 48 years as a member of the IEA, Belgium has been an active contributor to efforts to foster global energy security and sustainability. I particularly appreciate the leadership that Minister of Energy Tinne Van der Straeten is bringing to international efforts to achieve these goals, including through the IEA. I thank Belgium for serving in several critical roles that have strengthened the Agency's work, including Vice-Chair of the 2022 IEA Ministerial Meeting and Vice-Chair of the IEA Standing Group on Global Energy Dialogue. I also welcome Belgium's voluntary contributions to support the IEA's work on clean energy transitions in Africa.

Belgium was significantly impacted by the Covid-19 pandemic, with its GDP dropping by more than 5% in 2020. I am pleased to note that Belgium's economic recovery plan places strong emphasis on accelerating its clean energy transition with funding for sustainable mobility, energy efficiency, offshore wind and hydrogen based on renewable energy. This is in keeping with the important leadership that Belgium has demonstrated in the transition to clean energy, especially on offshore wind.

Belgium has demonstrated clear support for international co-operation on energy security, investing heavily to ensure its electricity is highly connected with its neighbours and participating in several multilateral forums to promote greater integration of Europe's energy system. In co-operation with the Netherlands, Germany and France, Belgium is working to ensure the security of gas supply as production from the Groningen field is phased out. Thanks to its strong efforts, Belgium is several years ahead of schedule on infrastructure projects needed to support the Groningen phase-out.

Despite these notable successes in advancing the clean energy transition, Belgium remains heavily reliant on fossil fuels, with the government currently forecasting that fossil fuel demand will continue to increase at least through 2030. All sectors have considerable work ahead of them to meet the country's targets for increasing the share of renewables and reducing emissions. I sincerely hope the recommendations proposed in this report will help Belgium navigate the transformation of its energy system as it seeks to build momentum towards achieving climate neutrality while maintaining secure supplies of energy.

Dr. Fatih Birol
Executive Director
International Energy Agency

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1. Executive summary

Overview

Belgium's energy policy is focused on transitioning to a low-carbon economy while ensuring security of supply, lowering costs for consumers, increasing market competition and continuing integration with the European energy system. The federal government is committed to phasing out most nuclear electricity generation by 2025 and has developed a capacity remuneration mechanism that aims to ensure security of electricity supply. In light of the Russian invasion of Ukraine and goals to reduce fossil fuel dependency, the federal government decided in March 2022 to take the necessary steps to extend 2 GW of nuclear capacity by ten years, and introduced a EUR 1.2 billion package to accelerate energy transition and protect consumers from high energy prices. Belgium is also working with France, Germany and the Netherlands to ensure that security of gas supply is maintained as production from the Groningen gas field is phased out.

Since the IEA's last energy policy review in 2016, Belgium has made progress on its energy transition. From 2010 to 2020, the share of renewable energy in Belgium's total final energy consumption increased from 6% to 12%, driven by growth in renewable electricity generation, mainly from wind and solar photovoltaics (PV), and an increased use of bioenergy, mainly for industrial and building heating and for transport. Progress on renewable energy has been especially pronounced for offshore wind. In 2021, Belgium had the sixth-highest offshore wind capacity in the world and is planning for a major expansion of offshore wind deployment.

Belgium faces notable challenges as it continues to push for its energy transition. In 2020, fossil fuels (mainly oil and natural gas) accounted for 71% of its energy supply. Most fossil fuel demand comes from industry and transport, but Belgium's buildings also have a notable demand for gas, while oil covered 33% of residential building demand in 2020. Because of the high share of fossil fuels in its energy supply, Belgium has seen only limited reductions in greenhouse gas (GHG) emissions in recent years. From 2011 to 2019, energy-related GHG emissions fell by just 3.5 million tonnes of carbon dioxide (Mt CO₂) to reach 90 Mt CO₂. More aggressive policies are needed to reduce Belgium's fossil fuel dependency and accelerate emissions reductions, especially given that the nuclear phase-out will increase the carbon intensity of electricity generation.

Energy and climate policy

Responsibility for Belgium's energy and climate policy is divided between the federal government and the regional governments of Flanders, Wallonia and the Brussels-Capital Region. The federal government is responsible for electricity transmission and large-scale generation; transport of natural gas and oil; nuclear energy; security of energy supply;

price policy; consumer protection; the national rail system; transportation fuels; offshore energy; and energy research, development and demonstration (RD&D) related to its competences. Regional governments are responsible for renewable energy (except offshore energy), energy efficiency and GHG emissions (except for federal buildings and vehicles), distribution of electricity and natural gas, regulation of retail energy markets, vehicle registration, public transportation, urban and rural planning, and energy RD&D related to their competences.

Belgium has a wide range of energy and climate targets for 2030 aiming for energy transition and achievement of European Union (EU) targets. GHG emissions from Belgium's energy-intensive industrial facilities and large electricity generation plants are regulated under the EU Emissions Trading System (ETS). Belgium's National Energy and Climate Plan (NECP) sets 2030 targets for a 35% reduction of non-ETS GHG emissions versus 2005 levels; for primary energy demand less than 42.7 million tonnes of oil equivalent (Mtoe) (compared to 49.1 Mtoe in 2019 and 43.9 Mtoe in 2020); for final energy demand less than 35.2 Mtoe (compared to 35.8 Mtoe in 2019 and 33.3 Mtoe in 2020); for renewable energy to reach 17.5% of gross final energy consumption, 37.4% of electricity generation, 11.3% of heating and cooling demand, and 23.7% of transport demand; and to increase total RD&D spending to at least 3% of gross domestic product (GDP).

The EU-wide 2030 GHG emissions reduction target has been increased from 40% to 55%. Belgium will therefore have to increase its targets for emissions reduction, energy efficiency and renewable energy. Belgium should update its NECP with increased targets and additional measures to support the EU-wide 55% reduction target. The federal and regional governments are in the process of developing a burden-sharing agreement to divide responsibility for Belgium's 2030 targets. The burden-sharing agreement should account for the increased EU-wide GHG target and should be concluded in a timely manner to give clarity to all stakeholders involved in its implementation.

Belgium supports EU carbon neutrality by 2050 and under EU requirements has adopted its own Long-term Strategy for energy and climate (LTS2050). The LTS2050 aims to put Belgium on a path that supports the Paris Agreement and EU 2050 carbon neutrality, but it does not include a clear target for national climate neutrality by 2050. Belgium should update its long-term strategy to include a clear commitment and path to 2050 carbon neutrality.

Key measures

The NECP is Belgium's main energy and climate policy document, defining the measures the federal and regional governments will implement to help achieve Belgium's 2030 targets. The NECP's measures are focused on reducing energy demand and increasing the deployment of renewable energy, especially for electricity generation and transport. Achieving the targets for electricity generation (reduced emissions and an increased renewable energy share) are promoted mainly through the ETS and programmes that require electricity suppliers to obtain green certificates linked to electricity generated from renewables.

The federal government established a dedicated offshore wind zone covering 225 square kilometres (km²). As of 2021, 9 offshore wind farms with a total capacity of 2.26 gigawatts (GW) had been built in the offshore wind zone. Belgium is developing a second offshore

wind zone of 281 km² and a planned capacity of up to 3.5 GW. The federal government is developing competitive bidding procedures to drive cost-effective deployment in the second offshore wind zone. Belgium's transmission system operator (TSO) developed a modular offshore grid to connect offshore wind projects to the onshore grid. This offshore grid will be expanded and upgraded to connect projects developed in the second offshore wind zone. The federal government is examining options to further increase offshore wind generation, including repowering the first offshore wind zone and creation of a third offshore wind zone.

Renewable energy in transport is promoted mainly through a federal biofuels blending mandate that requires all companies selling road transportation fuels to achieve a certain share of biofuels by energy content in their annual fuel sales (9.55% for 2020 and 2021). The NECP proposes annual increases to reach 13.9% by 2030. Reductions in transport emissions and energy demand are also promoted through vehicle taxation that favours the purchase of low-emission vehicles and electric vehicles (EVs). There are also numerous measures to reduce transport emissions and energy demand through modal shifts away from private cars to public transport, walking and biking.

Regional governments have responsibility for reducing buildings emissions and their energy demand and for increasing renewable heating and cooling. There is a wide variety of measures, including direct financial support, loans and tax deductions for renovations; building codes; energy performance certificates; and information platforms for consumers. There is a notable focus on transitioning away from oil-based heating, with regional programmes favouring heat pumps and renewables. The federal government also contributes by setting appliance efficiency standards.

Reductions of industry emissions and energy demand are mainly driven by the ETS and voluntary agreements between regional governments and industry. The voluntary agreements vary by region, but in general focus on audits to identify cost-effective energy efficiency measures, with companies receiving tax relief or other incentives if these measures are implemented. The voluntary agreements focus on energy-intensive industrial facilities, but there is an increasing effort to include small and medium-sized enterprises (SMEs).

In 2018, the federal government published a report on the results of a national debate on carbon pricing for non-ETS sectors. The report detailed the impact of three carbon-pricing options on fossil fuel prices and on emissions from transport, buildings, non-ETS industry and other sectors, but so far no decision on carbon pricing has been taken. Under EU directives, Belgium developed an inventory of fossil fuel subsidies and is committed to eliminating fossil fuel subsidies.

The federal government aims to reform federal taxation to make it more climate- and environmentally friendly, following the polluter-pays principle and sending price signals supporting decarbonisation. In support of this reform, the federal government will carry out a study in consultation with the regional governments to be published in 2022. Proposals for fiscal reform based on this study will be made by late 2023. Belgium should consider the reform of federal taxation as an opportunity to eliminate fossil fuels, introduce broader carbon pricing and better align energy prices (especially for electricity) with its energy transition goals.

To address energy poverty and ensure energy access, Belgium has a social tariff that results in reduced gas and electricity bills for residential consumers that meet certain

socio-economic requirements. The federal government automatically notifies energy suppliers which of their consumers qualify for the social tariff. All energy suppliers must provide the social tariff to their qualifying consumers. In 2020, 9.7% of electricity consumers (around 470 000 consumers) and 10% of gas consumers (around 295 000 consumers) received the social tariff. There are additional federal and regional programmes to address energy poverty.

Electricity market reform

Electrification is a central aspect of Belgium's push for energy transition. However, Belgium's low heating oil and gas prices and high electricity prices significantly limit the incentive for electrification. In 2019, Belgium's retail gas prices were among the lowest in Europe, and electricity prices for households were the third-highest among IEA member countries, while the retail electricity price for industry was the sixth-highest. Under the current tariff structure, home heating with electricity is 50% more expensive than heating with natural gas or fuel oil, even though electric heating is more efficient and less polluting.

A key reason for Belgium's high electricity prices is the high level of charges that are not associated with electricity generation, transmission or distribution. The high cost of electricity limits its ability to compete with other energy carriers and reduces the incentive for consumers and businesses to invest in electrification of building heating, transport, industrial processes and other key areas. A change in the tariff structure is needed to ensure that electricity prices align with the energy transition goals. Lower electricity prices also improve the situation of vulnerable households and help foster industrial competitiveness.

In 2019, Belgium had the highest consumer switching rate for electricity in Europe. However, Belgium's electricity market remains highly concentrated, with limited competition. In 2019, just one supplier had a 72% market share at the wholesale level, while just four suppliers dominated Belgium's retail electricity markets. More effort is needed to remove barriers to competition and ensure that new companies and innovative services can enter the market.

There are also notable concerns over the time required to obtain permits for the construction of transmission infrastructure and generation facilities, especially onshore wind and large-scale solar PV. Timely project permitting is essential, especially given the need to quickly develop new generation and transmission capacity to ensure a secure electricity supply during and after the nuclear phase-out, and to support the strong deployment of renewable energy needed to meet the energy transition goals.

Belgium has also made progress on energy security. The infrastructure projects supporting a secure gas supply after the Groningen phase-out should be complete several years ahead of schedule. However, Belgium lacks a national strategy and plan for decarbonising the gas sector, including mid- to long-term targets for low-carbon gases such as biomethane and hydrogen. More clarity is needed on the decarbonisation of the gas sector, especially as the nuclear phase-out is expected to result in the deployment of new gas-fired electricity plants.

Covid-19 response

Belgium is still assessing the impact of the Covid-19 pandemic on its energy policies and markets. Several measures to address the impacts of the pandemic on the energy sector have been implemented. In 2020, eligibility for the social tariff was temporarily expanded to all consumers with a gross income below EUR 20 000, which significantly increased the number of consumers receiving it. In addition, the deadline for requesting payments from the Social Heating Fund were extended and the government expects the number of households receiving these payments to increase. The regional governments also took a variety of steps to protect vulnerable consumers and extended the deadlines to apply for zero-emission vehicle grants, to repay loans for building energy efficiency measures and to obtain building energy performance certificates.

In response to the pandemic, the European Commission approved Belgium's EUR 5.9 billion National Recovery and Resilience Plan. More than half of the plan's funding contributes to Belgium's climate and energy goals, including EUR 1 012 million for building renovation, EUR 672 million for modal shifts in transport and EUR 100 million for the development of an offshore energy hub. Several measures support investments in production, transportation and the use of hydrogen produced from renewable energy, with a goal for Belgium to reach at least 150 megawatts (MW) of electrolysis capacity by 2025. The plan also supports a legal framework for carbon capture, utilisation and storage (CCUS), including cross-border infrastructure for CO₂ transportation.

The European Commission provided an overall positive endorsement of Belgium's plan and noted that it should have a positive economic impact and drive public and private investments in areas relevant for Belgium's energy and climate goals. However, the Commission pointed out that the plan contains limited investments in renewable energy and indicated that additional funding and measures beyond what is detailed in the plan are needed to achieve Belgium's 2030 renewable energy targets.

Key recommendations

The government of Belgium should:

- Update the National Energy and Climate Plan with new targets and measures that support the European Union's 55% emissions reduction target and provide long-term certainty to stakeholders for making the necessary investments for decarbonisation.
- Agree on long-term climate and energy targets at a national level for the period 2030-2050, including a national 2050 carbon neutrality target, as part of a stable regulatory framework to provide clarity to investors and consumers.
- Ensure measures addressing energy poverty foster the use of renewable energy and energy efficiency improvements, enable a just transition that protects vulnerable households, and make them part of the energy transition.
- Use the reform of taxation to create appropriate price signals to drive decarbonisation across the entire economy and to support electrification.
- Ensure that infrastructure planning, approval and permitting processes allow for the timely expansion of transmission and distribution systems needed to support a rapid and sustained renewables deployment, especially for the second offshore wind zone.

2. General energy policy

Key data (2020)

TES: 50.4 Mtoe (oil 36.2%, natural gas 30.1%, nuclear 17.8%, bioenergy and waste 7.6%, coal 4.7%, solar and wind 3.1%, heat 0.5%, hydro 0.05%, electricity exports -0.1%), -8.6% from 2010 to 2019, -8.1% from 2019 to 2020

TES per capita: 4.4 toe/cap, -13% from 2010 to 2019, -9% from 2019 to 2020 (IEA average: 3.8 toe/cap)

TES per GDP: 97 toe/USD million, -20% from 2010 to 2019, -2% from 2019 to 2020 (IEA average: 91 toe/USD million)

Energy production: 13.8 Mtoe (nuclear 65.2%, bioenergy and waste 21.1%, solar and wind 11.4%, heat 1.7%, coal 0.4%, hydro 0.2%), -0.3% from 2010 to 2019, -13.0% from 2019 to 2020

TFC: 38.0 Mtoe (oil 45.7%, natural gas 26.8%, electricity 17.9%, bioenergy and waste 5.5%, heat 1.2%, solar 0.1%, coal 1.0%), -6.0% from 2010 to 2019, -5.2 from 2019 to 2020

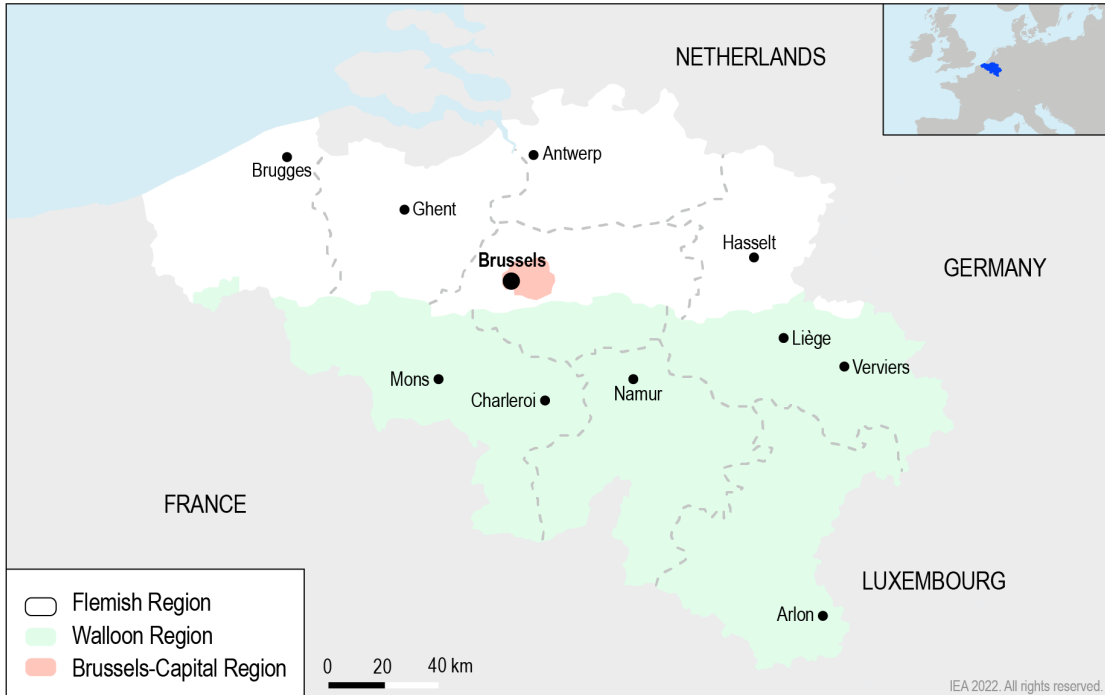
Country overview

The Kingdom of Belgium (hereafter Belgium) has a total land area of 30 688 km² and is located in Western Europe bordering France, Germany, Luxemburg and the Netherlands. In 2020, Belgium had a population of 11.5 million and one of the world's highest population densities (376 inhabitants per km²). The City of Brussels, with a population of 180 000, is the capital and hosts a number of EU institutions, including the European Parliament, the European Commission and the European Council. Antwerp is Belgium's most populous city, with a population of 520 000, and is home to the Port of Antwerp, the second-largest port in Europe and a major hub for industry (Port of Antwerp, 2021).

Belgium is a constitutional monarchy, with the monarch (King Philippe since 2013) serving as head of state and appointing the prime minister as head of government. Since October 2020, the prime minister is Alexander De Croo of the Open Flemish Liberals and Democrats party. Belgium is a federal state composed of three regions (the Brussels-Capital Region, the Flemish Region and the Walloon Region) and three communities (the Flemish Community, the French Community and the German-speaking Community). The Constitution also recognises that Belgium is comprised of four language areas (a Dutch-speaking area, a French-speaking area, the Brussels-Capital bilingual area and a German-speaking area).

Belgium is a founding member of the EU, the International Energy Agency (IEA), the Organisation for Economic Co-operation and Development (OECD), the North Atlantic Treaty Organization, the United Nations, and the World Trade Organization. Belgium is also part of Benelux, a political and economic union with Luxembourg and the Netherlands.

Figure 2.1 Map of Belgium



This and all the maps in this report are without prejudice to the status of or sovereignty over any territory; to the limitation of international frontiers and boundaries; and to the name of any territory, city or area.

Belgium's strategic location in Europe and large port facilities make it a hub for commerce. In 2019, Belgium was the seventh-largest economy in the EU, with a GDP of USD 628 billion and GDP per capita of USD 54 693. The Covid-19 pandemic notably impacted Belgium's economy, reducing GDP to USD 598 billion and GDP per capita to USD 51 873 in 2020. Belgium's economy relies mainly on the service sector (78% of GDP in 2018) followed by the industry sector (21% of GDP), while agriculture, forestry and fishing together account for less than 1% of GDP. The unemployment rate was 5.3% in 2021, lower than the OECD average of 6.6%.

Responsibility for Belgium's energy and climate policy is divided between the federal government and the regional governments of Flanders, Wallonia and the Brussels-Capital Region.¹ The federal government is responsible for large electricity generation and transmission, transport of natural gas and oil, nuclear energy, security of energy supply, price policy, consumer protection, the national rail system, transportation fuels, offshore energy generation, and energy RD&D related to its competences. Regional governments are responsible for renewable energy (except offshore energy), energy efficiency and GHG emissions (except for federal buildings and vehicles), distribution of electricity and

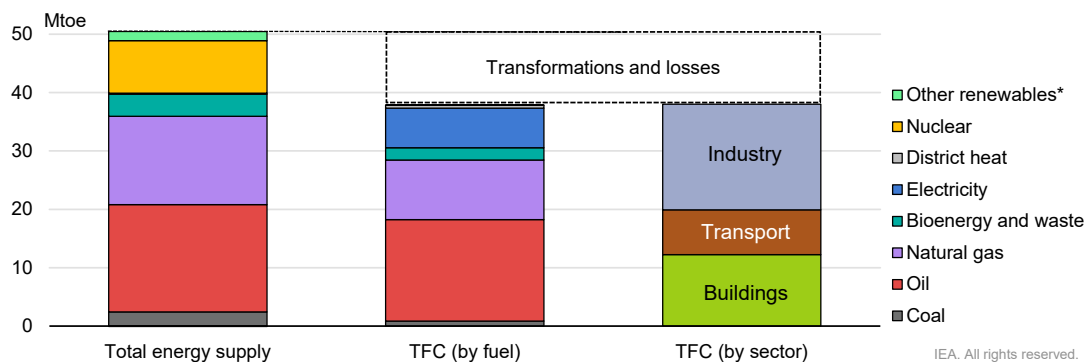
¹ There is no hierarchical link between the federal legal norms and those of the constituent entities and the autonomy of the various constituent entities should be regarded as the main principle. In this note, there is a clear distinction between Belgium (geography, or the four entities together) and the federal government.

natural gas, regulation of retail energy markets, vehicle registration, public transportation, urban and rural planning, and energy RD&D related to their competences.

Energy supply and demand

Belgium's energy supply and demand are dominated by imported fossil fuels. In 2020, oil accounted for 36% of total energy supply (TES), followed by natural gas (30%) and coal (5%) (Figure 2.2). All of Belgium's oil and natural gas supplies are imported. Belgium's last coal mine closed in 1992 and most of the coal supply is imported. However, in 2019, 2% of Belgium's coal supply was sourced domestically from slag heaps at former mines. Nuclear plays a major role in Belgium, covering 18% of TES in 2020. Most of Belgium's final energy demand is covered by oil (46% of total final consumption [TFC] in 2019) and natural gas (27%), followed by electricity (18%), bioenergy and waste (6%), district heating (1.2%), and coal (1%). Industry accounts for the largest share of Belgium's energy demand (48% of TFC in 2020), followed by buildings (32%) and transport (20%). Belgium also uses a significant amount of oil products from international aviation and marine bunkers, amounting to 7.5 Mtoe in 2020, or 15% of TES.

Figure 2.2 Energy supply and demand in Belgium, 2020



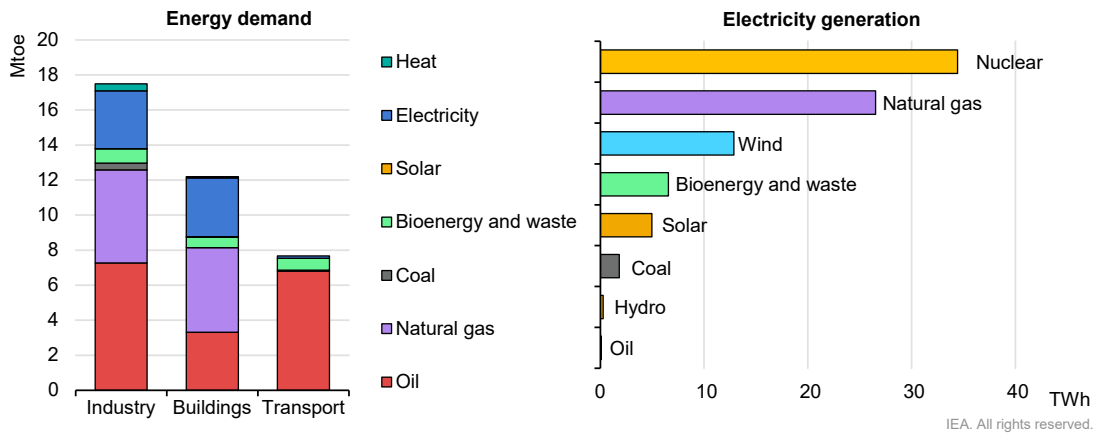
Belgium's energy supply and demand are dominated by imported oil and natural gas. Nuclear energy plays a major role. Industry has the largest energy demand (48% of TFC in 2020).

* *Other renewables* includes wind, solar, hydro and geothermal.

Source: IEA (2022), *World Energy Balances* (database), <https://www.iea.org/data-and-statistics/data-product/world-energy-balances>.

The industry sector relies mostly on oil (40%), natural gas (29%) and electricity (18%) and is responsible for almost all of Belgium's coal demand (Figure 2.3). Transport is the least diverse sector, with 89% of demand covered by oil, followed by small shares of biofuels (8%), electricity (2%) and natural gas (1%). Most building energy demand is covered by natural gas (40%), electricity (27%) and oil (27%) with a small use of biomass (5%) and almost no district heating (0.6%). In 2019, the share of oil in Belgium's building energy demand (24%) was the fifth highest among IEA countries and notably higher than the IEA average of 8%. In 2019, electricity covered 18% of Belgium's TFC, below the IEA average of 22%. Belgium's electricity mix is dominated by nuclear (39% of generation in 2020), followed by natural gas (30%) and renewables (26.5%, mainly wind, biomass and solar PV). Belgium's last coal-fired electricity plant closed in 2016; however, a small share of electricity generation (2% in 2020) still comes from one industrial plant that uses coal mainly for heat, but also for electricity generation.

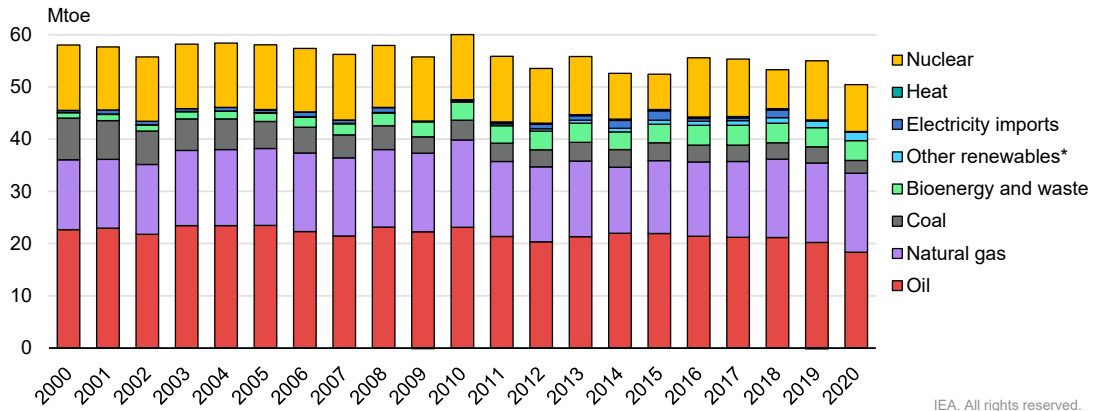
Figure 2.3 Energy demand per sector and per fuel, and electricity generation by fuel in Belgium, 2020



Industry and building energy demand is dominated by oil and gas, while oil covers most transport energy demand. Electricity is generated mainly with nuclear, natural gas and wind.

Source: IEA (2022), *World Energy Balances* (database), <https://www.iea.org/data-and-statistics/data-product/world-energy-balances>.

From 2010 to 2019, Belgium's TES fluctuated notably between a low of 52 Mtoe in 2015 and a high of 60 Mtoe in 2010, while in 2020 it dropped to 50 Mtoe as a consequence of the Covid-19 pandemic (Figure 2.4). The fluctuations were driven mainly by fluctuations of nuclear availability and changes in heating demand for oil and natural gas. The contribution of nuclear energy experienced strong annual variations, from 6.8 Mtoe in 2015 to 12.6 Mtoe in 2011, resulting from major maintenance and safety investments on several reactors. Renewable energy in TES grew from 2010 to 2020, with bioenergy and waste increasing from 3.5 Mtoe to 3.8 Mtoe, wind from 0.1 Mtoe to 1.1 Mtoe, and solar from 0.06 Mtoe to 0.5 Mtoe. From 2010 to 2020, the share of fossil fuels in TFC decreased slightly, from 75% to 74% (Figure 2.5). From 2010 to 2020, oil demand fluctuated between a high of 21 Mtoe in 2010 and a historic low of 17 Mtoe in 2019. Gas demand also fluctuated, from a high of 11 Mtoe in 2010 to a low of 9.2 Mtoe in 2014 and was 10.2 Mtoe in 2020. Demand for electricity was stable, at around 7 Mtoe from 2010 to 2020.

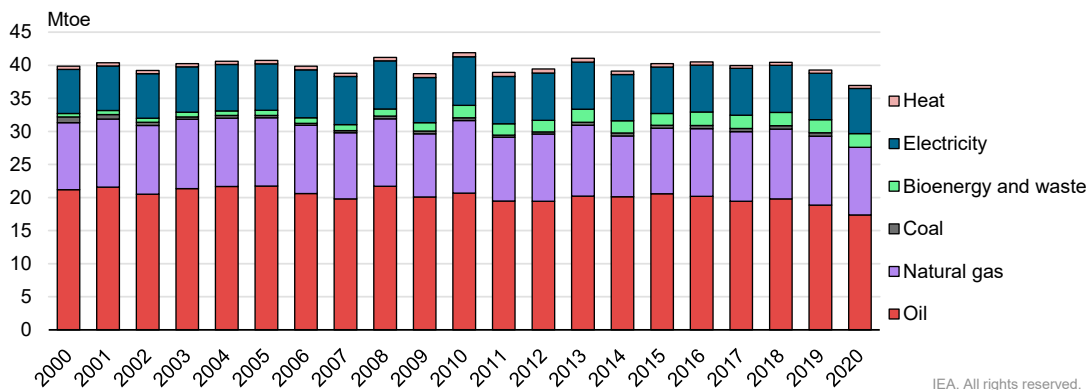
Figure 2.4 Total energy supply by source in Belgium, 2000-2020

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Energy supply is dominated by fossil fuels and has fluctuated notably in recent years, mainly due to maintenance and safety investments on nuclear reactors and changes in transport and heating demand.

*Other renewables includes wind (1.11 Mtoe in 2020), solar (0.456 Mtoe), and smaller shares of hydro (0.023 Mtoe) and geothermal (0.003 Mtoe).

Source: IEA (2022), *World Energy Balances* (database), <https://www.iea.org/data-and-statistics/data-product/world-energy-balances>.

Figure 2.5 Total final consumption by source in Belgium, 2000-2020

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Between 2010 and 2020, demand for oil and gas fluctuated, with an overall decrease in oil demand, while electricity demand was relatively stable.

Source: IEA (2022), *World Energy Balances* (database), <https://www.iea.org/data-and-statistics/data-product/world-energy-balances>.

Energy and climate targets

Under EU directives and national laws, Belgium has a wide range of energy and climate targets for 2020 and 2030, which aim to support the achievement of EU-wide targets (Table 2.1). GHG emissions from Belgium's energy-intensive industrial facilities and large electricity generation plants are regulated under the EU ETS. Belgium's NECP defines 2030 targets for non-ETS GHG emissions, energy efficiency and renewable energy.

Table 2.1 Belgium's 2020 and 2030 energy sector targets and status in 2019 and 2020

		Status		Targets	
		2019	2020	2020	2030
Non-ETS GHG emissions	CO₂-eq reduction (versus 2005)	-8.8%	-16.4%	-15%	-35%
Energy efficiency*	Primary energy consumption (Mtoe)	49.1	43.9	43.7	42.7
	Final energy consumption (Mtoe)	35.8	33.3	32.5	35.2
Renewable energy share	Gross final energy consumption	9.9%	13.0%	13%	17.5%
	Electricity*	20.8%	25.1%	20.9%	37.4%
	Heating and cooling*	8.3%	8.5%	11.9%	11.3%
	Transport	6.8%	11%	10.1%	23.7%
Cross-border electricity interconnection*		24%	24%	24%	33%

* Indicative targets.

Belgium has a mixed performance on the achievement of its 2020 energy and climate targets. The target for non-ETS emissions reductions will be achieved under EU accounting rules that allow credits from years when emissions were below annual targets to offset deficits for years when emissions exceeded annual targets. Despite a large and likely temporary reduction in energy demand resulting from the pandemic, Belgium did not meet its 2020 indicative energy efficiency targets.

Belgium will achieve the 2020 targets for renewables in transport (thanks to increased biofuels blending in 2020) and for renewables in electricity; the share of renewable heating and cooling will not reach the indicative target in 2020. Belgium will not achieve a 13% share of domestic renewable energy in gross final energy consumption. However, it will meet its 2020 renewable energy target by purchasing statistical renewable energy transfers from EU member states who exceeded their 2020 renewable energy target.

The European Commission commented on Belgium's NECP in October 2020, noting that the 2030 targets for GHG emissions reductions supported the achievement of the EU-wide emissions reduction target, but that Belgium's 2030 contributions for renewable energy and for energy efficiency were not sufficiently ambitious to support the achievement of the EU-wide 2030 targets (EC, 2020). In addition, it is likely that Belgium will need to increase its 2030 targets and contributions for GHG emissions, renewable energy and energy efficiency to support the achievement of the increased EU-wide 2030 GHG emissions reduction target, which was recently raised from 40% to 55%.

EU member states must submit a national progress report on the implementation of their NECP every two years starting in 2023. Based on these reports, the European Commission will assess progress on 2030 targets at the EU level and for each member state and take necessary action to ensure that targets will be met. Each member state's NECP will receive a final update by 30 June 2024 (with a draft update submitted to the European Commission by 30 June 2023). The NECPs will then be updated every ten years to support the achievement of the target for EU climate neutrality by 2050.

Energy policy overview

Responsibility for energy policy is divided between the federal and regional governments. The federal government is responsible for electricity generation and transmission, transport of natural gas and oil, nuclear energy, security of energy supply (electricity, natural gas and oil), price policy and consumer protection, the national rail system, transportation fuels (including biofuels), offshore wind generation, and energy RD&D related to its competences. Regional governments are responsible for the distribution of electricity and natural gas, regulation of gas and electricity retail markets, renewable energy (except offshore energy), energy efficiency and GHGs (except for federal buildings and fleets), energy RD&D related to its competences, transportation (except national rail, shipping, aviation and automotive), and urban and rural planning. There is no hierarchy between the federal and regional governments.

At the federal level, energy matters are handled by the Directorate-General for Energy, part of the ministry called Federal Public Service for Economy, SMEs, Self-employed and Energy. The Energy Consultation is a formal body responsible for co-ordinating all energy policy matters between the federal and regional governments. Climate policy is co-ordinated between the federal and regional governments through the Coordination Committee for International Environmental Policy and the National Climate Commission. The Belgian Competition Authority is an independent administrative authority that contributes to the definition and implementation of competition policy in Belgium, including in the energy sector.

In 2017, the energy ministers of the federal and regional governments reached an agreement on a Belgian Inter-federal Energy Pact, which is a common vision for Belgium's energy transition to 2030. The Energy Pact guides co-operation on energy policy and was a key input for developing the NECP, which integrates inputs from the federal and regional governments and was approved in December 2019.

The NECP is Belgium's main energy and climate policy document through 2030 (EC, 2019). It defines the national targets that drive policy and measures to be taken by the federal and regional governments to support the achievement of these targets. The NECP also identifies measures based on co-operation between the federal and regional governments, especially on fiscal and financial mechanisms to drive decarbonisation.

Energy efficiency is supported by a range of regional programmes, including energy audits and voluntary energy efficiency agreements for industry. The main efficiency measures for transport are EU standards and vehicle taxes and fees that are lower for low-emission/high-efficiency vehicles and for EVs. The building sector has the widest range of programmes and measures for energy efficiency, including building codes, appliance standards, loan and grant programmes, and platforms to support consumers. There is also a push to reduce oil-based heating in buildings (see Chapter 4).

Belgium promotes electricity generation from renewable energy primarily through requirements that electricity suppliers obtain green certificates. There are four separate green certificate programmes (one for the federal government covering only offshore wind generation and one for each of the three regional governments covering a range of renewable technologies). The regional programmes have increasing annual quotas on the number of certificates each electricity supplier must obtain. An offshore renewable energy scheme has been established by the federal government to support the development of

renewable electricity production in the Belgian territorial sea. Renewable energy in transport is promoted through a federal biofuels mandate and some support for EVs, mainly tax breaks. Renewable heating and cooling are promoted mainly through regional building codes and support programmes tied to energy efficiency (see Chapter 4).

Under EU regulations, Belgium was required to develop a long-term energy and climate strategy contributing to the EU 2050 climate neutrality goal. Belgium's Long-term Strategy (LTS2050) was adopted in early 2020 and is based on long-term strategies of the regional governments and also specifies the role of the federal government (CNC, 2020). The LTS2050 is intended to put Belgium on a path that supports achievement of the Paris Agreement's goal of limiting global warming to well below 2°C, preferably to 1.5°C, and the EU goal of carbon neutrality by 2050. The LTS2050 is focused on emissions reduction targets for 2050 and details a variety of supporting measures across the electricity, industry, building, transport, agriculture and waste sectors.

In light of the Russian invasion of Ukraine and goals to reduce fossil fuel dependency, the federal government decided in March 2022 to take the necessary steps to extend 2 GW of nuclear capacity by ten years (see Chapters 7 and 8), and introduced a EUR 1.2 billion package to accelerate energy transition (see Chapters 4 and 5) and to protect consumers from high energy prices, including temporary reductions in excise duties for gasoline and diesel, and temporary value-added tax (VAT) reductions for electricity and natural gas.

Energy transition investment

The National Pact for Strategic Investments assesses the strategic investments needed through 2030 to meet Belgium's policy goals in the areas of digitalisation, cybersecurity, education, healthcare, energy and mobility. Based on the pact, the federal government developed an overview of the estimated investments required to achieve Belgium's 2030 energy and climate targets, which total EUR 84-88 billion (Table 2.2).

Experts from the federal and regional governments are co-operating to identify the funding sources and policy measures that will support the investments identified in the National Pact for Strategic Investments and achievement of the 2030 targets. This work examines all options, including budgetary and financial tools, various financing techniques (debt agencies, national promotional banks and financial market instruments), and funding sources (EU, federal, regional and private). One new source of funding is Belgian green linear bonds. In 2018 and 2019, the federal government launched the first green linear bonds, totalling EUR 6.89 billion, with the income being used solely for public expenditure on the transition to a sustainable economy. The expenditure from these bonds for the period 2021-2030 will be made in the transport, energy and buildings sectors.

Table 2.2 Investments needed to achieve Belgium's 2030 energy and climate targets according to the National Pact for Strategic Investments

Area	Recommendations	Funding (EUR billion)	
		Public	Private
Major renovation of public buildings	<ul style="list-style-type: none"> Invest heavily in renovating public buildings to make them intelligent and more energy efficient 	8.5	8.5
Electricity mix	<ul style="list-style-type: none"> Continue to guarantee security of supply at competitive prices Continue developing renewable energy, including in households Find a solution to further reduce the cost of renewable energy 	0	19
Strengthening of systems	<ul style="list-style-type: none"> Invest in transmission and distribution systems to ensure a fair and more flexible transition Support the development of smart grids 	0	17
Development of storage	<ul style="list-style-type: none"> Use the storage capacity (of vehicles, housing and businesses) Attract a battery producer to Belgium Develop pumped storage 	0	5
Roll-out of alternative fuels	<ul style="list-style-type: none"> Ensure that there are sufficient compressed natural gas refuelling stations and electric vehicle charging stations Support RD&D in hydrogen and green gas 	0	0.3
Nuclear decommissioning and waste management research	<ul style="list-style-type: none"> Support projects aimed at building the decommissioning knowledge of Belgian businesses via the Advanced Belgian Cluster on Decommissioning Research how to effectively treat nuclear waste 	0.7	1
Maintain and develop integrated transport networks and services	<ul style="list-style-type: none"> Service and maintain existing infrastructure Improve access to towns and cities, particularly through suburban rail systems, hubs and integrated cycle paths Improve rail access to ports and industrial parks and modernise shipping locks 	17.2-20.5	2.8-3.5
Facilitate intelligent mobility solutions	<ul style="list-style-type: none"> Create a single group mobility application to facilitate door-to-door mobility Roll-out intelligent transport systems to reduce congestion 	1.5-2	0.1
Manage transport demand	<ul style="list-style-type: none"> Promote spatial planning and redevelopment of industrial sites Create satellite offices and co-working spaces Smart charging for mobility services Promotional events on the theme of mobility 	0	2
Establish a support framework	<ul style="list-style-type: none"> Create a national mobility observatory Produce a multiannual, multimodal investment agenda providing a clear vision of investments and specific governance structures at the appropriate level (metropolitan, regional or national) 	0	< 0.1
Total		28-32	56-57
		84-88	

Energy taxation

Most of Belgium's taxation policy, including energy taxation, falls under the control of the federal government, including taxes and levies for transportation fuels, heating oil, other oil products, natural gas, coal and electricity. The regional governments also play a role in energy taxation policy as they control the taxes and fees on vehicles.

Taxes for oil products (diesel, gasoline, heating oil, etc.) consist of an excise duty, a special excise duty, a levy on energy, the value-added tax (VAT), and federal contributions related

to oil stockholding and to environmental and social funds (CREG, 2018). Natural gas and electricity are subject to the levy on energy and the VAT. The value of each tax component depends on both the type of energy product and the end-use. There are notable tax exemptions or reductions for certain uses of oil products and natural gas. Household and business consumers pay different tax rates on natural gas and electricity. Overall, industry and businesses pay lower tax rates on energy than households. Belgium's tax system also provides tax deductions for investments that support the energy transition, including for energy efficiency, renewables and green innovation.

Outside of participation in the ETS (required under EU directives), Belgium does not have a carbon-pricing mechanism. From 2017 to 2018, the government conducted a national debate on options for implementing a carbon price in non-ETS sectors with a focus on buildings and transport. The debate involved stakeholders and experts from the private sector, federal and regional governments, academia, associations, and trade unions. A report on the results of the debate was published in 2018 (BNDPCP, 2018).

The federal government aims to reform federal taxation to make it more climate- and environmentally friendly, following the polluter-pays principle and sending price signals driving decarbonisation. In support of this tax reform, the federal government will carry out a study in consultation with the regional governments to be published in 2022 with a goal to propose fiscal reforms by late 2023.

In January 2022, the federal government introduced an energy norm that uses structural reform and regular monitoring of energy bills to ensure that energy prices in Belgium do not exceed those of its neighbouring countries. It is foreseen that federal and regional energy regulators will conduct an annual study assessing whether excise duties exemptions or a tariff adjustment are needed to improve the competitiveness of companies and the purchasing power of households. If necessary, the federal share of the energy bill can be adjusted. To support implementation of the energy norm, the five federal energy levies were combined into a single excise duty on 1 January 2022 and the federal share of the energy bill was fixed at the 2021 level. Flanders also has an energy norm that functions in a manner similar to the federal energy norm, but which affects only energy fees that come from Flemish policy.

Fossil fuel subsidies

In the first quarter of 2021, the federal and regional governments sent the European Commission a required inventory of energy subsidies, including those for fossil fuels. In 2019, the subsidies with the largest forgone tax revenues were the reduced excises for heating oil (EUR 2.1 billion in forgone federal tax revenue), the reduced excises for gas (approximately EUR 1 billion in forgone federal tax revenue), the reduced excises for diesel for professional users or commercial and industrial use (approximately EUR 1.5 billion in forgone federal tax revenue), the tax and fiscal treatment of company cars (approximately EUR 2 billion in forgone federal tax revenue), fuel cards (approximately EUR 0.5 billion in forgone federal income tax), exemption from excise duty on aviation kerosene (approximately EUR 0.5 billion in forgone federal tax), and voluntary agreements with industry, which provide lower taxes to companies that meet certain energy efficiency requirements (approximately EUR 1 billion in forgone federal and regional tax revenue). The regional governments also have policies with respect to fossil fuel subsidies (to a lesser extent than the federal government since fossil fuel-related policies mainly fall within the competence of the federal government).

Under EU regulations, Belgium is required to report on the implementation of measures to phase out fossil fuel subsidies. The federal government will examine options for eliminating fossil fuel subsidies as part of the study to be carried out in support of the planned tax reform to make taxation climate- and environmentally friendly. The federal government has committed to developing an action plan to gradually phase out fossil fuel subsidies, including the favourable tax regime for fossil fuel-powered company cars. The regional governments have also taken steps to eliminate fossil fuel subsidies, in particular, eliminating support for oil-based heating in buildings; however, many of these measures support conversion to gas heating.

Energy poverty

To address energy poverty and ensure energy access for all, Belgium has a social tariff that results in reduced gas and electricity bills for residential consumers that meet certain socio-economic requirements. The federal government automatically notifies energy suppliers which of their consumers qualify for the social tariff. All energy suppliers must provide the social tariff to their qualifying consumers (FPS Economy, 2022a). In 2019, 9.1% of electricity consumers (around 438 000 consumers) and 9.9% of gas consumers (around 266 000 consumers) received the social tariff (CREG, 2020a). In 2021, eligibility for the social tariff was temporarily expanded for one year in response to the Covid-19 pandemic to all consumers with a gross income below EUR 20 000, for energy customers who are entitled to the increased reimbursement through the health insurance fund (FPS Economy, 2022b). Following this expansion of eligibility, 9.7% of electricity consumers (around 470 000 consumers) and 10% of gas consumers (around 295 000 consumers) received the social tariff (CREG, 2020a). The federal government has indicated an interest in maintaining the income eligibility criteria for the social tariff.

Since July 2020, the CREG (Belgium's energy sector regulator) sets the social tariff every three months. The energy component of the social tariff is set at the lowest retail tariff available in Belgium over the previous month. The distribution and transmission components of the social tariff are set to the lowest distribution and transmission tariffs in Belgium during the previous month. There are also caps that limit how much the tariffs can be increased from one quarter to the next (CREG, 2020b). From 2017 to 2019, the electricity social tariff was 34-36% less than the average electricity retail price, while the gas social tariff was 38-48% less than the average gas retail price. The reduced revenues resulting from the social tariff are refunded to energy suppliers from the fund for protected consumers, which is financed by the federal contribution paid by all energy consumers (CREG, 2020b). The expansion in 2021 was financed through public funds so as to not increase the energy bills (CREG, 2021).

The federal government is working to introduce a social tariff for heating. However, very little heating demand in Belgium is covered by direct supply of heat. In 2019, district heating covered just 1% of energy demand from service sector buildings and just 0.2% of energy demand from residential buildings.

Energy poverty is also addressed through the federal government's Social Heating Fund, which provides residential consumers that meet certain socio-economic requirements with direct payments covering a portion of the costs for oil-based heating (kerosene, propane, heating oil). Payments depend on the price paid for the fuel and range from EUR 210 to EUR 300 per year per household. The Social Heating Fund is partially financed through

a federal contribution charge to consumers purchasing oil products intended for heating and partly through public funds (FSC, 2004).

From 2015 to 2019, the share of households receiving payments from the Social Heating Fund decreased from 96 588 (2% of households) to 85 813 (1.73% of total households). Payments from the Social Heating Fund are based on receipts sent by qualifying consumers to accountants certified by the government. In response to the Covid-19 pandemic, the deadline for submitting receipts was extended and the government expects the number of households receiving these payments to increase.

The regional governments created public service obligations that prevent consumers unable to pay their electricity or gas bills from being disconnected. The details of the public service obligations vary between the regions, but in general consumers who cannot pay their energy supplier (dropped consumers) receive gas or electricity from a supplier of last resort. The regional governments have assigned the role of supplier of last resort to the various distribution system operators. Different systems, including prepaid meters and federal regulated tariffs, are used to ensure dropped consumers continue to receive electricity and gas while paying their debts to energy suppliers.

From 2017 to 2019, the share of dropped electricity consumers increased from 81 012 (1.7% of electricity consumers) to 85 332 (1.8% of electricity consumers). The share of dropped gas consumers declined from 62 778 (2.3% of gas consumers) to 59 015 (2.3% of gas consumers). In response to the Covid-19 pandemic, changes were made to increase protection for dropped consumers and it is expected that the number of dropped consumers increased in 2020.

The regional governments also have programmes for residential energy efficiency to address energy poverty by providing increased financial support based on socio-economic conditions. Wallonia provides subsidies to increase the energy efficiency of homes; low-income residents are eligible for higher subsidies. The amount of energy premiums provided by the Brussels-Capital Region are also higher for low-income residents.

Flanders has premiums and loan schemes for building renovation and household appliances that provide favourable access for vulnerable households. People at risk of energy poverty in Flanders can apply for a free energy scan. An energy efficiency expert visits their home to find solutions to reduce their energy bill. Protected consumers in Flanders have a right to a EUR 150 discount voucher to buy an energy-efficient refrigerator or washing machine. Flanders also has a programme to renovate low efficiency homes occupied by low-income residents. Qualifying residents receive EUR 30 000 and technical and social support throughout the renovation process.

International collaboration

Because of Belgium's central location in Europe, well-interconnected electricity and natural gas infrastructure, and large port infrastructure for oil and natural gas trade, the country plays an important role in the European energy system. Belgium places a priority on international co-operation related to energy and is highly active in numerous international institutions focused on energy markets and security. Through the Benelux Union, Belgium co-operates with Luxembourg and the Netherlands on a wide range of energy issues, especially related to security of supply. Through the Pentalateral Energy Forum, Belgium co-operates with Austria, France, Germany, Luxembourg, the Netherlands and Switzerland on a wide range of energy market and security issues, such as regional

generation adequacy assessments carried out by the TSOs of Pentalateral Energy Forum countries in 2015 and 2018. Through the North Seas Energy Cooperation, Belgium cooperates on offshore wind with Denmark, France, Germany, Ireland, Luxembourg, the Netherlands, Norway and Sweden.

Hydrogen

In November 2021, the Council of Ministers approved the federal Hydrogen Strategy, which lays out the federal government's vision for low-carbon hydrogen in Belgium's economy and energy sector through 2050. The focus is mainly on becoming an import and trading hub, and on using hydrogen to decarbonise industry and heavy transport (and potentially other sectors in the long term). The strategy estimated that Belgium's demand for low-carbon hydrogen could reach 3-6 terawatts (TWh) by 2030 and 100-165 TWh by 2050, while noting regional demand could be double these values.

The strategy notes EU goals for European electrolyser capacity to reach 6 GW by 2024 and 40 GW by 2030. However, it indicates that Belgium will not become a large-scale producer of low-carbon hydrogen, citing concerns over limited land area. The strategy notes that Belgium's National Recovery and Resilience Plan contains funding to support the deployment of at least 150 MW of electrolysis capacity by 2026. The strategy does not have any other targets or goals for low-carbon hydrogen production and indicates that most of Belgium's hydrogen demand will be covered by imports.

The strategy contains four pillars. Pillar 1, "positioning as an import and transit hub for renewable molecules in Europe", includes goals of finding international partners for the import of renewable molecules, providing financial support for hydrogen import infrastructure by 2022, and pushing for the development of a European voluntary certification scheme and a register for renewable fuels of non-biological origin by 2025. Pillar 2, "consolidating Belgian leadership in hydrogen technologies", includes goals of adapting existing research and innovation funding to support hydrogen technologies (see Chapter 6), providing financial support to develop hydrogen testing infrastructure by 2022 and limited deployment of domestic electrolysis capacity (at least 150 MW by 2026).

Pillar 3, "establishing a robust hydrogen market", includes goals to implement a framework ensuring optimal planning of energy networks (hydrogen, electricity and natural gas) by 2021, adapting the legal and regulatory framework for hydrogen pipeline transport by 2023, with a public consultation of the market players launched in 2022. Pillar 3 also contains goals on infrastructure, including commissioning at least 100-160 km of new open access hydrogen transport pipelines by 2026 and a 2030 target to connect the domestic hydrogen network to networks in neighbouring countries to become an import and transit hub.

Pillar 4, "investing in co-operation", includes key goals to implement a structural consultation on hydrogen in Belgium between the federal and regional governments; adopt a proactive and dynamic attitude within the working groups dedicated to hydrogen (Benelux, Pentalateral Energy Forum, European Union); represent Belgium in international organisations and forums on hydrogen; engage in continuous interactions with the sector, research institutes and citizens to keep the Hydrogen Strategy up-to-date with the evolving issues and needs.

The regional governments have also developed strategies and support schemes for hydrogen. They also support several EU projects of common interest on hydrogen.

Wallonia is considering the establishment of a support mechanism to encourage building hydrogen-related infrastructure, and the taxation of hydrogen vehicles will be reviewed in order to fine-tune Wallonia's objectives in terms of the development alternative fuels. The regional governments are supporting several EU projects of common interest on hydrogen.

Flanders has a detailed regional Hydrogen Strategy covering production and demand. It includes targets for large- and small-scale electrolysis with combined capacity of at least 221 MW by 2025 and 560 MW by 2030. It also aims to decarbonise current natural gas hydrogen production and to greatly expand hydrogen import and transport infrastructure. It provides 2025 and 2030 goals to increase the use of hydrogen in industry transport and buildings. In October 2021, Flanders and the European Investment Bank signed a memorandum of understanding to collaborate on financing and implementing hydrogen projects in Flanders.

Energy security overview

Belgium faces near-term challenges to the security of its electricity supply. Nuclear energy is Belgium's largest source of electricity, covering 47% of generation in 2019. The federal government is committed to phasing out most nuclear electricity generation by 2025 and has developed a capacity remuneration mechanism (CRM) that aims to ensure security of electricity supply as nuclear generation is reduced. The CRM uses auctions that award payments for availability of capacity to drive deployment of additional capacity and retention of existing capacity including generation, demand-side response (DSR), storage and retention of existing of existing capacity There are two auctions per delivery year (one auction four years ahead of the delivery year and one auction one year ahead) (EUR-Lex, 2019).

The first CRM auction was held in October 2021 for delivery of capacity in 2025 and awarded payments to around 4.4 GW of capacity, mainly to natural gas generation including new gas-fired plants. In light of the Russian invasion of Ukraine and goals to reduce fossil fuel dependency, the federal government decided in March 2022 to take the necessary steps to extend 2 GW of nuclear capacity by ten years, and introduced a EUR 1.2 billion package to accelerate energy transition (see Chapters 5, 7 and 8).

There are also energy security issues related to Belgium's natural gas supply. Almost 50% of Belgium's gas imports come from the Netherlands. Most of these imports are low-calorific gas (L-gas) from the Groningen gas field, which will stop production in mid-2022. Belgium and neighbouring countries are taking steps to ensure security of gas supply as production from Groningen is phased out. Belgium is in the process of converting its L-gas network to support high-calorific gas (H-gas). Due to faster than expected progress on infrastructure conversion, Belgium now aims for a complete transition of its gas supply and infrastructure to H-gas by 2024, well ahead of the original goal of 2029 (see Chapter 9).

Covid-19 response

Belgium is still assessing the impact of the pandemic on its energy policies and markets. However, several measures to address the impacts of the pandemic on the energy sector have been implemented. At the federal level, eligibility for the social tariff was temporarily

expanded to cover additional consumers. Wallonia developed a regional protected customer tariff that applies to a wider range of consumers than the federal social tariff, and introduced a new category of economically protected consumer.

Flanders approved legislation providing a lump sum to cover the energy costs of households in which at least one member was temporarily unemployed due to the pandemic and prohibiting electricity and gas from being cut off for all households. Flanders also extended the deadlines to apply for zero-emission vehicle grants, to repay loans for building energy efficiency measures and to obtain building energy performance certificates. The Brussels-Capital Region extended a winter period prohibition on shutting off energy meters to cover all of 2020, broadened the criteria of protected consumers to include those who lost income because of the pandemic, and created additional energy grants to encourage renovation and support the construction sector.

In response to the pandemic, the EU approved EUR 750 billion in funding to support recovery and resilience plans developed by each EU member state. In June 2021, the European Commission approved Belgium's EUR 5.9 billion National Recovery and Resilience Pplan. More than half of the plan's funding contributes to Belgium's climate and energy goals, including EUR 1 012 million for building renovation, EUR 672 million for modal shifts in transport and EUR 100 million for the development of an offshore energy hub (EC, 2021).

The Belgian plan includes investments to improve the energy efficiency of public buildings and private and social housing, including renovation subsidies for households. The plan has several measures to increase efficiency and reduce emissions from the transport sector, including support for active modes of transport like biking and walking and for public transport, particularly rail. There are measures to drive the electrification of public and private transport, including accelerated deployment of EV charging infrastructure and a reform of the company car tax scheme geared towards electrification. Several measures support the production, transportation and use of hydrogen production based on renewable energy, with a goal for Belgium to reach at least 150 MW of electrolysis capacity by 2025. The plan also supports CCUS, including cross-boarder infrastructure for CO₂ transportation.

The European Commission provided an overall positive endorsement of Belgium's plan and noted that it should have a positive economic impact and drive public and private investments in areas relevant for Belgium's energy and climate goals. However, the European Commission pointed out that the plan has limited investments in renewable energy and indicated that additional funding and measures beyond what is detailed in the plan are needed to achieve Belgium's 2030 renewable energy targets.

Assessment

In 2017, the energy ministers of Belgium's federal and regional governments reached an agreement on a Belgian Inter-federal Energy Pact, which is a common vision for Belgium's energy transition to 2030. The Energy Pact guides co-operation on energy policy and was an input for developing the National Energy and Climate Plan, Belgium's main energy and climate policy document through 2030. However, both the Energy Pact and the NECP often lack a coherent national perspective. For example, for some energy topics, it can be unclear how the various federal and regional policies and measures will interact with each

other or exactly how the combined efforts of the federal and regional governments support the achievement of national-level targets. The federal and regional governments should consider developing a new Energy Pact and/or using the update of the NECP in 2023 to present a clear and more coherent path to the achievement of national targets and long-term goals.

Belgium's energy and climate policy is driven by 2020 and 2030 targets for GHG emissions reductions, energy efficiency and renewable energy that support EU-wide targets. A policy agreement signed in 2018 on burden sharing divides responsibility between the federal and regional governments for Belgium's 2020 targets on non-ETS GHG emissions reduction and renewable energy. Under this agreement, each entity is responsible for reaching its assigned targets, which are then added up to form Belgium's contribution to the EU-wide targets. Belgium has mixed performance on the achievement of its 2020 targets: the energy efficiency targets were not achieved and achievement of the renewable energy target required purchasing statistical renewable energy transfers from other EU member states. The federal and regional governments are still working to finalise a new burden-sharing agreement to allocate Belgium's contributions to the 2030 EU-wide targets. The IEA recommends examining the factors that led to the mixed performance on the 2020 targets and use this information when developing the burden-sharing agreement for the 2030 targets. The new burden-sharing agreement should also use transparent mechanisms and methodologies, and be concluded in a timely manner to avoid renegotiations during the implementation period and to give clarity to all stakeholders involved in its implementation.

In 2021, the EU-wide GHG emissions reduction target for 2030 was increased from 40% to 55%. This additional ambition at EU level will likely require Belgium to set higher 2030 targets and develop additional measures for GHG emissions reductions, renewable energy and energy efficiency. More ambitious targets accounting for the EU 55% target should be included in the new burden-sharing agreement. In addition, these more ambitious targets and additional measures should be included in the updated draft NECP requested by the European Commission in 2023. Both steps would help to send a clear signal to investors.

Belgium is facing near-term challenges related to the security of electricity supply. The federal government is committed to phasing out most nuclear electricity generation by 2025 and has developed a CRM that aims to ensure security of electricity supply as nuclear generation is reduced. The first CRM auction was conducted in October 2021 and awarded payments to 4.4 GW of capacity, mainly to natural gas (2.0 GW existing and 1.6 GW new), and smaller amounts to existing co-generation, DSR and other technologies.

The federal government has expressed concerns about the timely deployment of new projects selected in the CRM. The federal government should closely monitor the CRM results, including progress on the deployment of new projects selected in the auctions and work with the regional governments to identify and mitigate risks to timely project deployment. This includes ensuring that permitting requests for projects and supporting infrastructure are processed and delivered in a transparent and timely manner.

In light of the Russian invasion of Ukraine and goals to reduce fossil fuel dependency, the federal government decided in March 2022 to take the necessary steps to extend 2 GW of nuclear capacity by ten years. The extension of the 2 GW of nuclear capacity requires notable investments at Belgium's two nuclear plants and completion of complex regulatory

processes. It is expected that no nuclear generation will be available the winter of 2025-26 and that the steps needed to complete the extension of the 2 GW of capacity will not be completed until 2026 or later.

Belgium is highly dependent on fossil fuels and the NECP estimates an increasing share of fossil fuels in Belgium's energy supply mainly due to a growing use of natural gas (from 24.4% of gross consumption in 2020 to 38.9% in 2030). The estimated increase in natural gas demand and associated GHG emissions results mainly from the expected deployment of new gas-fired electricity generation resulting from the phase-out of most nuclear generation and CRM auction. In June 2021, Belgium passed a royal decree making it mandatory for developers of new gas-fired plants to commit to net zero emissions by 2050 (Moestue, 2021). The IEA commends this step, but recommends developing a more detailed plan to reduce the climate impacts of any new gas-fired generation, provide clear guidance to investors and avoid stranded assets.

Belgium's energy policy emphasises reducing energy poverty and ensuring energy access. The federal government implemented a social tariff that results in reduced gas and electricity bills for residential consumers that meet certain socio-economic requirements. In 2020, 9.7% of electricity consumers and 10% of gas consumers benefited from the social tariff. The federal Social Heating Fund provides residential consumers that meet certain socio-economic criteria with direct payments covering part of the costs for oil-based heating. In 2019, around 5% of all households using heating oil received payments from the Social Heating Fund. The Flemish government has introduced premium and loan schemes for building renovation and household appliances. Certain vulnerable households have extra favourable access to these schemes. The Flemish government wants to reduce energy poverty by reducing consumption with structural, sustainable, long-term measures.

While the need to protect vulnerable households is an understandable priority, policy mechanisms that artificially reduce the cost for energy products distort markets, and can increase energy consumption and related GHG emissions. The IEA encourages Belgium to use cost-benefit analysis to examine which support measures best serve the needs of vulnerable consumers, while minimising market distortions and aligning with decarbonisation goals. Especially critical are energy efficiency measures, promoting renewables and improving the comfort of residences. The IEA recommends consulting renewable and energy efficiency associations along with retail energy suppliers and distribution network operators when examining options to more effectively address energy poverty.

The federal government has committed to developing an action plan to gradually phase out fossil fuel subsidies, including tax reductions for fossil fuel-powered company cars. The regional governments have also taken steps to eliminate fossil fuel subsidies, in particular with the elimination of support for oil-based heating in buildings. However, many of these measures support a conversion to gas heating, when a focus on heat pumps and energy efficiency would be more effective in reducing emissions. The IEA strongly encourages the federal and regional governments to quickly eliminate all fossil fuel subsidies.

The federal government aims to reform federal taxation to make it more climate- and environmentally friendly, following the polluter-pays principle and sending price signals supporting decarbonisation. This process presents an excellent opportunity to address several issues that will help energy price signals drive investments and behaviours in

line with Belgium's climate and energy goals. The tax reform should take a broad approach that includes eliminating fossil fuel subsidies, reducing electricity prices, introducing carbon pricing and tackling energy poverty. The reform should be accelerated and concluded as soon as possible to send a clear signal to investors and consumers.

Because of numerous non-energy charges on electricity bills, Belgium's electricity prices are among the highest in Europe. Electricity is significantly more expensive in comparison to oil and gas. The NECP assigns an important role to electrification for decarbonising the transport, buildings and industrial sectors. But the high cost of electricity limits its ability to compete with other energy carriers and reduces the incentive on consumers and businesses to invest in the electrification of building heating, transportation, industrial processes and other key areas. Under the current tariff structure, home heating with electricity is 50% more expensive than heating with natural gas or fuel oil, even though electric heating is more efficient and less polluting. In addition, lower electricity prices would improve the situation of vulnerable households and help to foster industrial competitiveness.

The federal and regional governments, together with energy regulators, should examine how electricity prices can be reduced in line with efforts to reform energy taxation, eliminate fossil fuel subsidies, address energy poverty, develop an energy norm and drive decarbonisation through electrification. One clear option would be to remove charges that are not related to the generation, transmission and distribution of electricity from electricity bills and finance the programmes associated with these charges through the federal and regional budgets or other means.

Belgium's National Recovery and Resilience Plan is highly ambitious, with more than half of the investments contributing to Belgium's climate and energy goals. Under EU regulations, projects have to be implemented between 2021 and 2026, which may be a challenge, as many projects will take time to prepare and will have to obtain planning and environmental permits from federal and/or regional governments. The IEA recommends that the federal and regional governments make a strong effort to efficiently process permitting requests related to the Recovery and Resilience Plan projects.

There is no legal obligation to consult the Belgian Competition Authority on the design of energy policies. Competitive and well-functioning markets are key for the integration of renewables and energy efficiency, as well as the active participation of consumers. The IEA recommends consulting the Belgian Competition Authority in a structural manner on energy policy development.

Recommendations

The government of Belgium should:

- Swiftly conclude an agreement between the federal and regional governments on burden sharing of Belgium's contribution to EU-wide targets for greenhouse gas emissions reduction, renewables and energy efficiency, while taking into account lessons learnt from the 2020 agreement and the need for flexibility to react to changes or unforeseen developments.
- Adopt a common long-term energy vision between the federal and regional governments and develop holistic and coherent policies and measures that are clearly aligned with national-level targets and goals.
- Proceed swiftly with the planned fiscal reform to ensure taxation steers consumer and business behaviour towards achieving energy and climate goals, taking into account the commitment to phase out fossil fuel subsidies, the recent study on carbon pricing and the goal to increase electrification.
- Ensure measures addressing energy poverty foster the use of renewable energy and energy efficiency improvements, enable a just transition that protects vulnerable households and makes them part of the energy transition.
- Prepare scenarios to maintain generation adequacy after 2025 in case the capacity remuneration mechanism or the planned extension of 2 GW of nuclear generation do not result in the needed capacity, and work with the regional governments to identify and mitigate risks to the timely deployment of new energy projects.

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3. Energy and climate change

Key data

GHG emissions without LULUCF (2019): 116.65 Mt CO₂-eq, -19.9% since 2005, -19.9% since 1990

GHG emissions with LULUCF (2019): 115.6 Mt CO₂-eq, -19.4% since 2005, -18.8% since 1990

Energy-related CO₂ emissions (2020):

CO₂ emissions from fuel combustion: 82.7 Mt CO₂, -14% from 2010 to 2019, -8% from 2019 to 2020

CO₂ emissions by fuel: oil 46.4%, natural gas 39.6%, coal 10.3%, non-renewable waste 3.8%

CO₂ emissions by sector: industry 31.7%, buildings 26.4%, transport 25.3%, electricity and heat generation 16.6%

CO₂ intensity per GDP: 0.179 kg CO₂/USD (IEA weighted average in 2019: 0.197 kg CO₂/USD)

Overview

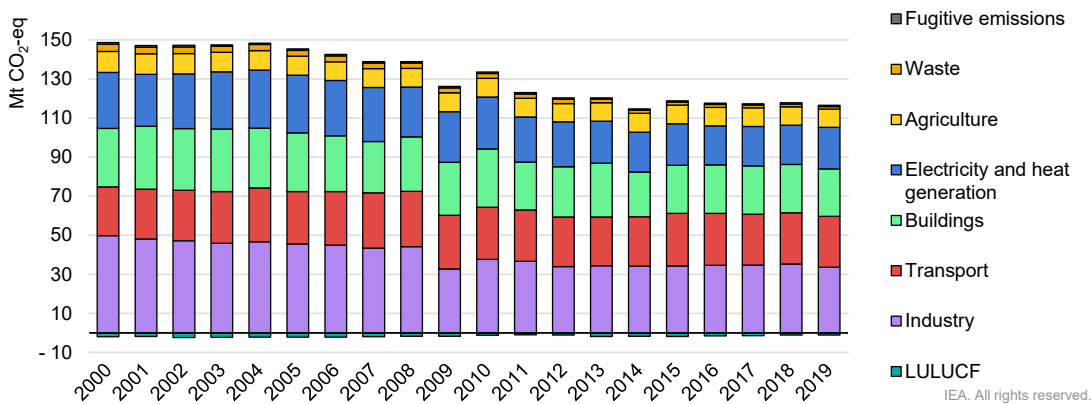
Under EU regulations, Belgium has targets to reduce non-ETS GHG emissions by 15% by 2020 and by 35% by 2030; both targets are compared to 2005 levels. Belgium will likely meet its 2020 target, as it overachieved on its trajectory to 2020 to compensate for an actual shortfall in 2020. In 2021, the 2030 EU-wide GHG emissions reduction target was increased from 40% to 55% by 2030 (versus the 1990 level). This additional ambition at the European level will likely require Belgium to adopt a non-ETS emissions reduction target for 2030 that is higher than 35%, and to take stronger actions to reduce emissions.

Belgium's climate and energy policies are focused on reducing GHG emissions through the deployment of renewables and improving energy efficiency. Belgium's NECP is the key document defining climate and energy policies through 2030 and defines the federal and regional measures to meet the 2030 non-ETS target. The European Commission estimated that the NECP's emissions reduction measures would result in a reduction of 34.4% by 2030, just missing Belgium's target.

Between 2005 and 2012, Belgium's GHG emissions excluding land use, land-use change and forestry (LULUCF) experienced a relatively steady decline, from 146 million tonnes of CO₂-equivalent to 120 million tonnes of CO₂ equivalent (Mt CO₂-eq). Since 2012, emissions have been relatively stable and were 117 Mt CO₂-eq in 2019 (Figure 3.1). LULUCF has consistently acted as a carbon sink in Belgium, absorbing around

1 Mt CO₂-eq of emissions each year from 2000 to 2019. The majority of Belgium's GHG emissions are energy-related (74% in 2019).

Figure 3.1 Greenhouse gas emissions by sector in Belgium, 2000-2019



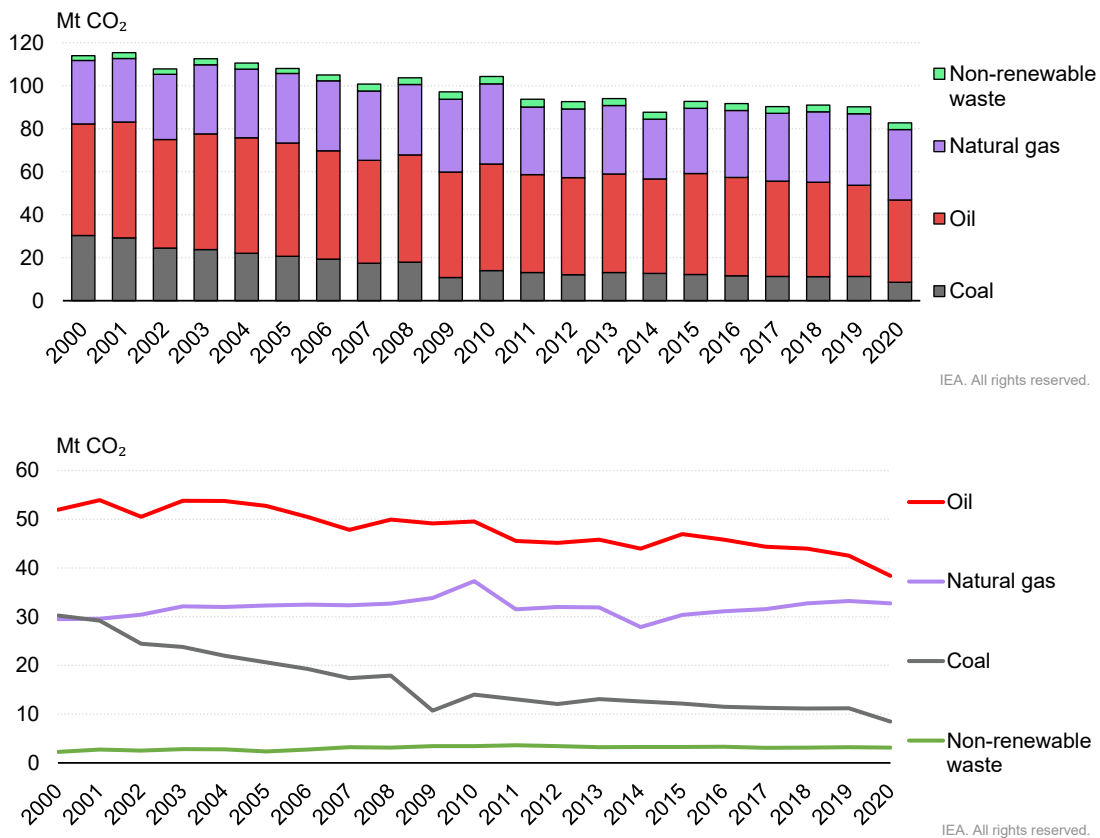
Source: UNFCCC (2021), *Greenhouse Gas Inventory Data* (database), https://di.unfccc.int/detailed_data_by_party.

Energy-related CO₂ emissions

Prior to 2011, Belgium experienced a relatively consistent decline in energy-related CO₂ emissions, with the exception of notably higher emissions in 2010 resulting from abnormally cold weather. Since 2011, emission reductions have slowed (Figure 3.2). From 2011 to 2019, energy-related emissions fell by just 3.6 Mt CO₂ to reach 90 Mt CO₂. In 2020, impacts from the Covid-19 pandemic resulted in energy-related CO₂ emissions dropping by 8% to 83 Mt CO₂, with most of this reduction coming from a sharp drop in transportation demand for oil along with a decline of industry demand for coal. In 2020, industry accounted for the largest share (32%) of energy-related CO₂ emissions, followed by buildings (26%), transport (25%), and electricity and heat generation (17%). Belgium's energy-related CO₂ emissions come mostly from oil (46% in 2020) and natural gas (40%), while coal accounted for 10% and non-renewable waste just 4%.

Industry emissions come mainly from gas (53% in 2020) and oil (26%), both of which are used in the refining and petrochemical industries and to meet industrial process heat demand. Transport sector emissions come mainly from road transport demand for diesel (78% in 2020) and gasoline (21%). Building emissions come mainly from natural gas (52% in 2020) and oil (47%), which are the main fuels for building heating. Belgium's share of building emissions from oil was notably higher than the IEA average of 24% in 2019. Electricity emissions come from natural gas (58% in 2020) and from generation based on gases recovered from coal-fired blast furnaces (28%).

Figure 3.2 Energy-related CO₂ emissions by sector and source in Belgium, 2000-2020



Energy-related CO₂ emissions declined by 7% between 2009 and 2019. Emissions from coal and oil decreased, while natural gas emissions have increased since 2014.

Source: IEA (2022), *Greenhouse Gas Emissions from Energy* (database), <https://www.iea.org/data-and-statistics/data-product/greenhouse-gas-emissions-from-energy>.

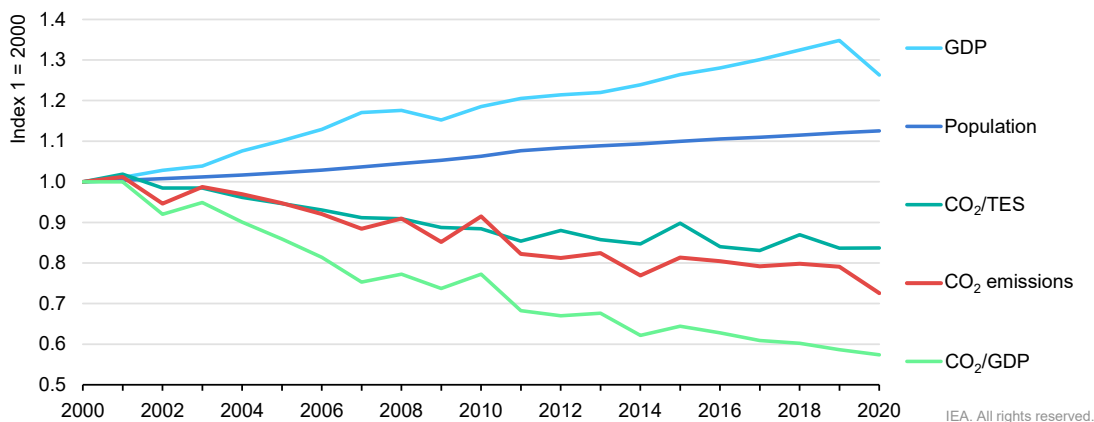
CO₂ emission drivers and carbon intensity

From 2010 to 2019, total energy-related CO₂ emissions in Belgium declined by 7% despite a 10% growth in GDP per capita and a 6% increase in population (Figure 3.3). This is in line with a 20% reduction in the carbon intensity of the economy (CO₂ per GDP) as well as a decrease of 6% in the carbon intensity of the energy supply mix (CO₂ per TES) over the same period.

In 2019, the carbon intensity of Belgium's energy supply was 39.2 tonnes CO₂ per terajoule (t CO₂ per TJ), the seventh-lowest among IEA member countries, and lower than both the overall IEA average (50.4 t CO₂ per TJ) and the average of European IEA countries (46.2 t CO₂ per TJ). The carbon intensity of Belgium's energy supply is relatively low thanks to the large role of nuclear energy, which covered 18% of TES and 39% of electricity generation in 2020, and renewables, which covered around 9% of TES and 26% of electricity generation in the same year.

Despite having a relatively low-carbon energy supply, Belgium's carbon intensity of GDP (0.16 kilogrammes [kg] of CO₂ per USD in 2019) was higher than all of its neighbouring countries and higher than the average for European IEA member countries (0.14 kg CO₂ per USD). This higher carbon intensity of GDP results from Belgium's concentration of heavy industry and the major role of chemical and petrochemicals, which accounted for 59% of industry energy demand in 2019. However, Belgium's carbon intensity of GDP was lower than the IEA weighted average of 0.2 kg CO₂ per USD. This shows the benefit of Belgium's low-carbon energy supply in reducing the carbon intensity of economic activity in the service sector and other areas of the economy with high levels of electrification.

Figure 3.3 Energy-related CO₂ emissions and main drivers in Belgium, 2000-2020



Decreasing CO₂ emissions and increasing population and GDP per capita show decoupling between carbon emissions and economic growth in Belgium.

Source: IEA (2022), *Greenhouse Gas Emissions from Energy* (database), <https://www.iea.org/data-and-statistics/data-product/greenhouse-gas-emissions-from-energy>.

From 2009 to 2019, the carbon intensity of Belgium's electricity generation dropped from 215 g CO₂ per kilowatt-hour (kWh) to 168 g CO₂ per kWh, due to the growth in renewable energy sources combined with a coal phase-out. In 2019, the emissions intensity of Belgium's electricity generation was half of the IEA weighted average (337 g CO₂ per kWh), thanks mainly to generation from nuclear and also to increasing generation from wind and solar PV. Together, nuclear, wind and solar PV accounted for 67% of generation in 2019.

Belgium's ETS emissions are expected to increase from 42.3 Mt CO₂ in 2020 to 58.1 Mt CO₂ by 2030, mainly because of increased gas-fired generation resulting from the nuclear power phase-out. This would notably increase the carbon intensity of Belgium's electricity generation, energy supply and economy.

Climate targets

Like in other EU countries, GHG emissions reduction policy in Belgium is governed by European regulations. Emissions from large electricity plants and energy-intensive industrial facilities are regulated under the EU ETS. The ETS uses tradable emissions allowances to drive emissions reductions at ETS-regulated facilities in the EU, Iceland, Liechtenstein and Norway. The ETS has targets to reduce emissions from regulated

facilities by 21% by 2020 and 43% by 2030 (both versus 2005 levels). All other emissions (non-ETS) are governed by national targets that are agreed within the EU.

Belgium has targets to reduce non-ETS GHG emissions by 15% by 2020 under the EU Effort Sharing Decision (ESD) and by 35% by 2030 under the EU Effort Sharing Regulation (ESR). Both targets are reductions versus 2005 levels. The ESD and ESR set non-ETS targets in all EU member states and in combination with the ETS targets aim for a 20% reduction in EU-wide GHG emissions by 2020 and a 40% reduction by 2030 (both versus 1990 levels).

This division of responsibility to achieve the 2020 emissions reduction target was divided between the federal and regional governments through a burden-sharing agreement adopted in 2018. The federal and regional governments are still in the process of developing a new burden-sharing agreement for the emissions reductions required to meet the 2030 targets.

Most of Belgium's GHG emissions are, however, not covered by the ETS. In 2019, 62% of Belgium's GHG emissions were from non-ETS sources, with the largest shares coming from transport (36%) and buildings (30%) (EEA, 2021). In 2019, Belgium achieved an 8.8% reduction in non-ETS emissions versus 2005 levels. However, Belgium will meet its 2020 target of a 15% reduction versus 2005 under EU accounting rules that allow credits from years when emissions were below annual targets to offset deficits for years when emissions exceeded annual targets (Table 3.1). From 2013 to 2018, Belgium's validated emissions were below the annual target every year except for 2016 and 2018; however, the excess emissions in 2016 and 2018 were offset by credits from surpassing the target in other years, and Belgium expects that these credits will cover any excess emissions in 2019 and 2020 (Climat.Be, 2020).

Table 3.1 Belgium's non-ETS greenhouse gas emissions and targets, 2013-2020

Non-ETS emissions (Mt CO₂-eq)	2013	2014	2015	2016	2017	2018	2019	2020
Annual emissions target	78.4	76.9	75.3	73.8	72.5	71.1	69.7	68.2
Validated annual emissions	74.3	70.1	72.7	74.1	70.8	74.3	72.0	66.7
Emissions over (+) or under (-) target	-4.1	-6.8	-2.6	0.3	-1.7	3.2	2.3	-1.5
Net credits to offset emissions	4.1	10.9	13.5	13.2	14.9	11.7	9.4	7.9

In October 2020, the European Commission commented on Belgium's NECP, noting that the implementation of the NECP's emissions reduction measures would result in a reduction of 34.4% by 2030, just missing Belgium's target. In 2021, the 2030 EU-wide GHG emissions reduction target was increased from 40% to 55%. The legislative package proposed by the European Commission in July 2021 is intended to revise several pieces of EU climate legislation, including the ETS and ESR, to align with the 55% target. In the European Commission's proposal, Belgium's emissions reduction target for sectors covered by the ESR (non-ETS) is set to -47% by 2030 in relation to 2005 levels.

It is likely that Belgium will need to increase the ambition of its 2030 targets for non-ETS emissions, renewable energy and energy efficiency to help achieve the new EU-wide 55% GHG reduction target.

As an EU member state, Belgium is a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) and reports GHG emissions annually to the UNFCCC to show its contribution to EU-wide emissions reductions under the Paris Agreement. In March 2020, the EU sent a long-term strategy to the UNFCCC committing to EU carbon neutrality by 2050. Belgium supports EU carbon neutrality by 2050 and under EU requirements has adopted its own long-term strategy for energy and climate (LTS2050). The LTS2050 aims to put Belgium on a path that supports the Paris Agreement and EU 2050 carbon neutrality, but it does not include a clear target for national climate neutrality by 2050 (CNC, 2020).

The LTS2050 is based on the long-term strategies of the regional governments. The Long-term Strategy of Wallonia aims to achieve carbon neutrality by 2050 through a reduction of GHG emissions by 95% compared to 1990, supplemented by CCUS and negative emissions. The Long-term Strategy of Flanders aims to reduce GHG emissions from non-ETS sectors by 85% by 2050 (versus 2005), with the ambition to move towards carbon neutrality. The Climate Ordinance of the Brussels-Capital Region aims reduce GHG emissions by 90% by 2050 (versus 2005). The LTS2050 contains an estimation of the expected emissions reduction resulting from the implementation the three regional strategies (Table 3.2).

Table 3.2 Belgium's estimated emissions reductions under the LTS2050

Emission source	Reduction in 2050 versus 2005
Electricity	-100%
Transport	-100%
Industry (non-ETS)	-76% to -83%
Buildings	-89% to -91%
Agriculture	-45% to -51%
Waste	-95% to -98%
Total non-ETS	-85% to -87%

Climate policy

Responsibility for climate policy is divided between the federal and regional governments with co-ordination of climate policy through the National Climate Commission (NCC) and the Coordination Committee for International Environmental Policy (CCIEP). The NCC advises the CCIEP and other government entities on climate issues and approves reports to the EU and the UNFCCC. The NCC also evaluates co-operation between the federal and regional governments and the implementation and environmental, social and economic impacts of the NECP's policies and measures. The CCIEP enables Belgium to present a unified national perspective on environmental matters (including climate) within international organisations, including the EU and the UNFCCC. The CCIEP includes steering and working groups on climate change.

The NECP is Belgium's main climate policy document, defining the emissions reductions measures to be implemented by the federal and regional governments to achieve the 2030 emissions reduction target. The NECP measures are focused on reducing energy demand (see Chapter 4) and increasing the deployment of renewable energy, especially for electricity generation and transport (see Chapter 5). Most of Belgium's emissions

reductions measures are implemented by the regional governments, which have responsibility for most policy for renewable energy and energy efficiency (except for federal buildings and fleets). The federal government also plays a role in driving emissions reductions, notably by setting policy for offshore energy, investments in rail transport, product policy (ecodesign), fiscal measures, and by exchanging technical expertise and other support with the regional governments.

Emissions reductions from electricity generation are promoted mainly through the ETS and programmes that require electricity suppliers to obtain green certificates that are linked to electricity generated from renewables. There are four separate green certificate programmes (one for the federal government covering offshore wind generation and one for each of the three regional governments covering a range of technologies). There are additional programmes supporting the deployment of small-scale distributed renewables (see Chapter 5).

Emissions reductions from transport are promoted mainly through vehicle taxation that favours the adoption of low-emission vehicles and EVs. The regional governments are responsible for the registration tax (paid once at the purchase of a vehicle) and the vehicle tax (paid annually). In all regions, these taxes are proportionate to a vehicle's emissions and EVs are exempted, providing financial incentives to purchase low-emission vehicles and EVs. The system for taxing company cars also favours low-emission vehicles and EVs, and there are numerous programmes and measures to reduce transport emissions through modal shifts (see Chapter 4).

Regional governments have the main responsibility for reducing emissions from buildings, with policy focused on energy efficiency and to a smaller degree distributed renewable energy. The federal government is mainly focused on reducing emissions from federal buildings, but also contributes through setting appliance efficiency standards. There is a wide variety of emissions reduction measures for buildings, including direct financial support, loans, tax deductions, building codes, energy performance certificates and information platforms for consumers. There is a notable focus on reducing building emissions by transitioning away from oil-based heating, with regional programmes favouring heat pumps and renewables, though in some cases a transition from oil to gas heating is supported (see Chapters 4 and 10).

Emissions reductions from industry are mainly driven by the ETS and voluntary energy efficiency agreements between regional governments and industry. The voluntary agreements vary between regions, but in general focus on audits to identify cost-effective energy efficiency measures, with participating companies receiving reduced taxes or other incentives if these measures are implemented. The voluntary agreements focus on energy-intensive industrial facilities, but there is an increasing effort to help SMEs reduce their emissions (see Chapter 4).

Carbon pricing

Belgium's only carbon-pricing mechanism is the EU-mandated ETS. Under current EU rules, funding equal to at least 50% of ETS allowance revenues must be spent to modernise the energy system and reduce GHG emissions. Under the current burden-sharing agreement, ETS allowance revenues go mostly to the regional governments and are used mainly to support a variety of programmes dedicated to reducing GHG emissions.

Most of Belgium's GHG emissions are not covered by the ETS. In 2018, the federal government published a report on the results of a national debate on carbon pricing for non-ETS sectors. The report included an overview of how carbon pricing has been implemented in other countries and an analysis of three carbon-pricing trajectories for non-ETS emissions in Belgium. Each trajectory started at 10 EUR/t CO₂ in 2020 and increased respectively to 40 EUR/t CO₂, 70 EUR/t CO₂ and 100 EUR/t CO₂ in 2030.

The report detailed the impact of the three carbon-pricing options on fossil fuel prices and on emissions from transport, buildings, non-ETS industry and other sectors. The report indicated that carbon pricing would result in substantial additional tax revenue, EUR 607 million per year in 2020, increasing to EUR 2 599 million per year in 2030 under the 2030 price of 70 EUR/t CO₂. The report examined budget-neutral redistributions of carbon-pricing revenues in ways that are aligned with climate and social policy, for example by reducing charges and levies on electricity.

The federal government aims to reform federal taxation to make it more climate- and environmentally friendly following the polluter-pays principle and sending price signals supporting decarbonisation. The insights from the report on carbon pricing will be used when developing options for federal tax reform. In support of this reform, the federal government will carry out a study in consultation with the regional governments to be published in 2022. Proposals for fiscal reform based on this study will be made by late 2023.

Climate adaptation

Belgium's National Adaptation Plan 2017-2020 was adopted in 2017 by the NCC (CNC 2017). The plan provides information on adaptation policies and their implementation and identifies measures to strengthen institutional co-operation on climate adaptation and increase climate resilience. The plan addresses six sectors – biodiversity, crisis management, energy, health, research and international co-operation – and includes a measure intended to increase security of electricity supply by evaluating climate change impacts on energy supply, transportation and distribution. In 2020, the NCC commissioned a study identifying the physical impacts and economic costs resulting from climate change, including impacts and costs for the energy sector. Belgium is aiming to release an updated National Adaptation Plan in 2022.

The regional governments have also developed climate adaptation plans or addressed climate adaptation in other key planning documents. The Flemish Adaptation Plan 2013-2020 aims to increase understanding of Flanders vulnerability to climate change and improve the ability to defend against impacts. Flanders is in the process of developing the Flemish Adaptation Plan 2021-2030. In 2016, the Brussels-Capital Region adopted its integrated Air-Climate-Energy Plan, which includes the main aspects of its adaptation policy and covers the following areas: infrastructure, forest management, water management and natural heritage. Some climate adaptation measures are also included in the Brussels-Capital Region's thematic plans for the management of water and natural areas. The Walloon Air-Climate-Energy Plan adopted includes measures on adaptation.

Carbon capture, utilisation and storage

Belgium sees long-term potential for CCUS, primarily through co-operation with its neighbouring countries. Belgium's National Recovery and Resilience Plan (developed as part of the EU response to the Covid-19 pandemic) calls for investments in CCUS infrastructure. However, Belgium does not have a national CCUS strategy and the capacities of potential CO₂ storage sites are largely uncertain. Flanders and Wallonia have transposed the EU CCS Directive, which regulates subsurface activities below 500 metres and creates a legal framework for CO₂ storage. However, no exploration licences or storage permits for CO₂ have been requested or granted. Neither the Brussels-Capital Region nor the federal government (which regulates Belgium's offshore subsurface) have transposed the EU CCS Directive, and CO₂ storage in these regions has been evaluated as infeasible due to geological conditions.

Because there is no readily available CO₂ storage potential, Belgium depends on co-operation with its neighbouring countries for implementing CCUS projects. There are several projects examining the development of CO₂ transport infrastructure to allow access to CO₂ storage in other countries. In 2020, the CO₂TransPorts project was approved as an EU project of common interest. It aims to develop CO₂ transport infrastructure connecting the Port of Antwerp, the North Sea Port (serving Ghent, Terneuzen, Borsele and Vlissingen) and the Port of Rotterdam, which is developing CO₂ storage capacity through the Porthos project. The CO₂TransPorts project aims for a transport capacity up to 10 Mt CO₂ per year by 2026, with increased capacity planned after 2030 (EC, 2021a). Belgium also participates in the Northern Lights EU project of common interest, which supports projects in Belgium, France, Ireland, the Netherlands, Sweden and the United Kingdom to develop infrastructure to transport captured CO₂ by ship to offshore storage in Norway (EC, 2021b). Under the Antwerp@C project, a consortium of private companies is investigating CO₂ capture and transport infrastructure in the Port of Antwerp. The consortium aims to reduce the CO₂ emissions from the port by up to 50% by 2030. The Antwerp@C project is linked to the CO₂TransPorts and Northern Lights projects (Hakirevic, 2020).

Belgium supports research to reduce the costs of CCUS and is hosting or participating in several pilot and demonstration projects for CCUS. At the North Sea Port, 20 public and industrial partners (including a large steel plant located in Ghent) have joined forces in the North-CCU-Hub, which is focused on developing CCU to reduce the port's emissions (North-CCU-Hub, 2022). The Balmatt deep geothermal pilot project installed direct air capture on the air-cooling units of the geothermal plant in 2018 (Vito, 2018).

The Low Emissions Intensity Lime & Cement (LEILAC) project, ongoing in Wallonia since 2016, is supported by the EU and aims to enable the cement and lime industries to capture CO₂ emissions from the processing of limestone. A pilot plant is operating at a cement plant in Belgium. Several Belgian companies are involved in the follow-up project, LEILAC2, where a demonstration-scale capture installation will be built at a German cement plant (LEILAC, 2020). In December 2020, a joint development agreement was concluded in Wallonia on a project that aims to convert the CO₂ generated during lime production into methane. The project will demonstrate a process combining carbon capture and a 75 MW electrolyser.

Assessment

Under EU regulations, Belgium has targets to reduce non-ETS GHG emissions by 15% by 2020 and by 35% by 2030; both targets are compared to 2005 levels and are intended to support EU-wide emissions reduction targets. Belgium's climate and energy policies focus on reducing GHG emissions through the deployment of renewables and improving energy efficiency. Belgium's NECP is the key document defining climate and energy policies through 2030 and defines the federal and regional measures to meet the 2030 non-ETS target. The European Commission estimated that the NECP's emissions reduction measures would result in a reduction of 34.4% by 2030, just missing Belgium's target.

In 2021, the 2030 EU-wide GHG emissions reduction target was increased from 40% to 55%. This additional ambition at the European level will likely require Belgium to adopt a higher 2030 non-ETS emissions reduction target and to take stronger actions to reduce emissions, which have seen only limited declines in recent years. Belgium should include any changes in targets and measures needed to support the increased EU-wide GHG target in the draft NECP update due in 2023.

The ETS regulates GHG emissions from Belgium's large power plants and energy-intensive industrial facilities. According to the NECP, Belgium's ETS emissions are expected to increase from 42.3 Mt CO₂ in 2020 to 58.1 Mt CO₂ by 2030, mainly due to increased gas-fired generation resulting from the nuclear power phase-out. The government has estimated that gas-fired generation could increase to over 60% of total electricity generation by 2025, from just 28% in 2019. This would increase EU-wide ETS emissions and require a higher level of emissions reductions from ETS facilities in other EU member states to achieve the EU-wide 2030 ETS emissions reductions target.

Other than the ETS, Belgium does not have a carbon-pricing mechanism. The federal government conducted a national debate on carbon pricing for the non-ETS sectors and a report on the debate was published in 2018. The federal government aims to propose reforms to federal taxation in late 2023 to make it more climate- and environmentally friendly following the polluter-pays principle and sending price signals supporting decarbonisation. The reform of taxation presents an excellent opportunity for implementing a broad carbon price to send clear signals to investors and consumers. The government should use the 2018 report on carbon pricing to inform the development of carbon-pricing options and should accelerate the schedule for reforming federal taxation to support decarbonisation.

Belgium has made progress on the policy recommendations of the last IEA energy policy review conducted in 2016. The federal and regional governments implemented the recommendation to reach a political agreement on burden sharing of Belgium's 2020 climate and energy targets. The agreement has a detailed description of the governance to achieve the non-ETS emissions reduction target and the renewable energy target. In line with the IEA's recommendations, the burden-sharing agreement included mechanisms to co-ordinate the use of flexible instruments between the federal and regional governments, including international carbon credits.

However, the burden-sharing agreement was only signed in 2018, just two years before the 2020 target, missing the opportunity to send robust signals to investors. The long delay to conclude an agreement on how non-ETS emissions reductions would be divided between the regions reduced clarity on the level of emissions reductions required in each region, depriving investors of clear signals on where to direct funding for the projects and investments needed to reduce emissions.

The federal and regional governments noted that the burden-sharing agreement's methodologies to estimate GHG emissions inventories are broadly harmonised between the regions, but that there remain differences in how the impact of policies and measures are estimated. The NCC has not yet agreed on a methodology to estimate how new federal policies will impact emissions at the regional level.

The federal and regional governments have taken preliminary steps to develop a new burden-sharing agreement covering Belgium's 2030 non-ETS emissions reduction target. In 2017, the NCC launched preparations for a new burden-sharing agreement for the period 2021-2030. The NCC agreed in December 2020 to aim for a political decision by November 2021. When preparing a new burden-sharing agreement, Belgium should consider lessons learnt from previous agreements, including improving flexibility to respond to changing circumstances (e.g. potential for increased ambition at the EU or international level), setting targets based on shares instead of absolute values, and using cost-effectiveness as a criteria at a national rather than separately at the federal and regional levels. The new burden-sharing agreement should account for the increased EU 55% emissions reduction target and be concluded as quickly as possible to give investors clear signals on the needed level of ambition and on where to direct funding for the projects needed to reduce emissions.

The EU has set a goal for carbon neutrality by 2050. Belgium supports EU carbon neutrality by 2050 and under the EU requirement submitted a national long-term strategy for energy and climate to the European Commission in February 2020. However, the strategy does not include long-term national emissions reduction targets, nor does it include a clear commitment to carbon neutrality in Belgium by 2050. Belgium is encouraged to adopt national long-term emissions reductions targets for the period 2030-2050 to provide a clear signal to investors and to set a clear national goal for carbon neutrality by 2050 at the latest.

The federal government has approved an instrument to track the progress of the federal policies and measures, sharing the responsibility to achieve targets among all federal ministers. The Flemish government has introduced a similar mechanism to track progress and allocate responsibilities across the different Flemish ministers. The IEA encourages the federal and regional governments to develop a common methodology for estimating and monitoring the impact of policies and for increasing transparency on how targets will be met.

GHG emissions from Belgium's industry sector have been increasing, despite higher carbon prices in the ETS and ongoing agreements between the regional governments and industry to implement efficiency measures. More effort is needed on policies and measures to ensure that Belgium's industry can significantly lower emissions in line with 2030 targets while remaining economically competitive. Voluntary agreements with industry should push for accelerated implementation of cost-effective emissions reductions and it may also be necessary to provide subsidies for industrial decarbonisation (e.g. through

electrification, electrolysers and CCUS), to drive the needed emissions reductions and maintain industrial cost competitiveness.

Belgium's National Adaptation Plan 2017-2020 provides information on adaptation policies and their implementation, and identifies measures that need to be taken to strengthen institutional co-operation on climate adaptation and increase climate resilience. One of the measures that was successfully implemented was a study of the socio-economic impacts of climate change in Belgium, which estimated that climate change impacts in 2050 would have an economic cost of about EUR 9.5 billion, or 2% of Belgium's GDP, while benefits are equal to 0.65% of GDP under the worst-case scenario. Another action, to "undertake a study into the impact of climate change on energy security", was never commissioned, as CONCERE/ENOVER concluded that the European Environment Agency study entitled *Adaptation Challenges and Opportunities for the European Energy System* contained all the information needed. The European Environment Agency study suggests that the energy sector needs to strengthen its climate resilience. The NCC has decided to update the National Adaptation Plan. The IEA encourages Belgium to adopt a National Adaptation Plan for 2021-2030 that clearly addresses the climate impacts on the energy sector.

Recommendations

The government of Belgium should:

- Update the National Energy and Climate Plan with new targets and measures that support the EU's 55% emissions reduction target and provide long-term certainty to stakeholders for making the necessary investments for decarbonisation.
- Agree as soon as possible on internal burden sharing for the period 2021-2030, taking into account the EU's 55% emissions reduction target and the lessons from the previous burden-sharing agreement.
- Agree on long-term climate and energy targets at a national level for the period 2030-2050, including a national 2050 carbon neutrality target, as part of a stable regulatory framework to provide clarity to investors and consumers.
- Use the reform of taxation to create appropriate price signals to drive decarbonisation across the entire economy.

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4. Energy efficiency

Key data (2020)

TFC: 38.0 Mtoe (oil 45.7%, natural gas 26.8%, electricity 17.9%, bioenergy and waste 5.5%, heat 1.2%, coal 1.0%), -6.0% from 2010 to 2019, -5.2% from 2019 to 2020

TFC by sector: industry 47.6%, buildings 32.2%, transport 20.2%

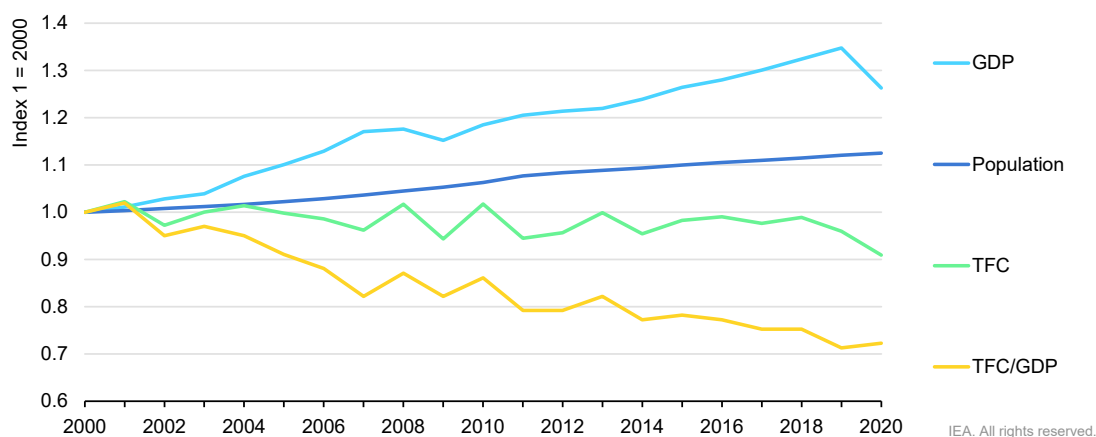
TFC per capita: 3.3 toe/capita (IEA average in 2019: 2.90 toe/capita), -15.6% since 2010

TFC per GDP: 73 toe/USD million (IEA average in 2019: 65 toe/USD million), -16.1% since 2010

Overview

From 2010 to 2019, Belgium's GDP increased by 14%, while its population increased by 5% (Figure 4.1). Despite marked increases in GDP and population, TFC decreased by 6% between 2010 and 2019, and the energy intensity of Belgium's economy (TFC per GDP) decreased by 17%, showing decoupling between economic growth and energy demand. However, in 2019, the energy intensity of Belgium's economy (72 toe/USD million) was the sixth-highest among IEA member countries.

Figure 4.1 Energy demand and drivers in Belgium, 2000-2020



The TFC/GDP ratio decreased by 16% between 2010 and 2020, showing decoupling between energy demand and economic growth.

Source: IEA (2022a), *World Energy Balances* (database), <https://www.iea.org/data-and-statistics/data-product/world-energy-balances>.

In 2020, TFC decreased by 5.2% with respect to 2019 due to the effects of the Covid-19 pandemic, with most of the reduction coming from the transport sector (-13.2%), followed by industry (-4.3%) and buildings (-0.9%).

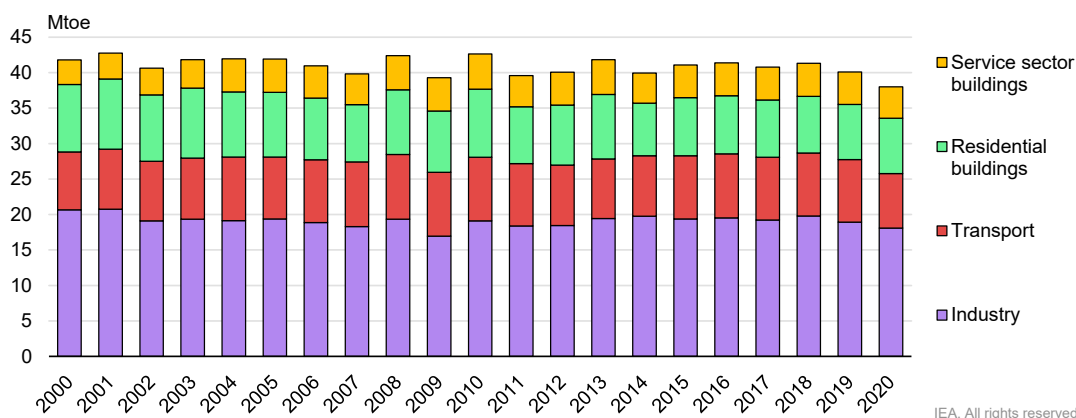
In line with EU regulations, Belgium set indicative targets for primary and final energy consumption for 2020 and 2030. Belgium's 2020 indicative target for primary energy consumption (PEC) was 43.7 Mtoe and the indicative target for final energy consumption (FEC) was 32.5 Mtoe. In 2020, Belgium's PEC was 43.9 Mtoe and FEC was 33.3 Mtoe. The decrease of PEC and FEC in 2020 was mainly caused by the Covid-19 pandemic, and the expected rebound of energy demand in 2021 will likely bring Belgium's PEC and FEC higher than the 2020 targets.

Looking ahead to 2030, Belgium has indicative targets for PEC of 42.7 Mtoe and for FEC of 35.2 Mtoe. These indicative targets require an update with increased ambitions to support the recent commitment from EU to reduce its GHG emissions by 55% by 2030, with respect to 1990 levels. In light of this, the government should assess why measures and policies did not achieve the desired reductions of energy demand by 2020, and use the lessons learnt to implement more effective policies to improve energy efficiency in all sectors in the next decade.

Energy demand by sector

In 2020, Belgium's energy demand was 38 Mtoe, with the largest share from industry (48% of TFC), followed by buildings (32% in total, with 21% from residential buildings and 12% from service sector buildings) and transport (20%) (Figure 4.2).

Figure 4.2 Energy demand by sector in Belgium, 2000-2020



Energy demand fluctuated around 40 Mtoe between 2009 and 2019, and dropped in 2020 due to Covid-19. The largest share comes from industry (48% in 2020).

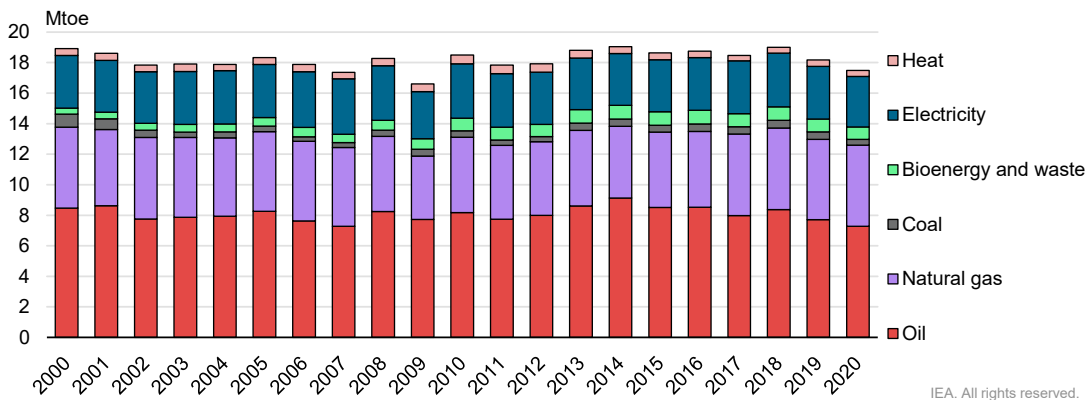
Source: IEA (2022a), *World Energy Balances* (database), <https://www.iea.org/data-and-statistics/data-product/world-energy-balances>.

From 2010 to 2020, Belgium's energy demand (TFC) consistently fluctuated, reaching a low of 39 Mtoe in 2009 and a high of 43 Mtoe in 2010, when an exceptionally cold winter increased energy demand in the buildings sector. The drop to 38 Mtoe in 2020 was caused mainly by the effects of the Covid-19 pandemic.

Industry

Industry energy demand (including feedstocks) was relatively stable from 2014 to 2018, at around 19.5 Mtoe, then started to decrease in 2019 and dropped again in 2020 when it was 18.1 Mtoe (Figure 4.3). Due to the presence of a large chemical and petrochemical sector, oil covers the largest share of industry energy demand (40% of industry TFC in 2020), followed by natural gas (29%) and electricity (18%). Coal is used mainly in the iron and steel sector and accounted for 2% of industry TFC in 2019, while bioenergy (mainly solid biomass) accounted for 5%.

Figure 4.3 Industry energy demand by source in Belgium, 2000-2020



Industry energy demand fluctuated around 19.5 Mtoe between 2013 and 2018, dropping in 2019 and 2020. Oil covered 40% of TFC in 2020, followed by natural gas and electricity.

Source: IEA (2022a), *World Energy Balances* (database), <https://www.iea.org/data-and-statistics/data-product/world-energy-balances>.

The chemical and petrochemical sector accounts for the largest share of industry energy demand (59% of industry TFC in 2020), followed by food and tobacco (9%); iron and steel (7%); non-metallic minerals (7%); agriculture/forestry (4%); and paper, pulp and print (3%). The coke and refined petroleum products sector had the largest energy intensity per value added in 2019 (51 megajoules [MJ] per USD), followed by basic metals (45 MJ/USD) and non-metallic minerals (19 MJ/USD). Overall, the industry sector's energy intensity per value added decreased by 10% between 2010 and 2019.

Buildings

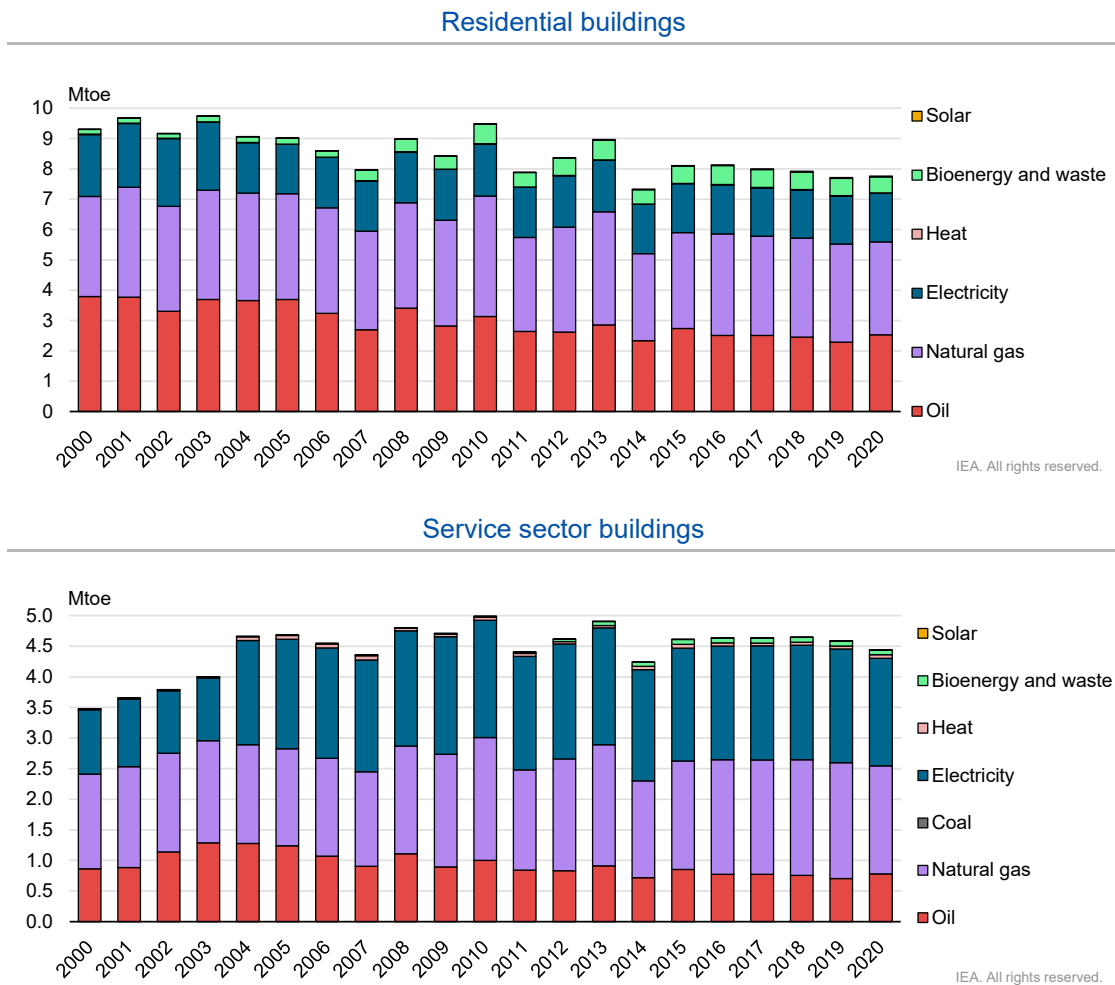
Energy demand in the buildings sector comes mostly from residential buildings (64% of buildings TFC in 2020), while service sector buildings (including both commercial and public services) accounted for 36%. From 2010 to 2020, buildings sector energy demand experienced an overall decline, from 15 Mtoe to 12 Mtoe, with notable fluctuations driven mainly by heating demand (Figure 4.4). While residential building energy demand decreased from 9.6 Mtoe to 7.8 Mtoe, service sector building energy demand fluctuated around 4.5 Mtoe, with a minimum of 4.2 Mtoe in 2014 and a peak of 5.0 Mtoe in 2010.

Most energy demand in residential buildings is covered by natural gas (39% in 2020), followed by a remarkably high share of heating oil (33%), electricity (21%) and bioenergy (7%). Natural gas plays a key role in covering energy demand also in service sector buildings (40% in 2020), while electricity covers a higher share (40%) than in residential

buildings and the shares from oil (18%) and bioenergy and waste (2%) are notably lower. In comparison to many European countries, very little building energy demand in Belgium is covered by district heating. In 2019, district heating covered just 1% of energy demand from service sector buildings and just 0.2% of energy demand from residential buildings, and comes mainly from co-generation or waste plants serving neighbouring service sector or residential buildings.

Space heating is responsible for most residential buildings energy demand (73% in 2019), followed by residential appliances (13%), water heating (12%) and cooking (2%) (IEA, 2022b). Most space heating uses natural gas (49% of space heating energy demand in 2019) and oil (37%), followed by bioenergy (10%) and a notably low share of electricity (3%). Oil covers a large share of total building energy demand in Belgium. In 2019, the share of oil in Belgium’s building energy demand (24%) was the fifth highest among IEA countries and notably higher than the IEA average of 8%.

Figure 4.4 Total final consumption in the buildings sector by source in Belgium, 2000-2020



While energy demand in residential buildings decreased on average between 2010 and 2020, the service sector buildings demand fluctuated around 4.5 Mtoe.

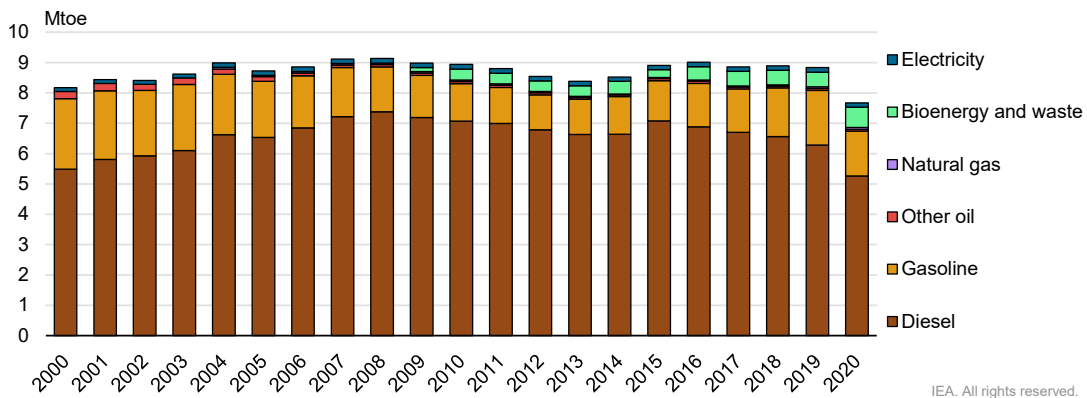
Source: IEA (2022a), *World Energy Balances* (database), <https://www.iea.org/data-and-statistics/data-product/world-energy-balances>.

Transport

Transport sector energy demand was relatively stable at just under 9 Mtoe from 2015 to 2019 (Figure 4.5). In 2020, transport energy demand dropped by 13%, mainly because of the impacts of the Covid-19 pandemic. Most transport energy demand is covered by oil products, mainly diesel (69% of transport TFC in 2020), followed by gasoline (19%). The use of biofuels almost doubled from 2010 to 2020 to reach 9% of transport TFC. Biofuels in Belgium consist mainly of biodiesel and bioethanol. In 2020, electricity accounted for 2% of transport TFC and is used mainly in railways. A very small share of transport demand is covered by natural gas (1%).

The vast majority of domestic transport energy demand comes from road transport (96% in 2019), followed by rail (2%) and shipping (2%). In 2019, passenger cars accounted for 55% of road transport, freight road 38%, buses 2% and motorcycles 1%.

Figure 4.5 Total final consumption in transport by fuel in Belgium, 2000-2020

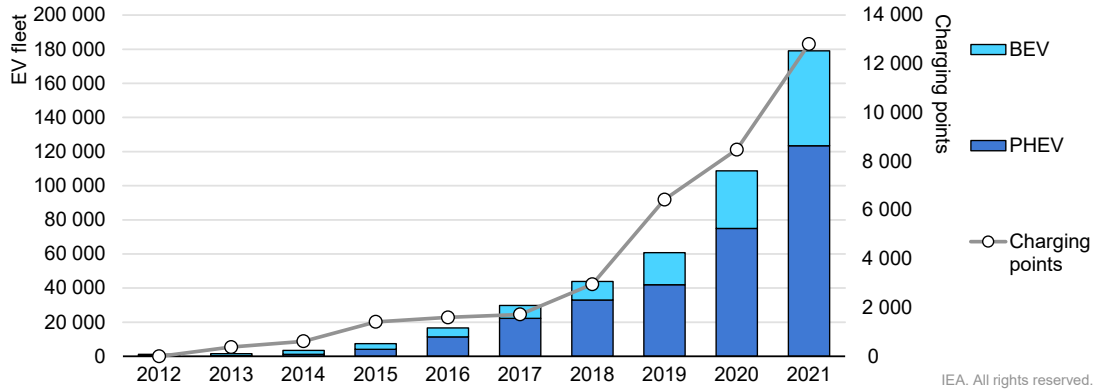


Transport demand in 2019 was at a level similar to that in 2009, but with a decreasing trend since 2016. The 2020 drop is caused by the Covid-19 pandemic. Biofuels and gasoline increased, with a decreasing share of diesel.

Source: IEA (2022a), *World Energy Balances* (database), <https://www.iea.org/data-and-statistics/data-product/world-energy-balances>.

EV deployment is increasing in Belgium (Figure 4.6). From 2012 to 2021, the number of registered EVs grew from just 1 163 to almost 180 000, to reach 3.1% of the total passenger car fleet compared to 1.5% in the EU. In 2020, new EV registrations reached 48 000, or 8.6% of annual new vehicle registrations. Most of this growth has come from plug-in hybrid electric vehicles (PHEV), with around 75 000 registered PHEVs in 2020, while battery electric vehicle registrations reached around 34 000 in the same year. There has also been strong growth in EV charging infrastructure. From 2013 to 2021, the number of publicly available charging points grew from just 378 to 12 816 (EAFO, 2019).

Figure 4.6 Registered electric vehicles and public charging points in Belgium, 2012-2021



Sales of electric vehicles are rapidly increasing in Belgium, with plug-in hybrids making up the largest share. Deployment of charging infrastructure has also increased in recent years.

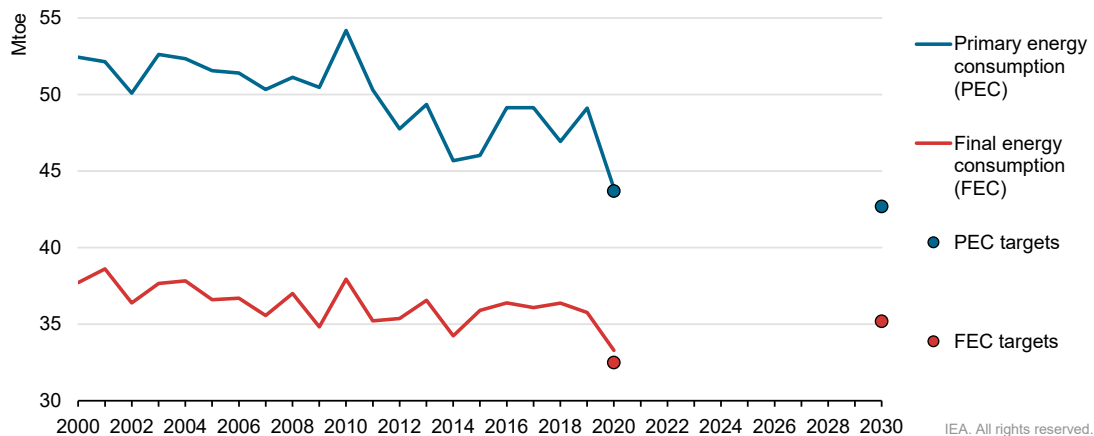
Note: BEV = battery electric vehicle.

Source: EAFO (2022), *Belgium* (database), <https://eafo.eu/countries/belgium/1724/summary>.

Energy efficiency targets

Belgium’s 2020 and 2030 energy efficiency targets are driven by the EU Energy Efficiency Directive (EED). Under the EED, each EU member state sets indicative national energy efficiency targets to contribute to the EU-wide 2020 target of a 20% reduction in energy consumption compared to a business-as-usual projection. Belgium has 2020 indicative targets to reduce PEC to 43.7 Mtoe and FEC to 32.5 Mtoe (Figure 4.7). Despite a large and likely temporary reduction in energy demand resulting from the pandemic, Belgium did not meet its 2020 indicative energy efficiency targets. In 2020, PEC was 43.9 Mtoe and FEC was 33.3 Mtoe.

Figure 4.7 Indicative energy efficiency targets for Belgium and status, 2004-2020



Despite the large drop in demand caused by the Covid-19 pandemic, Belgium did not meet its 2020 targets. 2030 targets need to be more ambitious to support the EU-wide commitments.

Sources: Eurostat (2022), *Complete Energy Balances* (database),

https://ec.europa.eu/eurostat/databrowser/view/nrg_bal_c/default/table?lang=en; EC (2014), Belgian Energy Efficiency Action Plan, <https://ec.europa.eu/energy/sites/ener/files/documents/Belgium%20NEEAP.pdf>; EC (2020), Belgian Integrated National Energy and Climate Plan, https://energy.ec.europa.eu/system/files/2020-09/be_final_necp_parta_en_0.pdf.

Belgium's NECP set 2030 energy efficiency indicative targets for PEC of 42.7 Mtoe and for FEC of 35.2 Mtoe. These indicative targets are intended to support the achievement of the EED 2030 target of a 32.5% reduction in EU-wide energy consumption compared to a business-as-usual projection. However, the EU recently released a proposal for increasing the EU-wide PEC and FEC reductions to 39% and 36% respectively, to support its commitment to achieve a 55% reduction of GHG by 2030 compared to 1990 levels. To support the EU-wide binding energy efficiency target, member states will be required to increase the ambition of their national PEC and FEC indicative targets.

Energy efficiency policy and measures

The regional governments are responsible for most areas of energy efficiency policy. The federal government is responsible for energy efficiency policy in several areas, including federal buildings, federal vehicle fleets, national railways, ecodesign and energy labelling of appliances, and modal-shift measures for federal civil servants. Collaboration on energy efficiency policy between the federal and regional governments is co-ordinated through the ENOVER/CONCERE working group on energy efficiency.

The Belgian tax system provides an increased deduction of 13.5% for energy-saving investments made by companies. To encourage energy efficiency in buildings, the federal government reduced the VAT from 21% to 6% for demolition and renovation projects (only renovation in the Brussels-Capital Region). This reduced VAT was limited to 32 urban areas, but has been extended temporarily from January 2021 to December 2022 to cover projects that satisfy certain conditions in all of Belgium. In Flanders, projects that are not entitled to the VAT reduction can apply for a regional premium for demolition and renovation.

The federal government holds responsibility for the implementation of EU legislation on ecodesign and labelling of appliances. Belgium is also implementing Article 6 of the EED, which regulates energy performance in relation to public procurement of products, services and buildings. Article 7 of the EED requires EU member states to reduce energy sales to final consumers by 1.5% annually through 2020, using an energy efficiency obligation scheme or alternative measures. In line with Article 7, Belgium set a target to achieve cumulative energy savings of 6 911 kilotonnes of oil equivalent (ktoe) by 2020 using alternative measures. As of 2018, Belgium had reached 4 510 ktoe of cumulative energy savings and expects to achieve its 2020 target. The EED was amended in 2018 to extend Article 7 to require annual savings of at least 0.8% of final energy consumption each year from 2021 to 2030. In line with the directive, Belgium's NECP sets the cumulative savings target of 185 TWh (15.9 Mtoe) by 2030. The federal government, Flanders, Wallonia and the Brussels-Capital Region will all contribute to achieving the 2030 target.

Flanders, the Brussels-Capital Region and Wallonia have implemented Article 8 of the EED, which requires large companies to conduct energy audits of industrial facilities and buildings. Audits must be conducted by regionally accredited auditors, meet minimal quality requirements, cover at least 80% of the company's energy demand and be renewed every four years. In Flanders, auditors are not accredited regionally and can be internal or external energy experts, but the minimum energy value of the audit is regulated and monitored. In this region, all large companies had to carry out a first energy audit in 2015 and a second one by the end of 2020. Wallonia introduced a mandatory audit for large enterprises in 2016. In the Brussels-Capital Region, there is a requirement for energy

audits for large companies applying for environmental permits. Grants are available to cover some of the expenses for implementing the audit recommendations. In Flanders, all cost-effective measures (based on internal rate of return) must be implemented.

Industry

The main measures to improve industrial energy efficiency are voluntary energy agreements between the regional government and industrial companies active in Flanders and in Wallonia. In Flanders, the voluntary agreements cover energy-intensive industrial companies (those with annual primary energy demand higher than 0.1 petajoule) and require companies to implement an energy management system or to get ISO 50001 certification. As of 2020, 98% of energy-intensive industrial companies in Flanders had implemented an energy management system. The Flemish government also has voluntary agreements with groups of SMEs per industry sector, which appoint an energy coach to assist SMEs in performing energy audits, identify energy efficiency measures, monitor implementation of measures and apply for subsidies. Flanders also has a variety of grant programmes to support industrial energy efficiency projects.

Voluntary agreements in Wallonia require targets for energy efficiency and GHG emissions reductions, annual progress monitoring, specific studies (including for renewable energy investments), and a carbon-footprint analysis. Industrial federations integrate the individual energy efficiency and GHG emissions targets of their member companies into targets for each industry sector that become an official commitment between the federations and Wallonia. The federations also issue low-carbon road maps for each industry sector. Fourteen federations representing 228 companies and 90% of Walloon industrial energy demand are participating in the second round of voluntary agreements. The regional voluntary agreement targets for 2020 were achieved and the agreements were extended, with new targets through 2023 to allow time to prepare a third round aiming to drive a transition towards a low-carbon economy.

Wallonia's government supports the Easy Green programme, which provides technical advice and loans up to EUR 1 million per project and EUR 3 million per company to help SMEs reduce energy consumption and GHG emissions, including through renewable energy projects. The Easy Up programme supports SMEs with loans covering up to 40% of qualifying costs (up to EUR 500 000) for developing innovative processes or services related to energy transition. As of April 2021, these two programmes had provided loans to 54% of Wallonia's SMEs, for a total of EUR 45 million in financing, supporting 201 projects.

Buildings

The regional governments are responsible for most energy efficiency policy for buildings as they set building and zoning codes and run the majority of support programmes related to improving buildings' energy efficiency and renovations. The federal government's role is limited to federal buildings, ecodesign and energy labelling of appliances. Belgium's National Recovery and Resilience Plan allocates EUR 1 billion for energy-efficient renovation of residential and public buildings, social housing, and higher energy efficiency subsidies for commercial buildings. The EUR 1.2 billion package of measures to accelerate energy transition introduced in March 2022 includes specific efforts targeting the building sector. For example, the VAT on solar PV panels, solar thermal collectors and heat pumps was reduced to 6% for the years 2022-2023.

Public buildings

Under Article 5 of the EU EED, the federal government has a goal to renovate every year 3% of federally owned and operated buildings with an area greater than 250 m² that do not meet minimum energy performance requirements. Renovations of federal buildings are managed by the Federal Real Estate Manager, which is responsible for the overall operation and maintenance of most properties owned or rented by the federal government. Regional governments are also implementing EED Article 5 by renovating 3% of their government-owned and occupied buildings each year. The regional targets are supported with energy management programmes and by energy service companies.

The Flemish Energy Company provides a wide variety of energy-related services for buildings owned and operated by the Flemish or local governments and buildings of entities that receive government funding. The Flemish Energy Company provides consulting services on implementing efficiency and renewable energy projects and accessing funding and is also an energy supply company for gas and electricity. Flanders has established the Schools of Tomorrow public-private partnership to provide investments of around EUR 1 billion to 182 projects to design, build and maintain efficient new school buildings. In March 2021, 169 projects had been completed.

In Wallonia, the Rational Use of Energy in Public Buildings programme provides subsidies for the renovation of residential and non-commercial service buildings. It has been estimated that the full cost of Wallonia's regional Renovation Strategy is EUR 120 billion for residential buildings and EUR 34-57 billion for non-commercial service buildings. Under this programme, a new mechanism to support the Renovation Strategy and a platform to support local renovation pilot projects have been developed. RenoWatt is a one-stop shop that carries out audits and studies supporting service and works contracts for the renovation of public buildings in Wallonia through energy performance contracts.

In the Brussels-Capital Region, the Local Plan for Energy Management provides management tools to improve the energy efficiency of buildings. Since 2019, participation is mandatory for both government entities and private companies with large real estate portfolios; other entities may join voluntarily. The NRClick energy service company supports efficient energy management of public buildings in the Brussels-Capital Region. NRClick provides a central purchasing service for energy efficiency measures and tools for technical analysis, energy accounting and monitoring.

The amended EU Energy Performance Buildings Directive requires EU member states to take additional steps to reduce buildings' energy demand, including the adoption of a long-term renovation strategy for a highly energy-efficient and decarbonised building stock by 2050, with milestones for 2030, 2040 and 2050. All three regional governments are implementing the directive, and have developed long-term renovation strategies and submitted them to the European Commission. Under Flanders' Long-term Renovation Strategy, public buildings have to achieve carbon neutrality by 2045. For semi-public buildings (schools, hospitals, etc.), the target year for carbon neutrality is 2050. Wallonia aims for carbon neutrality of public buildings by 2040. The federal government aims for carbon neutrality of federally owned or operated buildings by 2040.

Private buildings

In Belgium, the Energy Performance Buildings Directive's standard requirements on global energy performance, insulation, and indoor air quality and thermal comfort are required for

new buildings. In Wallonia, the last update entered into force in January 2021, requiring the nearly zero energy building standards for all new buildings.

In Flanders, rational energy use obligations imposed on electricity grid operators require payments to consumers that invest in certain energy-saving measures in existing residential and non-residential public and private buildings. Qualifying investments include, *inter alia*, insulation, high performance windows, solar thermal heating, heat pumps and efficient lighting (for non-residential buildings). In Wallonia, grants (Primes Logement and Énergie) and 0% loans (Écopack and Rénopack) provide financial support for the renovation of private buildings.

The renovation policy for private buildings in the Brussels-Capital Region relies on three financial instruments: 1) energy grants (Primes énergie); 2) Brussels green loan (Prêt vert bruxellois); and 3) home renovation grants. The Primes Énergie cover up to 70% of the costs of most energy efficiency investments in buildings, including improvements in heating and insulation and cover the costs of related audits. The Prêt vert bruxellois provides access to loans with interest rates from 0% to 2% for energy improvements in residential buildings, including solar photovoltaics, heat pumps, solar heaters and insulation. The Brussels-Capital Region has several programmes to facilitate deep renovation of private residential buildings.

Transport

Policies driving energy efficiency in the transport sector consist mainly of price signals to favour the adoption of electric or low-emission vehicles and to encourage modal shift. The regional governments are responsible for the registration tax, paid once at the purchase of a new or used car, and the vehicle tax, paid annually. In all regions, both of these taxes are proportionate to vehicle emissions, providing financial incentives to purchase lower emission (and more efficient) vehicles. EVs are exempt from both taxes, while owners of diesel or liquefied petroleum gas (LPG) vehicles have to pay an additional annual tax.

In 2016, Belgium introduced an annual fee charging owners of heavy-duty road trucks for each kilometre driven. In Wallonia, the base rate is EUR 11.6 (VAT excluded) per km travelled. In Flanders, the base rate is EUR 11.3/km travelled. Rates are adjusted based on the mass and emissions of the vehicle.

A tax deduction is applied on company cars, based on CO₂ emissions and ranging from a minimum of 50% for diesel vehicles with emissions of 190 g/km to a maximum of 100% for zero-emission vehicles (KBC Brussels, 2015). Belgium plans to progressively decrease the tax deduction for company cars that are not electric starting in 2023, and from 2026 onwards only EVs will receive the company car tax deduction.

Belgium does not provide any direct subsidies for the purchase of EV passenger or commercial cars. A federal tax credit of 15% of the purchase price is provided for electric motorcycles, tricycles and quadracycles. A corporate income tax deduction up to 120% is granted to companies for some expenses incurred to encourage the use of electric bicycles, such as buying electric bikes for use by employees, and for building storage for electric bicycles. The federal and regional governments are working on a plan for the progressive abolition of the sales of new vehicles that do not meet the zero standard emissions.

Federal civil servants can use public transport to commute to work for free. They also receive a non-taxable allowance of EUR 0.24 per km for work commutes by bicycle (regular or electric). A similar non-taxable allowance up to 0.24 EUR/km can be provided by private sector employers. In the private sector, the federal government covers 20% of the cost of work commutes by train if the employer signs an agreement with the Belgian national rail company. The federal government is working on a framework to allow workers without a company car to receive a mobility budget from their employer. Other measures aim to reduce commuting, such as a legal framework that favours teleworking and incentives to rent or buy a house close to the workplace. Flanders has an allowance for work commutes by bicycle for civil servants (0.21 EUR/km).

All vehicles owned and operated by the Flemish government have to be hybrid, battery electric, or compressed natural gas (CNG) and fulfil a minimum ecoscore. Since 2019, Flanders requires all new buses for public transport to be battery electric. Flanders has set a goal for all public transportation buses to be hybrid, battery electric or CNG by 2025, and for all taxis to be EVs by 2030. Starting in 2025, the Flemish government will only buy or lease zero-emission passenger cars (battery or fuel cell electric vehicles).

In 2017, Wallonia adopted the FAST vision 2030, a plan for sustainable mobility to support the 2030 target of reducing non-ETS GHG emissions by 35%. Wallonia plans to deploy electric charging stations and CNG and liquefied natural gas (LNG) stations and to promote vehicles running on natural gas, electricity, hydrogen and hybrid vehicles. Wallonia also plans a gradual phase-out of diesel vehicles. The low emissions decree passed in 2018 enables Walloon municipalities to establish low-emission zones on a permanent or temporary basis, starting from 1 January 2020.

The transportation policy of the Brussels-Capital Region is defined in the Good Move plan, approved in 2020. This plan includes objectives to reduce the use of private cars to a quarter of journeys by 2030, realise a 21% reduction in vehicle kilometres travelled by 2030 compared to 2018, improve the performance of the remaining vehicles, and encourage modal shift and vehicle sharing. The Brussels-Capital Region established a low-emission zone in 2018, with restrictions that will be progressively tightened to exclude diesel cars (LEZ Brussels, 2021).

The government of the Brussels-Capital Region aims to phase out diesel vehicles by 2030, and petrol and LPG by 2035 at the latest, by banning their access to the low-emission zone. The Brussels-Capital Region aims for the deployment of 22 080 charging points by 2035 to support a fully electrified car fleet. Future plans include the implementation of a taxation scheme linked to a vehicle's environmental performance.

Belgium's National Recovery and Resilience Plan contains several measures that should reduce transport energy demand through modal shifts, increased public transport and electrification. The plan allocates a total of EUR 1 292 million to transport investments between 2021 and 2026. EUR 672 million will be invested in public transport extensions in all regions to reduce road transport traffic. EUR 411 million are allocated to improving cycling and walking infrastructure, including creating or refurbishing 1 500 km of cycling pathways. EUR 209 million are planned for investments aimed to green road transport, such as financing of 356 green buses for public transport and promoting the deployment of over 78 000 electric charging stations.

The EUR 1.2 billion package of measure to accelerated energy transition introduced in March 2022 includes specific efforts to increase the deployment of EVs, including a

programme supporting deployment of smart EV charging stations (and solar PV) at the train stations of Belgium's national rail network. In addition, the minister of mobility was charged to take steps to double the modal share of trains in both passenger and freight transport.

Assessment

Belgium has 2020 indicative targets to reduce PEC to 43.7 Mtoe and FEC to 32.5 Mtoe. In 2020, PEC was 43.9 Mtoe and FEC was 33.3 Mtoe, with most of the reduction caused by the effects of the Covid-19 pandemic. It is likely that the rebound in 2021 will push PEC and FEC higher than the 2020 indicative targets. The federal and regional governments should determine why energy demand reductions have been so limited and understand which energy efficiency policies and measures were successful and which need to be revised or replaced to support increased and sustained demand reductions.

Belgium's NECP defines 2030 indicative targets to reduce PEC to 42.7 Mtoe and FEC to 35.2 Mtoe. The 2030 FEC indicative target is higher than Belgium's FEC in 2020 and requires a lower demand reduction than the 2020 FEC indicative target. The European Commission's review of Belgium's NECP stated that the 2030 energy efficiency indicative targets were not ambitious and did not support the EU-wide mandatory target of a 32.5% demand reduction by 2030 versus a business-as-usual case. Moreover, the NECP does not give any indication of how the energy efficiency first principle will be applied.

The EU has agreed on an ambitious target of 55% reduction of GHG emissions by 2030 with respect to 1990 levels, which will be supported by a more ambitious 2030 EU-wide energy efficiency target. IEA analysis indicates that about half the emissions reduction needed to achieve the 55% GHG reduction 2030 target will need to come from energy efficiency measures (IEA, 2020). As such, it is likely that Belgium will need to increase its 2030 energy efficiency indicative targets (and GHG emissions and renewables targets) to support the EU-wide 55% emissions reduction target.

Belgium should apply the energy efficiency first principle, and quickly determine which expanded, revised or new policies and measures are needed to achieve more energy savings across the whole economy to support the increased EU-wide target. Co-ordination between federal and regional levels could support more cost-effective demand reduction measures, for example by identifying best practices among measures applied in Belgium's regions and in other EU member states, and striving for common standards and measures at a national level. More ambitious energy efficiency indicative targets and measures should be developed in time to be included in the updated draft NECP, requested by the European Commission in 2023.

Energy efficiency targets were not part of the 2020 burden-sharing agreement, which divided responsibility for meeting Belgium's 2020 EU targets between the federal and regional governments. Energy efficiency is a key factor for reaching climate goals as well as for security of supply and affordability of energy. All possible efforts should be made to reduce energy consumption, not only in light of reaching EU targets. Lowering energy demand is generally the most cost-effective option for reducing GHG emissions and also facilitates the achievement of renewable energy targets. Given the numerous benefits of energy efficiency, the IEA recommends that Belgium's 2030 energy efficiency targets be included in the 2021-2030 burden-sharing agreement.

The IEA recognises the efforts that have been made to support the implementation of energy efficiency measures in industry, including within Article 8 of the EED, requiring large companies to carry out energy audits every four years. The IEA recommends that the next generation of voluntary agreements with industry includes objectives that incentivise investments in carbon-neutral technologies and processes, and leverages opportunities to combine efficiency measures with the deployment of renewable energy and electrification. The IEA also sees a need for Belgium to identify and remove barriers for energy service companies to offer services for energy efficiency projects in the industrial sector. Additionally, it would be beneficial to ensure monitoring and evaluation of all energy-saving measures implemented in all segments for both large companies and SMEs, at the regional level.

The European Commission has highlighted that Belgium's building stock ranks low in energy performance and accounts for more than 30% of Belgium's non-ETS GHG emissions (EC, 2021). In addition, almost 80% of Belgium's building stock was built before energy standards were introduced. There is a strong need to accelerate renovations with a clear focus on reducing energy demand and improving thermal comfort, especially for vulnerable consumers. Renovations should also include the deployment of distributed renewables for both electricity generation and heating. Barriers to renovation should be clearly identified and considered in policy design, and renovation programmes should leverage economies of scale to bring down cost and accelerate demand reductions.

Support measures for building renovation could include simplifying tendering procedures and establishing a technical assistance fund and a guarantee fund. As private finance will be increasingly required to deliver the level of investments needed to achieve decarbonisation of buildings, stimulation of third-party financing would be essential. The IEA recommends that the federal and regional governments set up a risk guarantee fund for energy efficiency to support loans from commercial banks or third financial parties. In addition, it would be essential to develop standardised financial guidelines to apply to energy efficiency investments, to reduce the risks of financing energy efficiency projects.

The federal government aims for carbon neutrality in all federal buildings by 2040. To support this goal, the IEA recommends identifying barriers that limit the use of energy performance contracts and the ability of energy service companies to participate in the renovation of federal buildings. It would be beneficial to prepare guidelines, standardised energy performance contracts and protocols for monitoring, to help owners of public buildings to use energy performance contracts.

In 2018, the federal government introduced a mobility budget for anyone entitled to a company car to encourage modal shift. However, recent analysis showed that there is limited uptake of this measure and that most people still choose to have a company car. The federal government is considering expanding eligibility for the mobility budget beyond those entitled to a company car. The federal government should analyse why there is low uptake of the mobility budget and use this information in future policy design to more clearly support modal shift away from private vehicles.

Recommendations

The government of Belgium should:

- Co-operate with regional governments to determine why the desired decrease in energy demand through 2020 was not achieved, and develop measures to drive sustained improvement in energy efficiency across all sectors.
- Set more ambitious energy efficiency targets that support the EU-wide 55% emissions reduction target; closely monitor achieved energy savings; and be ready to expand, update or replace measures based on their results.
- Integrate measures supporting energy efficiency and renewable energy to create economies of scale and drive cost-effective energy reductions combined with renewables deployment.
- Consult with regional governments to identify and remove barriers for energy service companies to participate in the market for building renovation and energy efficiency in industry, and establish a risk guarantee fund.
- Co-operate with the regional governments to improve strategies to reduce transport energy demand through modal shift to public transport and walking and cycling, and through the electrification of vehicles.

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5. Renewable energy

Key data (2020)

Renewables in TFEF: 3.8 Mtoe/12.3% (IEA average in 2019: 12.9%)

Renewables in electricity generation: 23.4 TWh (wind 14.4%, bioenergy 6.0%, solar 5.8%, hydro 0.3%)

Renewable energy shares:* gross final consumption 13.0%, electricity 25.1%, heating and cooling 8.4%, transport 11.0%

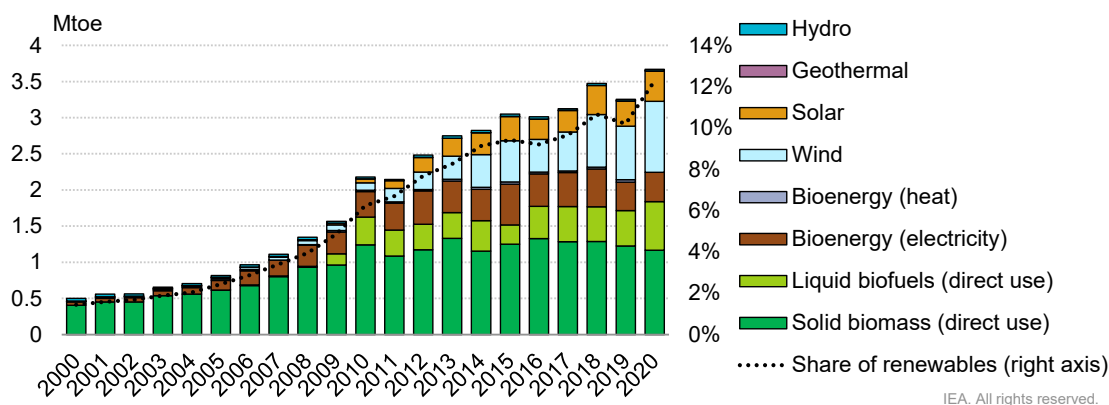
EU total renewable shares:* gross final consumption 22.1%, electricity 37.5%, heating and cooling 23.1%, transport 10.2%

*Computed according to Eurostat definitions for consistency with EU targets.

Overview

From 2010 to 2020, the share of renewable energy in Belgium's total final energy consumption (TFEF) doubled, from 6% to 12%, driven by growth in renewable electricity generation, mainly from wind, solar PV and liquid biofuels (Figure 5.1). However, in 2019, Belgium's share of renewables in TFEF ranked 24th among IEA member countries.

Figure 5.1 Renewable energy in total final energy consumption in Belgium, 2000-2020

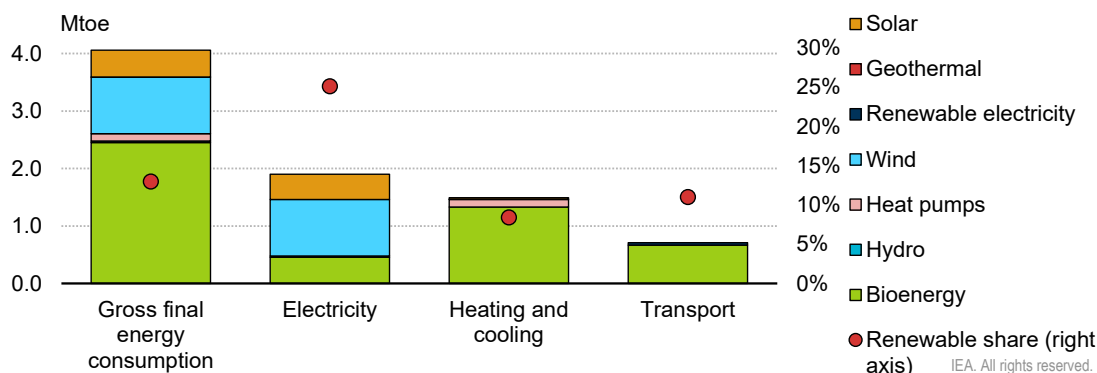


Renewable electricity generation from wind and solar, and direct use of liquid biofuels and biogas, drove the increase of renewables in total final energy consumption.

Source: IEA (2022), *World Energy Balances* (database), <https://www.iea.org/data-and-statistics/data-product/world-energy-balances>.

In 2020, renewables covered 13% of Belgium's gross final energy consumption, 25% of electricity generation, 8% of heating and cooling demand, and 11% of transport demand (Figure 5.2). These shares are based on Eurostat accounting, which is used to track progress towards Belgium's renewable energy targets.²

Figure 5.2 Renewable energy in key metrics in Belgium, 2020



Renewables in electricity generation reached 21% in 2019, but the renewable energy share is still low in heating and cooling and in transport.

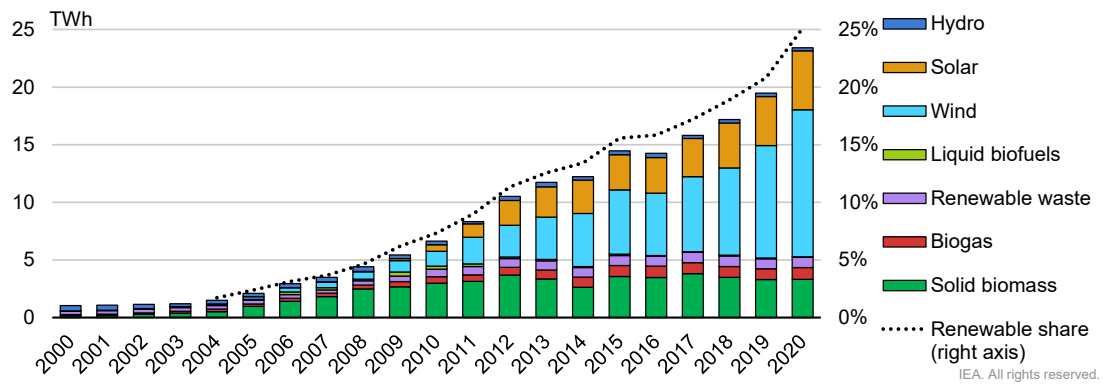
Source: Eurostat (2022), *Energy from Renewable Sources* (database), <https://ec.europa.eu/eurostat/web/energy/data/shares>.

Renewable energy by sector

From 2010 to 2020, renewable electricity generation increased almost threefold, from 5.4 TWh to 23.4 TWh (Figure 5.3), driven by increased wind generation, which grew from 1.4% to 14.4% of total electricity generation, and increased solar PV generation, which grew from 0.6% to 5.8% of generation. From 2010 to 2018, electricity generation from bioenergy (mainly solid biomass, but also biogas, renewable waste and liquid biofuels) experienced an overall increase, from 4.4% to 7.3%, but declined to 6.0% of generation in 2019. Belgium has limited hydropower resources and hydropower plays a small role, covering just 0.3% of generation in 2020, with almost no growth since 2000.

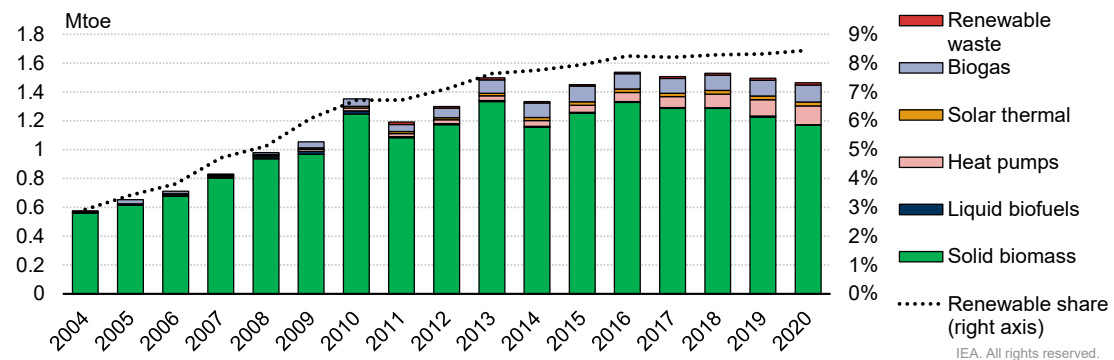
From 2010 to 2016, the share of renewables in heating and cooling grew from 6.7% to 8.2%. Since, it has been relatively stable, at 8.4% in 2020 (Figure 5.4). Most renewable heating and cooling in Belgium comes from solid biomass used for heating in industry and residential buildings. Solid biomass accounted for 80% of renewables in heating and cooling in 2020, followed by biogas (8.0%), heat pumps (8.9%), solar thermal (1.8%) and renewable waste (1.1%). Since 2016, the heating from solid biomass has consistently declined, while the use of heat pumps has been steadily rising.

² Eurostat applies formulas to normalise fluctuations of electricity generation from wind and hydro, and multiplication factors that give higher shares to transportation use of advanced biofuels and renewable electricity. The share of renewables in gross final energy consumption includes domestic renewables and statistical transfers of renewables from other EU member states allowed under EU rules.

Figure 5.3 Renewable energy in electricity generation in Belgium, 2000-2020

Renewable electricity generation increased almost threefold between 2010 and 2020, driven by an increase wind and solar PV deployment.

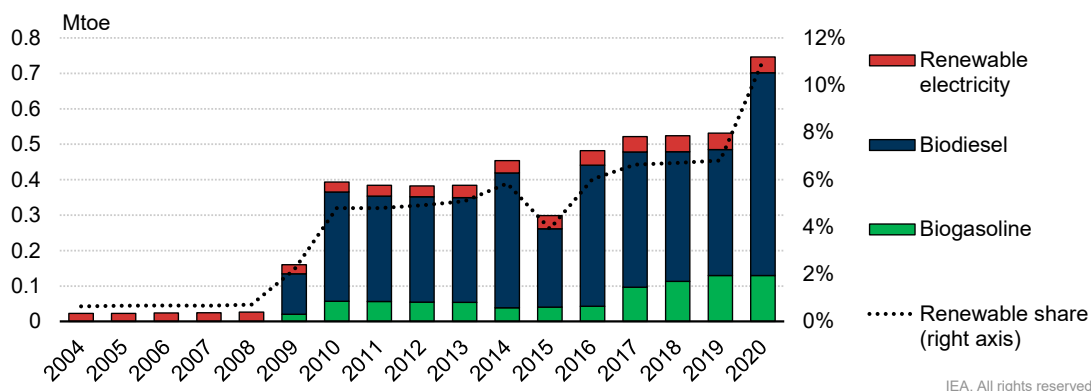
Source: IEA (2022), *World Energy Balances* (database), <https://www.iea.org/data-and-statistics/data-product/world-energy-balances>.

Figure 5.4 Renewable energy in heating and cooling in Belgium, 2004-2020

Since 2016, the share of renewables in heating and cooling has been stable at just over 8%. Most renewables heating and cooling comes from solid biomass, with an increasing role of heat pumps.

Sources: Eurostat (2022), *Energy from Renewable Sources* (database), <https://ec.europa.eu/eurostat/web/energy/data/shares>.

Renewables in transport consist mainly of biofuels blended with diesel and gasoline, along with renewable electricity in rail (Figure 5.5). Biodiesel accounted for 77% of renewables in transport in 2020, almost doubling since 2010, with a significant rise in 2020. Biogasoline accounted for 17% of renewables in transport in 2020 and has more than doubled since 2010, notably increasing since 2016. Renewable electricity used in rail accounted for 5% of renewables in transport in 2020 and has increased by 48% since 2009. Electricity in road transport accounted for 0.5% of renewables in transport in 2020, but is expected to grow with increasing EV uptake (see Chapter 4).

Figure 5.5 Renewable energy in transport in Belgium, 2004-2020

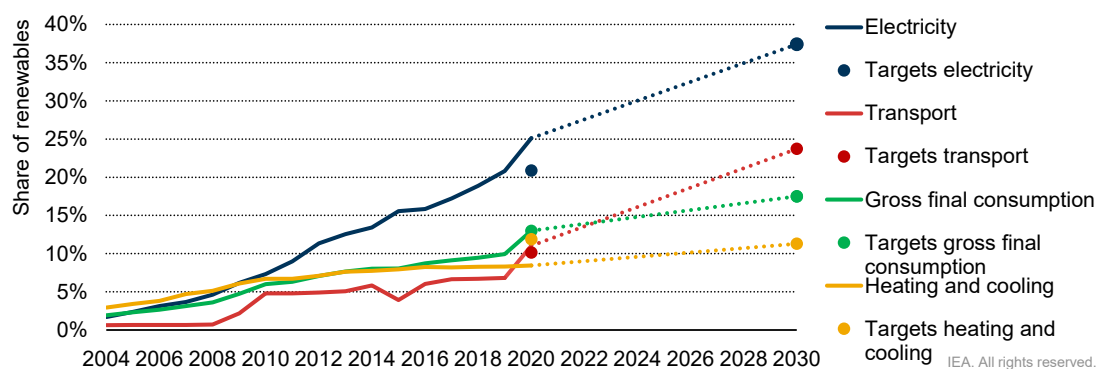
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Renewables in transport consists mainly of biofuels blended with diesel and gasoline.

Sources: Eurostat (2022), *Energy from Renewable Sources* (database), <https://ec.europa.eu/eurostat/web/energy/data/shares>.

Renewable energy targets

Under the EU Renewable Energy Directive (RED), Belgium has 2020 and 2030 targets for renewables in gross final consumption, electricity generation, heating and cooling, and transport (Figure 5.6). Belgium's renewable energy targets are intended to support the targets for the entire EU to reach a 20% share of renewable energy in gross final energy consumption by 2020 and 32% by 2030. To support the increased 55% GHG emissions reduction target, the EU is developing a higher renewable energy target for 2030.

Figure 5.6 Belgium's 2020 and 2030 renewable energy targets and status, 2004-2020

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Renewable energy share	2019 status	2020 status	2020 targets	2030 targets
Gross final energy consumption	9.9%	13%	13%	17.5%
Electricity*	20.8%	25.1%	20.9%	37.4%
Heating and cooling*	8.3%	8.4%	11.9%	11.3%
Transport	6.8%	11%	10.14%	23.7%

* Indicative targets.

Sources: Eurostat (2022), *Energy from Renewable Sources* (database), <https://ec.europa.eu/eurostat/web/energy/data/shares>; EC (2021a), Belgian Integrated National Energy and Climate Plan, https://energy.ec.europa.eu/system/files/2020-09/be_final_necp_parta_en_0.pdf.

Belgium achieved the 2020 indicative target for renewables in electricity. Thanks to an increase in biofuel blending in 2020, Belgium's share of renewables in transport reached

11%, exceeding the 2020 binding target of 10%. However, the share of renewable heating and cooling did not reach the desired indicative share. Belgium's 2018 burden-sharing agreement divides responsibility for meeting the 2020 target of 13% renewables in gross final energy consumption between the federal and regional governments. Under this agreement, the estimated level of renewable energy needed to meet the 2020 target (49 125 gigawatt hours [GWh]) was divided between Flanders (25 074 GWh), Wallonia (14 851 GWh), the federal government (8 350 GWh) and the Brussels-Capital Region (849 GWh).

Under EU rules, any EU member state not meeting its target for renewables must purchase statistical transfers from EU member states that exceeded their 2020 target. Belgium's burden-sharing agreement requires governments failing to meet their contribution to the national 2020 target to purchase statistical transfers needed to cover their deficit. Projections from 2020 indicated that Wallonia had a surplus of 1 465 GWh over its contribution. However, this was insufficient to compensate for deficits from Flanders, the federal government and the Brussels-Capital Region. In October 2020, Flanders purchased 2 070 GWh of statistical transfers from Denmark for EUR 22.5 million (The Brussels Times, 2020). In September 2021, the federal government purchased 1 655 GWh of statistical transfers from Finland for EUR 18.6 million (Finnish Government, 2021). In 2021, the Brussels-Capital Region purchased 152 GWh of statistical transfers from Lithuania (EC, 2021b).

The federal and regional governments are developing a burden-sharing agreement to divide responsibility for meeting the 2030 targets.

Renewable energy policy and support measures

Belgium's NECP is the main policy document defining renewable energy policy through 2030. In line with EU requirements, the NECP sets Belgium's 2030 renewable energy targets and specifies the policies and measures intended to help achieve these targets. The policies and measures in the NECP reflect the division of competencies between the federal and regional governments. Competency over renewable energy policy rests mainly with the regional governments. The federal government is responsible for Belgium's territorial waters, giving it authority over policy for offshore energy development. The federal government also has responsibility over policy for transportation fuels, including biofuels. The NECP defines the specific measures to be taken by each government to support the achievement of Belgium's 2030 renewable energy targets.

Renewables in electricity

Electricity generation from renewable energy is promoted primarily through programmes that require electricity suppliers to obtain a quota of green certificates. There are four separate green certificate programmes (one for the federal government covering only offshore wind generation and one for each of the three regional governments, covering a range of renewable technologies). The programmes of Wallonia and the Brussels-Capital Region include increasing annual quotas.

Certificates are issued by the relevant energy regulator based on MWh of renewable electricity generated (federal government and Flanders) or on avoided CO₂ emissions (Wallonia and the Brussels-Capital Region). The green certificate programmes of

Flanders, Wallonia and the Brussels-Capital Region allow electricity producers and suppliers to trade certificates. The regional programmes also impose fines on suppliers that do not meet their certificate quota. Certificates cannot be traded between the regional programmes and the federal programme does not allow any trading of certificates.

Renewable energy projects can generate green certificates for a certain number of years following project commissioning: 10 years for the Brussels-Capital Region, 10-15 years for Flanders and Wallonia, and 20 years under the federal programme for offshore wind (19 years since 2019). The prices paid for certificates vary between programmes and have been adjusted numerous times to reduce the level of subsidies, in line with falling technology and deployment costs and so that certificate prices vary in line with electricity market prices.

Under the federal green certificate programme, the TSO is allowed to offset the cost of purchasing green certificates with an offshore surcharge to all end consumers. The maximum surcharge for private companies is EUR 250 000 per grid connection. Companies participating in a voluntary energy efficiency agreement can receive a 15-45% reduction on the offshore surcharge, depending on their annual electricity demand. Voluntary energy efficiency agreements require companies to take certain action to reduce energy demand (see Chapter 4). The discount on the offshore surcharge is funded through specific excise duties and general corporate tax.

The federal government is in the process of updating the discount system, including changes to how the discount is calculated, adopting European guidelines for state aid with regard to companies with significant electricity demand, eliminating the offshore surcharge for electricity storage installations and setting a different discount for railway network operators.

In tandem with the green certificate programme for offshore wind, the federal government established a dedicated zone for offshore wind deployment covering 225 square kilometres (km²) in the Belgian North Sea adjacent to the marine border with the Netherlands. This zone was selected based on a review of wind resource quality and accounting for other issues, including environmental factors and competing uses (commercial fishing, shipping, and military and civilian aviation). As of 2020, nine offshore wind farms with a total capacity of 2.26 GW had been built in the offshore wind zone, which is close to the maximum planned deployment.

The Marine Spatial Plan 2020-2026 requires the development of a second offshore wind zone of 281 km² in the Belgian North Sea adjacent to the marine border with France. In October 2021, the planned capacity for the second offshore zone was expanded from 2.2 GW to 3.15-3.5 GW. This increased the goal for total offshore wind capacity from 4 GW to 5.35-5.7 GW by 2030. Together, the two zones will cover much of the area available for offshore wind deployment in Belgium's territorial waters. To drive cost-competitive deployment in the second offshore wind zone, the federal government is developing a competitive bidding procedure.

In 2019, the TSO finished the deployment of the first phase of Belgium's Modular Offshore Grid, which supports the connection of offshore wind projects to the national grid at a reduced cost and allows for connection with the offshore grids of other countries operating offshore wind farms in the North Sea. The Modular Offshore Grid connects the four offshore wind projects commissioned from 2019 to 2020 and it is planned that it will be expanded to connect projects developed in the second offshore wind zone (Elia, 2022).

Belgium's National Recovery and Resilience Plan (issued in response to the Covid-19 pandemic) includes EUR 100 million for the development of an offshore energy hub to support the expansion of offshore wind generation.

In addition to green certificate programmes, the regional governments have a variety of programmes and support measures that push for the deployment of electricity generation from renewable energy, especially for small-scale distributed solar PV generation. These programmes provide financial support and work to address challenges like spatial planning.

The EUR 1.2 billion package of measures to accelerate energy transition introduced in March 2022 includes several efforts to increase the deployment of renewable electricity generation. This includes plans to accelerate the development of the second offshore wind zone, repower the first offshore wind zone to increase its capacity, examine options for creating a third offshore wind zone and a push for deployment of a meshed offshore electricity grid linking the countries around the North Sea.

The package also pushes for accelerated deployment of solar PV, including funding to deploy solar PV on national railway stations (in connection with EV smart charging) and on federal buildings. There are also measures to support the deployment of large-scale floating solar PV systems. In addition, the VAT on solar PV panels was reduced to 6% for 2022 and 2023. The package also aims to reduce the time needed to obtain permits and licences for onshore solar PV and wind generation projects.

Renewables in transportation

Belgium's main policy for encouraging renewable energy in transport is a biofuels blending mandate that requires all companies selling road transportation fuels to reach a certain share of biofuels (by energy content) in their annual sales. The biofuel blending obligation was 9.55% for 2020 and 2021. The NECP proposes annually increasing the required share to reach 13.9% by 2030. Under the RED, the contribution of first-generation biofuels (derived from food or animal feed) to meeting the blending mandate is limited to 7%. The remainder must be covered by advanced biofuels that meet sustainability criteria or by renewable electricity used in road and rail transport. EU accounting rules give a bonus above the actual energy content for qualifying advanced biofuels and renewable electricity. Belgium is aiming to increase the share of renewable energy in transport through the deployment of EVs in tandem with increased electricity generation from renewables (see Chapter 4). The March 2022 package to accelerate energy transition includes plans to deploy EV smart charging and solar PV at the stations of the national railway operator.

Renewables in heating and cooling

The regional governments are responsible for most policies related to renewables in heating and cooling and have established a variety of support programmes (tenders, direct payments, building codes, etc.) to encourage the development of both distributed solutions (heat pumps and bioenergy) and renewable district heating. Wallonia has introduced a support scheme providing payments to projects that inject biomethane into the natural gas grid. The March 2022 package to accelerate energy transition aims to increase renewable heating and cooling. For example, the VAT on solar PV thermal collectors and on heat pumps was reduced to 6% for 2022 and 2023.

Assessment

From 2009 to 2019, the share of renewable energy in Belgium's TFEC increased from 5% to 10%, driven by growth in renewable electricity generation (mainly wind and solar PV) and increased bioenergy use for transport and industrial and building heating. However, in 2019, Belgium's share of renewables in TFEC was relatively low, ranking 24th among IEA member countries.

Under the RED, Belgium has 2020 and 2030 targets for renewables that are intended to support the achievement of EU-wide renewable energy targets. Belgium achieved the required 13% share of renewables in gross final energy consumption, however this required purchasing statistical transfers for other EU member countries (without these transfers, the 2020 share was 12%). The federal and regional governments should co-operate to determine why domestic use of renewable energy was not sufficient to meet the 2020 renewable target, what the main barriers were, which measures were successful in driving the deployment of renewables, and which measures need to be revised or replaced to support increased and sustained uptake of renewables.

Belgium's NECP is the main policy document defining renewable energy policy through 2030. It sets Belgium's 2030 renewable energy targets and specifies the policies and measures intended to support the achievement of these targets. In October 2020, the European Commission provided comments on Belgium's NECP, noting that the 2030 targets for renewable energy are not sufficiently ambitious for the achievement of the EU-wide 2030 target of a 32% renewable energy share of the EU's gross final energy consumption (EC, 2021c). The EU calculation shows that Belgium needs to reach a 25% share of renewable energy in gross final energy consumption in 2030 (the current target is 17.5%). In addition, in July 2021, the 2030 EU-wide GHG emissions reduction target was increased from 40% to 55%. The EU has indicated that it will update the RED to increase the EU-wide renewable energy target from 32% to 40% to support the EU-wide 55% GHG reduction target.

Given the European Commission's assessment of the NECP and the likelihood of higher EU renewable energy targets, Belgium should increase its national renewable energy targets to ensure they support the EU-wide 55% emissions reduction target. Belgium should also quickly develop an understanding of the options for additional renewable energy capacity and the measures needed to accelerate the deployment of renewables. More ambitious targets and additional measures should be included in an updated NECP requested by the European Commission in draft form by 2023. Both these steps would help to provide clear signals to investors.

Belgium's renewable energy policies and measures reflect the division of competencies between the federal and regional governments. Responsibility for renewable energy policy rests mainly with the regional governments. This division of competencies hinders the development of a shared long-term vision and implementation of coherent policies. For example, the previous IEA energy policy review of Belgium recommended harmonising the country's four green certificate programmes to increase the impact and

cost-effectiveness of green certificates through a national market. However, the government has indicated that no steps have been taken to align the certificate systems or to allow for national trading.

The federal and regional governments are developing a burden-sharing agreement to divide responsibility for meeting the 2030 targets. The IEA recommends that federal and regional governments co-operate to quickly conclude a new burden-sharing agreement that harmonises policies across the country and accounts for the higher EU targets to provide policy clarity to stakeholders and investors. A burden-sharing agreement that takes into account the distribution of renewable resources among regions would result in a more climate-friendly, affordable and secure energy system.

Electricity generation from renewable energy is promoted primarily through green certificate programmes (the federal programme covers offshore wind while the three regional programmes cover a range of renewable technologies). Details vary between the programmes, but in general certificate prices have been adjusted with the goal to reduce subsidies in line with falling technology and deployment costs and to better reflect market prices.

Belgium's National Recovery and Resilience Plan (issued in response to the Covid-19 pandemic) includes EUR 100 million for the development of an offshore energy hub to support the expansion of offshore wind generation. However, the European Commission's analysis from June 2021 noted that aside from the offshore energy hub, Belgium's National Recovery and Resilience Plan contains limited investments for the deployment of renewable energy and that additional funding outside of the plan will be necessary to achieve Belgium's 2030 renewable energy targets. Belgium should increase its efforts to align its plans for recovery from the Covid-19 pandemic with energy transition.

Belgium had rapid growth in offshore wind. In 2020, the development of its first offshore wind zone was completed with 2.26 GW of capacity. The NECP sets a target for at least 4 GW of offshore wind capacity by 2030. In 2019, the Marine Spatial Plan 2020-2026 was approved, requiring the development of a second offshore wind zone, and the federal government started working on the development of a competitive bidding process for offshore wind. The government should consider including an option for projects with battery storage in the competitive bidding process, as this would greatly increase the ability of new offshore wind projects to support system flexibility.

The TSO is responsible for the development and cost of the network to connect Belgium's offshore wind generation. The TSO finished the first phase of Belgium's Modular Offshore Grid, which connected the last project in the first offshore wind zone and will be expanded and upgraded to connect the second offshore wind zone. It is critical that the necessary onshore transmission investments are completed in time to support the offshore projects. No major issues have been identified with the Modular Offshore Grid; however, the TSO is having difficulties obtaining the necessary construction permits for the needed onshore transmission infrastructure, with the underlying risk of not being able to connect the new offshore wind farms in time. Wind farm developers have indicated they could commission their projects by 2025, but current permitting delays do not support this and could push commissioning past 2026. Given the critical need for additional generation capacity in line with the nuclear phase-out, strong efforts should be made to accelerate the deployment of infrastructure supporting offshore wind.

In 2021, Belgium had the sixth-highest offshore wind capacity in the world and is pushing for additional development. However, Belgium has limited territorial waters and offshore wind must compete with numerous other uses and respect environmental constraints.

Development beyond the second offshore wind zone will be difficult and Belgium is exploring the option of interconnection with or developing new offshore wind capacity in the waters of other countries.

In February 2021, Belgium and Denmark signed a memorandum of understanding for the development of an electricity interconnector from an energy island Denmark plans to build in the North Sea. The interconnector could connect Belgium to large offshore wind farms off the Danish coast. Power from the wind farms would be transmitted to both countries. Denmark is already co-operating with Germany and the Netherlands, looking into similar international connections from the energy island. If the electricity interconnection between Denmark and Belgium becomes a reality, it will pass through the offshore waters of four different countries, and will probably be the one of the world's longest DC high-voltage cables.

Belgium's goals to greatly increase generation from wind and solar PV require strong interconnections and domestic networks. Investments in the grid should be given priority to facilitate the necessary trade and prevent network congestion. The TSO is making regular investments to ensure adequate interconnection capacity. The Nemo Link high-voltage direct current (HVDC) subsea cable linked Belgium to the United Kingdom in 2019, and in 2020 an HVDC underground cable linked Belgium to Germany. Belgium is also examining the possibility of a second subsea interconnector with the United Kingdom (Nautilus) that connects the grids of both countries and directly connects offshore wind farms to the mainland. The European Commission selected Nautilus as a project of common interest.

There are permitting and public acceptance issues that the federal and regional governments need to address to ensure that renewables deployment (onshore wind and large-scale PV) and grid development can move forward as envisaged in the NECP. Given the likely need to increase renewable energy targets, efforts should be made to clearly align renewables deployment with the development of supporting infrastructure, taking into account environmental impacts and public acceptance.

The NECP also recognises the importance of energy storage for increasing the integration of renewable energy and improving overall system flexibility. Belgium currently has around 1.31 GW of pumped storage capacity, which plays an important role in system balancing. However, there is limited opportunity for further development of pumped hydro storage and Belgium has only limited deployment of battery storage. The governments should ensure that legal, regulatory or other barriers to storage deployment are removed and that storage is able to fully and effectively participate in all electricity markets.

The regional governments are responsible for most policies related to renewable heating and cooling and have established a variety of support programmes (tenders, direct payments, building codes) to encourage the development of both distributed solutions (heat pumps and bioenergy) and renewable district heating. Wallonia has introduced a support scheme providing payment to projects that inject biomethane into the natural gas grid.

Belgium's dense population is ideal for the development of district heating. However, very little heating demand in Belgium is covered by direct supply of heat. In 2019, district heating covered just 1% of energy demand from service sector buildings and just 0.2% of energy demand from residential buildings. Belgium should take actions to promote district heating. District heating can easily be decarbonised with renewables like biomass

co-generation, solar thermal or geothermal, large heat pumps, and excess heat. Moreover, waste heat from Belgium's large industrial complexes can be used for residential heating.

Belgium should place a strong focus on the renewable heating option in less dense areas (especially to eliminate the use of oil-based heating). Heat pumps and solar heat can be used for heating in rural areas, and combined with renewable generation from solar PVs with batteries. Belgium should also take steps to increase the sustainable production of biogas and biomethane, which can support renewable heating through direct use and grid injection.

Renewable energy in transport is mainly supported through a federal biofuels blending mandate, which requires all companies selling road transportation fuels to blend a certain share of biofuels by energy content. The blending obligation was 9.55% for 2020 and 2021. The NECP proposes annual increases in biofuel blending from 2020 to reach 13.9% by 2030. Under the RED, a certain share of transport biofuels must be advanced biofuels that meet sustainability criteria. Belgium should consider expanding the biofuel blending obligation to cover inland shipping.

In Belgium, transportation biofuels are taxed at the same rate as fossil fuels. The government should examine biofuels taxation in the upcoming fiscal policy review and consider decreasing or eliminating taxes on advanced biofuels, to limit price impacts and further promote biofuels deployment in the transport sector.

Belgium is also aiming to increase the share of renewable energy in transport through the deployment of EVs, in tandem with increased electricity generation from renewables. A strong deployment of EVs requires a clear strategy on charging infrastructure deployment and co-ordination with system operation to ensure that grids are expanded as needed to support charging. Smart charging and other strategies such as dynamic pricing should be developed across all of Belgium to ensure that EVs can be rapidly deployed with secure grid operations.

Recommendations

The government of Belgium should:

- Co-operate with the regional governments to evaluate the support measures for renewable energy, expand effective support measures, and update or replace ineffective measures to accelerate renewable deployment.
- Increase renewable energy targets in line with the EU's 55% emissions reduction target and expected revision of the Renewable Energy Directive, and together with the regional governments agree on a transparent road map with clear milestones to achieve these targets.
- Ensure that infrastructure planning, approval and permitting processes allow for the timely expansion of transmission and distribution systems needed to support a rapid and sustained renewables deployment, especially for the second offshore wind zone.

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6. Energy research, development and innovation

Key data

Public energy R&D spending (2020): EUR 285.4 million

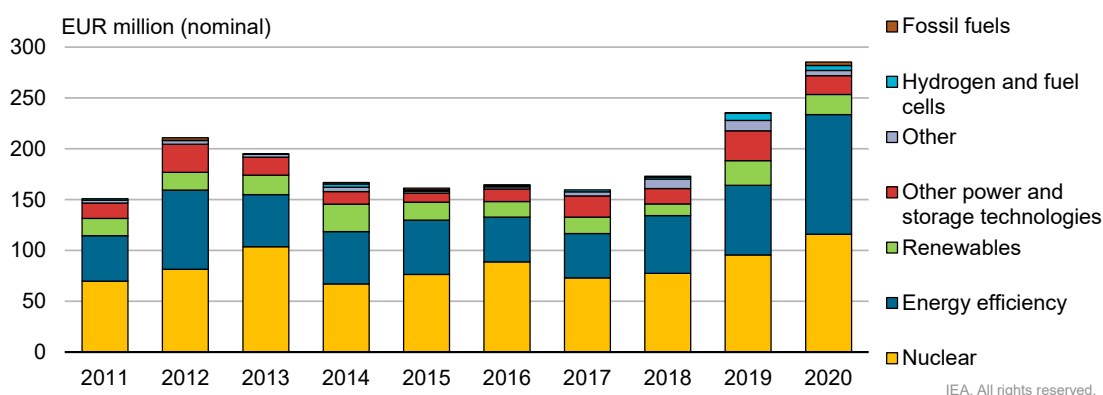
Public energy R&D share of GDP (2019): 0.050% (IEA median:* 0.035%)

* Median of 27 IEA member countries for which 2019 data are available.

Overview

Between 2012 and 2017, Belgium's public spending on energy research and development (R&D) fell from EUR 210 million to EUR 160 million. Since then, public spending on energy R&D has increased rapidly to reach EUR 285 million in 2020 (Figure 6.1). In 2020, the largest shares of public spending on energy R&D went to nuclear energy (41%, primarily for nuclear fission) and energy efficiency (41%, mainly for efficiency in transport and industry), followed by renewables (6.9%), other power and storage technologies (6.5%), hydrogen and fuel cells (1.7%), other cross-cutting technologies and research (1.8%), and fossil fuels (1.2%).

Figure 6.1 Public spending on energy R&D by sector in Belgium, 2011-2020



Public spending on energy R&D increased significantly between 2017 and 2020, especially for nuclear energy and energy efficiency.

Source: IEA (2022), *Energy Technology RD&D Budgets* (database), <https://www.iea.org/data-and-statistics/data-product/energy-technology-rd-and-d-budget-database-2>.

In 2019, Belgium's public spending on energy R&D equalled 0.05% of its GDP, the eighth-highest spending among IEA member countries and above the IEA average of 0.037% of GDP. According to Belgium's R&D survey, private sector research expenditures in energy-producing sectors averaged EUR 117 million per year between 2012 and 2017.

Responsibility for energy R&D policy is divided between the federal and regional governments based on their energy policy competencies. The federal government is responsible for R&D covering nuclear energy, offshore energy, transportation fuels, security of energy supply and network balancing. The regional governments are responsible for R&D related to energy efficiency, renewables and for public-private co-operation on R&D. The governments of the Flemish, French and German-speaking Communities organise the R&D conducted by Belgium's universities.

R&D targets

Under the Europe 2020 strategy, Belgium committed to supporting the target for combined public and private spending on R&D to reach 3% of the EU's GDP by 2020. This EU target was not achieved, with the share reaching just above 2% of the EU's GDP in 2020. Most EU member countries (including Belgium) fell short of spending levels needed to support the 2020 target. In September 2020, the European Commission issued a communication reaffirming the target for 3% of GDP to be invested in R&D, but with the deadline extended to 2030. The EU also set a 2030 target for 5% of each EU member country's public R&D funding to support R&D undertaken through co-operative European partnerships (EC, 2020).

Belgium is committed to achieving the 2030 EU R&D targets. Belgium's NECP commits to increasing total R&D spending to at least 3% of GDP (1% public, 2% private) by 2030 and places a strong focus on European co-operation. The government of Flanders has committed to reaching the target of 3% of GDP for R&D by 2024. To reach this target, Flanders will support R&D with a one-off allotment of EUR 194 million and a EUR 250 million increase in its annual R&D budget. This is on top of a EUR 500 million increase in the annual R&D budget from 2014 to 2018. Wallonia has also committed to reach the 3% of GDP invested in R&D by 2030, and wants to see the EU target increased to 4% by 2035 and 5% by 2050. The Brussels-Capital Region also supports the 3% by 2030 target.

Belgium's Inter-federal Energy Pact recommends that as of 2020, 5-10% of Belgium's public R&D spending supports projects related to decarbonising the economy. The federal government has indicated that as of 2020, 5-10% of its R&D budget will be earmarked for climate and energy projects. Belgium's NECP notes that Wallonia has set a target for public spending on energy and climate R&D to reach EUR 110 million per year by 2030.

Energy R&D policy and support measures

Energy R&D policy and support measures in Belgium are divided between the federal and regional governments based on their energy competencies. Given the significant role of energy-intensive industries in Belgium's economy, R&D policy places a strong focus on maintaining industrial competitiveness while helping industry to support energy transition.

Federal government

At the federal level, a key R&D priority is maintaining nuclear expertise, particularly in relation to the responsible management of radioactive waste and spent nuclear fuel to support the safe operation and decommissioning of nuclear power plants. The NECP reaffirms federal support for fusion R&D and for fission R&D in relation to the responsible management of radioactive waste and spent nuclear fuel.

Belgium seeks to maintain expertise in nuclear RD&D and is making a major investment in this area through the MYRRHA research facility that will support a range of nuclear R&D, including work related to the long-term management of high-level radioactive waste. The total budget for MYRRHA is estimated at EUR 1.6 billion, of which EUR 558 million are committed by the federal government. The federal government also places a priority on R&D related to security of electricity supply, especially in relation to the phase-out of most of Belgium's nuclear generation. In 2022, Belgium committed EUR 100 million over four years for research supporting the development of small modular nuclear reactors.

One of the main mechanisms supporting federal energy R&D is the Energy Transition Fund. Established in 2016, the fund is financed through a fee of EUR 20 million per year through 2025, paid by the operator of the Doel 1 and 2 nuclear reactors. The fund finances innovative energy projects falling under the responsibility of the federal government, including projects related to nuclear energy guaranteeing security of energy supply (particularly energy production and storage and demand-side management), offshore wind and biofuels. The Energy Transition Fund also provides funding for R&D infrastructures and innovation by SMEs.

The Energy Transition Fund provides support as grants issued through competitive calls for proposals organised by the Directorate-General for Energy. The topics of each call are determined based on input from the Minister of Energy. The fund supports a wide range of R&D, including fundamental research, industrial research, feasibility studies, experimental development and other areas across a range of technology readiness levels. The first three calls (issued in June 2017, December 2017 and August 2018), resulted in EUR 57 million of grants to 35 projects. Calls issued in October 2019, November 2020 and November 2021 offered a total budget of EUR 75 million. The government has announced that a seventh call for proposals will be issued in November 2022.

Belgium's tax code allows for a deduction of income related to a wide range of investments, with increased deductions for investments related to patents and green R&D. Belgium also provides a refundable tax credit targeting green R&D investments. There is also a tax exemption related to employing researchers with a masters or doctoral degree. A deduction for income related to intellectual property was abolished August 2016; however, this deduction could be applied through June 2021 for income related to intellectual property that was registered before July 2016. In place of the intellectual property deduction, Belgium established a tax deduction for innovation-related income in July 2016.

Flanders

In Flanders, energy R&D policy is part of science, technology and innovation (STI) policy. The main STI policy document sets six top-level priorities, including a priority for innovation supporting climate-neutral solutions for industry. In 2016, the Flemish government approved a decree establishing support for spearhead innovation clusters. The objective of the clusters is to increase the competitiveness of Flemish companies through

partnerships between companies and co-operation with public R&D entities. Five of the clusters focus on energy-related technologies and in 2019, a new cluster was established to focus on hydrogen. The Flemish government has also set a goal to become a frontrunner in hydrogen technologies and published a Regional Hydrogen Strategy in November 2020. The strategy sets general goals for research and innovation aiming to accelerate the production and use of low-carbon hydrogen, with a focus on international co-operation and securing EU funding for projects of common interest.

Flux50, one of the spearhead clusters, aims to support Flanders in gaining international recognition as a Smart Energy Region. Flux50 facilitates cross-sector collaboration between energy, information technology and building companies to enhance the competitiveness of the Flemish smart energy industry in the transition towards low-carbon systems. Flux50 brings together relevant players from industry, academia and government and provides them with project support, networking opportunities and a knowledge-sharing platform. To bring innovative and fully integrated energy products and services to market, Flux50 sets up and co-ordinates living labs in five innovator zones: 1) energy harbours; 2) micro-grids; 3) district-level multi-energy solutions; 4) energy cloud platforms; and 5) intelligent renovation (Flux50, 2021).

The Flanders Industry Innovation Moonshot Programme was established in 2019 with a budget of EUR 20 million per year through 2040. It supports co-operation between Flemish universities, research institutes and industrial companies on R&D to develop technologies for new climate-friendly processes and products by 2040, to achieve the 2050 objective of a carbon circular industry in Flanders. The Moonshot Programme identifies four themes based on R&D expertise in Flanders: 1) bio-based chemistry; 2) circularity of carbon in materials; 3) electrification and process transformation; and 4) energy innovation.

Energy R&D in Flanders is also supported through EnergyVille, a collaboration between several research entities working on sustainable energy and intelligent energy systems. EnergyVille develops the technologies and knowledge to support public and private stakeholders in their transition to an energy-efficient, decarbonised and sustainable urban environment (EnergyVille, 2021).

Wallonia

Wallonia's Regional Policy Statement 2019 defines its overall investment policy, including for R&D. Under the Regional Policy Statement, Wallonia intends to support energy R&D focused on climate change, including new low-carbon energy carriers, power-to-gas, direct air capture, PV windows and micro-grids.

Wallonia's Smart Specialisation Strategy defines a strategic framework for R&D and industrial policy. It defines five strategic innovation areas as priorities for R&D based on an analysis of local strengths. The five strategic innovation areas are: 1) circular materials; 2) innovations for health; 3) innovations for manufacturing; 4) energetic systems and sustainable housing; and 5) food processing and innovative management of the environment.

Wallonia is also working with industry to reinforce private R&D efforts in areas most relevant to energy transition. Wallonia will establish target-based contracts with competitive clusters in line with the innovation goals of the Smart Specialization Strategy. The competitive clusters are groups of companies and public or private R&D entities

focused on a particular market, technology or scientific field. These clusters play a key role as they inform R&D policy discussions and issue calls for proposals for R&D projects.

In 2021, Wallonia introduced an Intelligent Specialisation Strategy that identifies five strategic innovation domains. One of these domains, sustainable energy systems and housing, defines ambitions and strategic areas for energy research. It will drive European Structural Funds calls and regional calls of projects (Economie Wallonie, 2021).

Brussels-Capital Region

The R&D policy of the Brussels-Capital Region, set in its Regional Innovation Plan, aims to drive R&D that supports a 2050 carbon neutrality. The Regional Innovation Strategy (2021-2027) identifies six strategic innovation domains: 1) digital technology; 2) climate-resilient infrastructure; 3) optimal use of resources; 4) urban flows; 5) health; and 6) social innovation. In the context of this plan, R&D will aim to support various transition paths towards a low-carbon, circular and inclusive economy

The Brussels Regional Program for a Circular Economy (PREC 2016-2020) was adopted in 2016. One of its objectives is to stimulate technological and organisation innovations linked to the urban circular economy. The PREC stresses the need for funding innovation projects and living labs. It supported the creation of the Greenbizz incubator. The PREC is followed by the current Regional Strategy of Economic Transition, which aims to achieve the transition towards a circular and decarbonised economy, namely through targeted industrial R&D and employment policies.

International collaboration

Belgium co-operates on R&D with the EU and other EU member states through the numerous R&D initiatives and programmes organised by the EU. Belgium is committed to R&D as a means to support the EU's energy and climate policy objectives for sustainability, energy security and competitiveness. The federal and regional governments aim for their R&D policies to align with overall EU R&D policy, and Belgium's overall R&D efforts are closely linked with the priorities of the European Strategic Energy Technology Plan (SET Plan). Belgium participates in the SET Plan covering key actions in the following sectors: renewables, energy systems, energy efficiency, sustainable transport, CCUS and nuclear safety.

Within the framework of the SET Plan, Belgium's federal and regional governments are working with other EU member countries to define the strategic objectives of the plan's ten key actions. Defining these objectives will be followed by R&D activities towards achieving these objectives through Belgium's federal and regional R&D support programmes and co-financing of EU programmes, such as ERA-NET. Responsibility for R&D co-operation with the EU is shared between the federal and regional governments. Co-operation on the EU SET Plan takes place through the BELSET platform. Besides the SET Plan, ERA-NET and Horizon 2020, Belgian stakeholders also participate in various EU initiatives, notably the European Joint Technology Initiatives (e.g. Fuels and Hydrogen 2 Joint Undertaking) and the European Institute of Technology (EIT KICs).

The EU funds R&D in all member states (including Belgium) through a research and innovation framework programme that is updated every seven years. Horizon 2020, the research and innovation framework programme for 2014-2020, provided a total of

EUR 80 billion for R&D in the EU. Horizon 2020 awarded funding through a competitive process open to all public and private R&D entities in the EU and aimed to increase public-private partnerships and international co-operation.

Horizon 2020 provided EUR 3.1 billion of funding for R&D in Belgium, around 5.5% of total awarded funding (while Belgium accounts for only around 3.5% of the EU's GDP). Belgium's applicants for Horizon 2020 funding had a 17.3% success rate compared to the EU average of 12%. Around a quarter of Belgium's Horizon 2020 funding (EUR 782 million) went to energy and climate-related R&D, including EUR 245 million for smart, green and intelligent transport; EUR 238 million for secure, clean and efficient energy; EUR 177 million for advanced manufacturing and processing; EUR 122 million for climate action, environment, resource efficiency and raw materials; and EUR 0.6 million for nuclear energy (Horizon 2020, 2021).

Horizon Europe, the EU research and innovation framework programme for 2021 to 2027, was launched in February 2021. It aims to provide a total of around EUR 100 billion in R&D funding, will continue to support energy-related R&D and sets goals to increase international R&D co-operation (Horizon Europe, 2021). Belgium's NECP and the regional governments' R&D strategies show clear interest to support Belgium's R&D entities in winning funding from Horizon Europe.

In 2020, the European Commission approved the CO₂TransPorts project as an EU project of common interest. The CO₂TransPorts project aims to develop CO₂ transportation infrastructure connecting the Port of Antwerp, the North Sea Port and the Port of Rotterdam. Belgian companies are also participating in the Northern Lights EU project of common interest, which aims to support carbon capture and storage projects in Belgium, France, Ireland, the Netherlands, Sweden and the United Kingdom by developing infrastructure to transport captured CO₂ by ship to a storage site on the Norwegian continental shelf. A consortium consisting of Air Liquide, BASF, Borealis, ExxonMobil, INEOS, Fluxys, the Port of Antwerp and Total are investigating the technical and economic feasibility of building CO₂ infrastructure in the Port of Antwerp. Under the Antwerp@C project, the consortium aims to reduce the CO₂ emissions from the port by up to 50% by 2030 (see Chapter 3).

Belgium participates in IEA technology collaboration programmes, a multilateral mechanism established by the IEA to support global collaboration to advance co-operation on research and the application of specific energy technologies. The programmes are composed of thousands of experts across government, academia and industry in 55 countries that co-operate on 38 technology-specific programmes. Experts can be officially appointed by governments or join privately from industry and research entities.

In 2020, 23 experts from Belgium were participating in the following 14 technology collaboration programmes: energy technology systems analysis, buildings and communities, district heating and cooling, energy storage, heat pumping technologies, smart grids, user-centred energy systems, hybrid and electric vehicles, bioenergy, hydrogen, ocean energy systems, photovoltaic power systems, solar heating and cooling, and wind energy. Belgium also participates in the IEA Committee on Energy Research and Technology, which co-ordinates and promotes the development, demonstration and deployment of technologies to meet challenges in the energy sector. Belgium is not part of Mission Innovation or the Clean Energy Ministerial.

Assessment

The federal and regional governments all incorporate energy R&D into their R&D policies; however, there is a lack of a clear national vision on energy R&D. The IEA encourages the federal and regional governments to increase co-operation on designing and implementing energy R&D policy and support measures, with a focus on areas where national-level co-ordination and sharing resources can support R&D aligned with Belgium's energy and climate goals and R&D capacities.

The federal and regional governments should consider establishing an inter-governmental R&D platform that creates economies of scale and increases sharing of knowledge and research infrastructure. The platform should be closely monitored and updated as needed to ensure it is effective in driving better R&D co-operation across Belgium and delivering research results aligned with the energy sector's most pressing challenges. The EnergyVille initiative in Flanders also serves as a replicable model for institutional collaboration that could be extended across regions and include federal research entities.

Belgium's overall R&D policy places a strong focus on maintaining industrial competitiveness while helping industry play a role in supporting energy transition. There are regional programmes for co-ordination with industry on R&D including Flanders' spearhead innovation cluster programmes and Wallonia's Smart Specialisation Strategy. These programmes are driving R&D efforts on electrification, hydrogen, carbon capture, bio-based industry and other areas key to maintaining Belgium's industry competitiveness. However, there appears to be limited interregional collaboration on industrial R&D policy and support programmes.

The federal and regional governments should examine how R&D collaboration with industry could be conducted with a more national-level approach. The development of an inter-governmental R&D platform that identifies national-level R&D priorities would send clear signals to industry on which R&D investments are aligned with Belgium's climate and energy policy goals. The federal and regional governments should also examine how R&D funding to industry could be better co-ordinated at the national level to align with Belgium's most pressing energy and climate challenges.

There is also a need to increase the support for public-private co-operation on energy R&D, as several public research institutes have noted that even when they have successful projects with high technology readiness levels, they cannot find private partners for demonstration projects. There also seem to be barriers stemming from government requirements, e.g. in Wallonia R&D public-private partnerships must involve SMEs, but SMEs often lack the capacity and resources to enter into such partnerships. The federal and regional governments should work with all R&D actors to address these issues at a national level to increase the opportunity for promising products, services and technologies to reach commercial development. The regional cluster approaches could serve as a model for a national-level programme.

The federal government and Flanders have both developed hydrogen strategies that detail areas where R&D on hydrogen should be directed to support the development of a hydrogen value chain in Belgium (see Chapter 2). Wallonia is in the process of developing a Hydrogen Strategy. The regions support hydrogen R&D and industrial pilot projects, while the federal government is focusing on the transport infrastructure needed to support

a market for hydrogen. Belgium's private sector is also supporting R&D efforts on hydrogen, including a pilot project that will test blending of 10% hydrogen with natural gas at a co-generation plant.

There is very limited use of geothermal energy in Belgium. However, several studies have shown that there is a promising potential for geothermal energy to play a greater role in Belgium's energy transition. Additional research analysing geothermal resources, and support for pilot projects to confirm resources and test heating and generation applications, is needed. This is especially relevant given the limited progress in introducing renewable heating and cooling in Belgium. There has been some recent progress in this area. Flanders has started research and analysis on the exact role of geothermal in Belgium and in July 2021 Wallonia launched a call for projects on shallow geothermal energy.

Belgium had notable success in attracting funding from Horizon 2020, which provided EUR 3.1 billion of funding for R&D in Belgium, around 5.5% of total awarded funding (while Belgium accounts for only around 3.5% of the EU's GDP). Belgium's applicants for Horizon 2020 funding had a 17.3% success rate, compared to the EU average of 12%. Belgium's NECP and the R&D strategies of the regional governments show clear interest to support Belgium's R&D entities in winning funding from Horizon Europe. The federal and regional governments should continue to support Belgium's R&D entities in developing competitive proposals that are aligned with Belgium's energy and climate goals.

Recommendations:

The government of Belgium should:

- Develop a long-term energy R&D agenda to align the energy R&D policies of the federal and regional governments with Belgium's decarbonisation goals.
- Foster greater co-operation between all of Belgium's R&D entities to boost knowledge sharing and create economies of scale.
- Incentivise public-private partnerships on energy R&D, especially to support commercial development for promising research projects and technologies.

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7. Electricity

Key data (2020)

Electricity generation: 87.9 TWh (nuclear 39%, natural gas 30%, wind 15%, biofuels and waste 7%, solar 6%, coal 2%), -2% from 2010 to 2019, -5% from 2019 to 2020

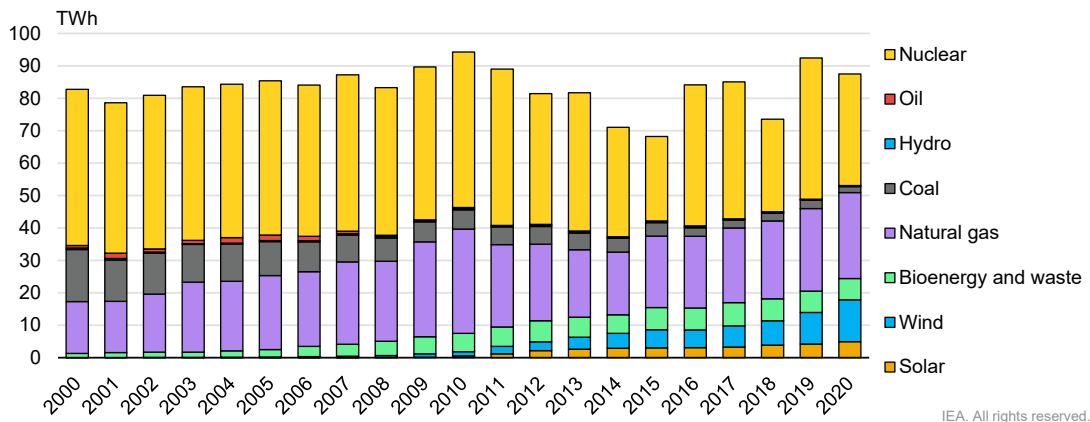
Electricity demand: 80.9 TWh (industry 50%, commercial 25%, residential 23%, transport 2%), -3% from 2010 to 2019, -3% from 2019 to 2020

Electricity net exports: 0.3 TWh (14.0 TWh exports, 13.7 TWh imports)

Electricity generation

From 2010 to 2020, Belgium's electricity generation experienced notable annual fluctuations, with a maximum generation of 94.5 TWh in 2010 and minimum of 68.7 TWh in 2015 (Figure 7.1). The main driver of these fluctuations was temporary closures at several of the country's nuclear reactors for major maintenance. In 2020, all seven of Belgium's reactors were back in operation and accounted for 39% of total electricity generation of 87.9 GWh.

Figure 7.1 Electricity generation by source in Belgium, 2000-2020



From 2010 to 2020, Belgium's electricity generation experienced notable variations, driven mainly by maintenance on nuclear reactors.

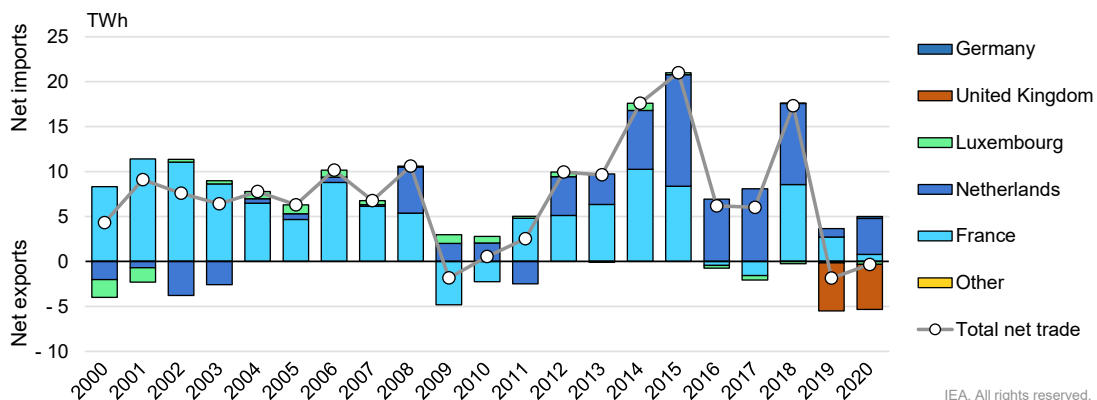
Source: IEA (2022), *World Energy Balances* (database), <https://www.iea.org/data-and-statistics/data-product/world-energy-balances>.

Belgium's last large-scale coal-fired electricity plant closed in 2016. One small-scale (10 MW) co-generation plant using coal and other fuels is in operation, but 95% of Belgium's remaining coal-related electricity generation is based on gases recovered from two blast furnaces used for steel production. Generation from renewables has grown significantly: from 2010 to 2020, generation from solar PV increased from 0.56 TWh to 5.0 TWh, and wind from 1.3 TWh to 12.9 TWh.

Electricity trade

Belgium has historically been a net importer of electricity, primarily from France and more recently from the Netherlands. Belgium has consistently been a net importer of electricity since 1991, but was a net electricity exporter in 2009 and again in 2019 and 2020 (Figure 7.2). Belgium's electricity trade experienced notable fluctuations from 2010 to 2020, driven primarily by lower availability of nuclear generation resulting from temporary closures for maintenance and safety investments. In 2019, a high level of generation from nuclear, along with increasing generation from wind and solar PV, and the commissioning of Belgium's first interconnection with the United Kingdom, contributed to high net electricity exports (1.9 TWh), while in 2020 exports decreased to 0.3 TWh.

Figure 7.2 Belgium's electricity imports and exports with neighbouring countries, 2000-2020

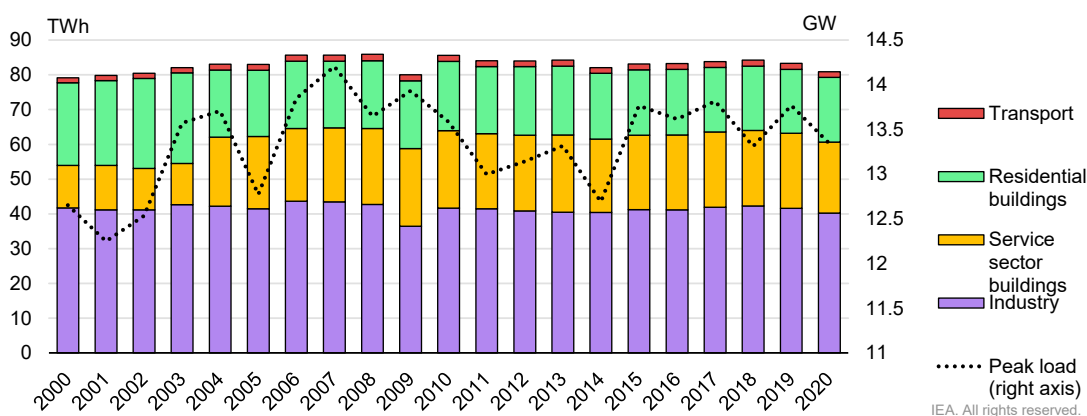


Belgium's electricity trade experienced notable fluctuations, driven primarily by changes in the available level of nuclear generation.

Source: IEA (2022), *World Energy Balances* (database), <https://www.iea.org/data-and-statistics/data-product/world-energy-balances>.

Electricity demand

Since 2011, Belgium's electricity demand has been relatively stable, at around 84 TWh, and was 83.7 TWh in 2019 (Figure 7.3). In 2020, electricity demand dropped by 3% to 80.9 TWh as a consequence of the Covid-19 pandemic. From 2010 to 2020, the industry sector covered around half of total electricity demand, while the share of demand from the service sector was stable at around one-quarter. The share of residential buildings was also stable, at around 23%. The transport sector covered the remaining 2%.

Figure 7.3 Annual electricity demand by sector and peak load in Belgium, 2000-2020

Since 2011, electricity demand has been relatively stable, at around 84 TWh, and dropped to 81 TWh in 2020. Electricity demand is almost evenly divided between industry and buildings.

Source: IEA (2021a), *World Energy Statistics and Balances* (database), <https://iea.org/statistics>.

From 2009 to 2020, Belgium's peak electricity demand experienced notable fluctuation, from a high of 13.9 GW to a low of 12.7 GW and was 13.3 GW in 2020. Peak demand consistently occurs from December to January between 5:00 pm and 7:00 pm. Peak demand is well below Belgium's total generation capacity (23.85 GW in 2020), while maximum import capacity was 6.5 GW in 2020.

Electricity policy

The federal government's electricity policy is focused on increasing the share of renewable electricity generation, increasing cross-border interconnection capacity, a secure phase-out of nuclear generation by 2025, ensuring security of electricity supply, lowering electricity costs and increasing the competitiveness of the electricity markets. The federal government has several measures to increase the deployment of offshore wind generation, including a competitive auction process to drive the deployment of a new offshore wind zone (see Chapter 5).

Regional electricity policy focuses on increasing electricity generation from renewables, distribution system flexibility and the participation of consumers in electricity markets through smart meters, DSR, energy storage and distributed renewables (including self-consumption).

Belgium is also an active member of the multilateral Pentalateral Energy Forum, which includes Austria, Belgium, France, Germany, Luxembourg, the Netherlands and Switzerland. The Pentalateral Energy Forum continues to successfully pursue ever further integration of the cross-border electricity markets of its members through the development of common rules and market mechanisms that promote energy security and efficient markets.

Nuclear phase-out and capacity remuneration mechanism

Belgium's federal Law of 31 January 2003 requires the phase-out of all nuclear electricity generation in the country. The law was amended in 2013 and 2015 to allow the Tihange 1

and Doel 1 and 2 reactors to remain operational until 2025. In light of the Russian invasion of Ukraine and goals to reduce fossil fuel dependency, the federal government decided in March 2022 to take the necessary steps to extend 2 GW of nuclear capacity by ten years. The government will amend the 2003 law to allow for this extension (see Chapter 8).

The 2021 adequacy and flexibility study conducted by the Belgian electricity TSO estimated that Belgium's nuclear phase-out in combination with the accelerated phase-out of thermal generation in neighbouring countries will require the deployment of 2.0-3.6 GW of new generation capacity in Belgium by 2025 and 3.2-4.1 GW by 2030. To ensure security of electricity supply as nuclear generation is reduced, Belgium created a CRM that uses competitive auctions to award payments for availability of capacity to encourage the deployment of new generation, DSR and energy storage assets and the retention/upgrading of such assets already in operation. Two auctions will be held for each delivery year (one auction four years ahead of the delivery year and one auction one year ahead). The first delivery year is set from November 2025 to October 2026. The electricity TSO is responsible for running auctions and reporting on auction results in relation to security of supply.

To participate in a CRM auction, a project must hold a production permit from the federal government and a combined building and environment permit from the relevant regional governments and present a plan covering project financing, electricity network connections and, for gas plants, gas network connections. Projects receiving any other subsidies from Belgium cannot participate in the CRM auctions unless they give up these subsidies. Capacity providers selected in an auction receive monthly payments for a period of 1-15 years, with the duration of payments depending mainly on investment costs (larger more expensive projects can submit bids for longer payment periods). Payments are based the selected bid price (EUR/MW/year) and a technology-specific derating factor.

For the first CRM auction, fossil thermal generation had the most favourable derating, e.g. combined-cycle gas turbines (CCGT) had a 91% derating (payments are based on 91% of actual plant capacity). DSR and storage deratings were based on the duration of capacity availability and range from 11% for one hour to 65% for seven to eight hours and 100% for unlimited availability (DSR only). Deratings were much lower for renewable generation, solar PV (4%), onshore wind (6%), offshore wind (15%) and run-of-river hydro (34%). Derating factors are reviewed annually and can be adjusted. Small changes were made in the derating factors for CRM auctions planned in 2022, but fossil generation still has the most favourable derating (mostly between 90% and 96%) while renewables generation still has the least favourable derating (1% for solar to 41% for run-of-river hydro).

The availability of capacity from projects selected in an auction is monitored and subject to testing by the electricity TSO. Penalties are applied if contracted capacity is unavailable. The CRM is financed through a federal excise duty that is charged to all electricity consumers (the duty also finances other programmes). The federal excise duty is set at a level guaranteeing that the federal component of electricity bills remains the same or decreases.

The first CRM auction was conducted in October 2021 for capacity that must be operating by 1 November 2025. The auction selected 4.4 GW of derated capacity, mainly natural gas CCGT plants (2 GW existing and 1.6 GW from two new plants) and also 0.36 GW of existing co-generation, 0.29 GW of existing DSR and around 0.1 GW of other technologies,

including some new battery storage (40 MW). The average price for selected bids was around 32 000 EUR/MW/year, while the highest selected bid was around 50 000 EUR/MW/year. The two new CCGT plants (one in Vilvoorde and one in Les Awirs, both with award capacity around 0.8 GW) have CRM contracts for 15 years. Payments to these plants from 2025 to 2040 are estimated to total between EUR 750 million and EUR 1.2 billion. The total cost of the CRM will depend on the number of future auctions and the prices and capacities awarded in those auctions.

The regional environmental permit of the proposed new gas plant at Vilvoorde was refused by Flanders in November 2021. In March 2022, the federal government cancelled the contract for the Vilvoorde plant and instructed the electricity TSO to reopen the October 2021 auction to select additional projects from already submitted bids to ensure electricity adequacy in the 2025 delivery year. It is expected that this will result in a new CRM contract with a gas-fired power plant of similar capacity (around 0.8 GW) that has all the needed permits in place.

Social tariff

To address energy poverty and ensure energy access, Belgium has a social tariff that lowers the electricity and natural gas bills of residential consumers that meet certain socio-economic requirements. The cost of the social tariff is covered by a fee charged to all energy consumers in Belgium (see Chapter 2). From 2017 to 2019, there was a steady increase in the number of electricity consumers receiving the social tariff (Table 7.1). In 2020, eligibility for the social tariff was expanded in response to the Covid-19 pandemic, resulting in a large increase in the number of electricity consumers receiving the social tariff (CREG, 2021a).

Table 7.1 Electricity social tariff in Belgium, 2017-2020

Year	Electricity social tariff		
	Consumers covered		Reduction versus average retail tariff
	Number	Share of consumers	
2017	426 299	8.8%	-36.4%
2018	434 161	9.0%	-34.2%
2019	438 309	9.1%	-33.6%
2020	470 305	9.7%	-30.5%

Market structure

Belgium's electricity market has been liberalised and fully open to competition since 2007. There is legal separation between commercial activities and network operations. Use of the electricity networks is open to any company wishing to supply electricity to end users. Consumers are free to choose the supplier of their choice and prices are determined by market forces.

Regulatory responsibility over the Belgian electricity market is divided between the federal regulator, the Commission for Electricity and Gas Regulation (CREG), and the three regional regulators: the VREG in Flanders, the CWaPE in Wallonia and the Brugel in the

Brussels-Capital Region. The regulatory authorities are independent, both from market players and from policy makers. The CREG is responsible for the electricity transmission system, including approval of transmission tariffs, and also advises the federal government on gas and electricity markets. The VREG, CWaPE and Brugel approve distribution tariffs and regulate electricity distribution and compliance with regional public service obligations. They also advise each regional government on the operation of the gas and electricity markets. The regional regulators monitor retail market competition in their respective regions, while the CREG monitors wholesale market competition.

Wholesale market

Belgium is part of a wholesale electricity market that links over 20 European countries. This market has been consistently expanded and more tightly integrated as part of the ongoing project to create a single European internal electricity market. The wholesale market manages day-ahead and intraday electricity trading between interconnected European bidding zones. Most bidding zones are correlated with national borders and Belgium is a single bidding zone.

In 2019, 19 companies were able to participate as wholesale electricity suppliers in Belgium (down from 21 in 2018). The wholesale electricity market in Belgium is highly concentrated with limited competition. In 2019, Electrabel alone had 72% of the market share in terms of electricity generated, followed by EDF Luminus (16%) and T-Power (4%). The Herfindahl-Hirschmann Index (HHI) score for the Belgian wholesale market was 5 450 points in 2019, down from 6 868 in 2009, but still reflecting high market concentration.

Retail market

Flanders, Wallonia and the Brussels-Capital Region each have separate retail electricity markets, overseen by their respective energy regulators, with different tariff structures and market rules. Belgium's retail electricity markets are more competitive than the wholesale market. In 2019, Belgium's combined retail electricity markets had HHI scores of 2 440, down from 2 735 in 2018, indicating a moderate to high level of market concentration. In 2019, 36 retail electricity suppliers were active in Flanders, 36 in Wallonia and 21 in the Brussels-Capital Region, with the 4 largest suppliers having dominant market shares (72-82%) in all 3 regional markets (Table 7.2).

Table 7.2 Share of electricity supplied by the main retail electricity suppliers in Belgium's regions, 2019

Electricity suppliers	Flanders	Wallonia	Brussels-Capital Region
Electrabel	39.9%	39.9%	51.7%
Luminus	18.9%	24.1%	16.0%
Lampiris	5.1%	10.9%	12.6%
Eneco Belgium	8.0%	6.7%	6.7%
Others	28.1%	18.4%	19.7%

Between 2017 and 2019, the rate for retail electricity consumers switching suppliers increased from 18.6% to a record high of 23%, which was the highest switching rate among European countries (ACER, 2020). By region, while the switching rate in Flanders and Wallonia in 2019 was relatively high, at 25.8% and 22.0% respectively, in the Brussels-Capital Region, the rate was 6.4% for households and 10.6% for SMEs.

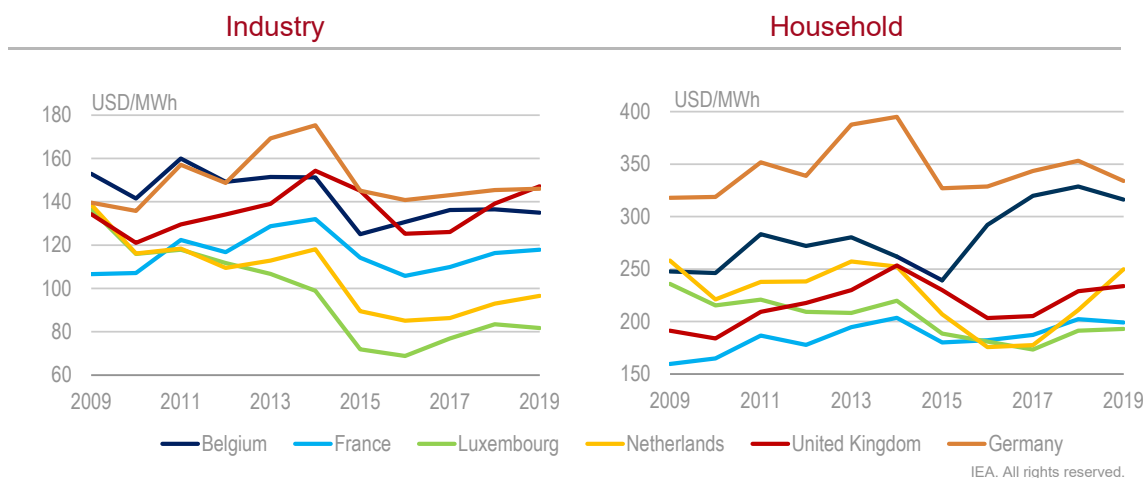
The regional governments created public service obligations that prevent consumers who are unable to pay their electricity or gas bills from being disconnected. The details of the public service obligations vary between the regions, but in general consumers who cannot pay their energy supplier (dropped consumers) receive gas or electricity from a supplier of last resort. Flanders and the Brussels-Capital Region have assigned the role of supplier of last resort to distribution system operators (DSOs). In Wallonia, the supplier of last resort is set by the DSO based on which supplier is designated as the historic incumbent, though another supplier can be given this role by the DSO. Different systems, including prepaid meters and regulated tariffs, are used to ensure dropped consumers continue to receive electricity and gas while paying their debts to energy suppliers.

From 2017 to 2019, the share of dropped electricity consumers increased from 81 012 (1.7% of electricity consumers) to 85 332 (1.8% of electricity consumers). In response to the Covid-19 pandemic, changes were made to increase protection for dropped consumers and it is expected that the number of dropped consumers increased in 2020.

Retail prices and taxes

Retail electricity prices in Belgium are composed of wholesale electricity costs, network tariffs, federal taxes and VAT. In 2019, Belgium's average retail electricity price for industrial consumers was the sixth-highest among IEA member countries (135 USD/MWh, with a tax rate at 25%), while the average retail electricity price for household consumers was the third-highest among IEA member countries (316 USD/MWh, with a tax rate of 59%). Belgium has relatively high electricity prices compared to the countries it is electrically interconnected with (Figure 7.4).

Belgium's industry electricity price declined notably in 2014-15, but has since increased and remains higher than prices in France, the Netherlands and Luxembourg. Belgium's household electricity price declined notably from 2013 to 2015, but has since experienced a sharp increase, almost reaching the price in Germany, which has the highest household electricity price among IEA member countries. The higher electricity prices in Belgium result mainly from the high level of public service obligations, surcharges and levies compared to most of its neighbouring countries. The notable increase in household electricity prices from 2015 to 2019 resulted mainly from increases in network tariffs (CREG, 2021b).

Figure 7.4 Electricity prices in Belgium and neighbouring IEA countries, 2009-2019

Belgium has relatively high electricity prices compared to countries it is electrically interconnected with.

Source: IEA (2021b), *Energy Prices and Taxes 2020* (database), <https://iea.org/statistics>.

Infrastructure

Belgium has a well-developed and highly interconnected electricity system serving domestic demand and supporting the European electricity market. Belgium's electricity network is one of just a few networks in the world to make extensive use of dynamic line rating (DLR). DLR uses distributed sensors to provide real-time monitoring of high-voltage electricity lines. DLR allows the TSO to better determine actual line capacity and improve overall system performance. In 2020, the TSO was using DLR on 28 high-voltage lines and estimated that DLR had increased Belgium's import and export capacity by around 10%, resolved congestions issues, and reduced redispatching costs and curtailment of renewable generation (Renewables Grid Initiative, 2018).

Generation and storage capacity

In 2020, Belgium's total electricity generation capacity was 23.85 GW, with Belgium's two nuclear plants accounting for 25% of total capacity, followed by natural gas (24%), solar PV (23%), wind (20%), hydro (6%), and small shares from bioenergy and oil (Table 7.3). Ownership of Belgium's generation capacity is highly concentrated. From 2013 to 2020, there was an increase in total installed capacity (+2.9 GW) and a notable shift in the mix of generation assets, with a large increase in wind and solar PV capacity offset by reduced capacity for natural gas, coal, oil and biomass. In 2019, Electrabel owned 69% of the total generation capacity, followed by EDF Luminus (16%) and T-Power (1.7%).

Most of Belgium's generation capacity is composed of large-scale generation assets (centralised plants or large wind and solar PV parks) connected to the electricity transmissions system (around 16 GW in 2020). However, a notable share of capacity (around 8 GW in 2020) is connected at the distribution level and this capacity has been increasing, especially small-scale distributed solar PV systems connected to the low-voltage networks.

Table 7.3 Electricity generation capacity by type in Belgium, 2013 and 2020

Capacity (GW)	2013	2020	Change
Total	20.95	23.85	+2.9
Nuclear	5.94	5.94	0
Natural gas	6.63	5.76	-0.87
Solar PV	2.90	5.50	+2.60
Wind (total)	1.78	4.76	+2.98
Offshore wind	0.71	2.26	+1.55
Onshore wind	1.07	2.50	+1.43
Hydro (total)	1.43	1.41	-0.02
Pumped storage	1.31	1.31	0
Coal	0.76	0	-0.76
Oil	0.29	0.18	-0.11
Biomass	0.72	0.60	-0.12
Other	0.98	0.92	-0.06

Belgium's pumped hydro storage (1.31 GW in 2020) plays an important role in system balancing. Belgium has limited battery storage capacity. There are no official consolidated data on battery storage, as this is not yet part of the mandatory energy statistics. A first unverified compilation of operational battery projects used for grid balancing was conducted in September 2021 and estimated capacity around 32.5 MW/30 MWh. However, the government indicated that this estimate is likely well below the actual capacity of operational battery storage. Belgium's battery storage capacity is expected to increase, as a 25 MW/100 MWh system is planned for 2022 (Renews, 2021). Flanders aimed for at least 5 000 home battery systems with a combined storage capacity of around 25 MWh will be installed by the end of 2021.

Transmission

The private company Elia is the Belgian electricity TSO. Elia is owned by the Elia Group, which also owns the German TSO 50Hertz. Around 48% of the shares of the Elia Group are held by two public holding companies (Publi-T and Publipart), which are owned by Belgium's municipalities. The remaining shares are traded on the Euronext Brussels Stock Exchange (Elia Group, 2021).

Elia operates the high-voltage electricity transmission network (30-380 kilovolts [kV]) that supports transmission of electricity across Belgium and electricity trading via the cross-border interconnectors. The part of the network from 70 kV to 380 kV is regulated by the CREG and the federal government. The part of the network from 30 kV to 70 kV is regulated by the regional regulators and governments. Most of the electricity supplied by the high-voltage transmission network is delivered via transformer substations to Belgium's electricity distribution networks, which serve the majority of consumers. However, the transmission system also directly supplies a large number of heavy industrial consumers.

Interconnections

In 2020, Belgium had interconnections to France, Luxembourg and the Netherlands via 12 high-voltage alternating current (AC) lines; with the United Kingdom via the Nemo Link HVDC subsea cable; and with Germany via the Aachen Liège Electricity Grid Overlay

(ALEGrO) HVDC underground cable (Figure 7.5 and Table 7.4). Belgium’s maximum technical interconnection capacity was 6.5 GW in 2020. Projects under development will expand Belgium’s interconnection capacity with the Netherlands and increase maximum technical interconnection capacity to 8.4 GW.

Figure 7.5 Electricity infrastructure in Belgium

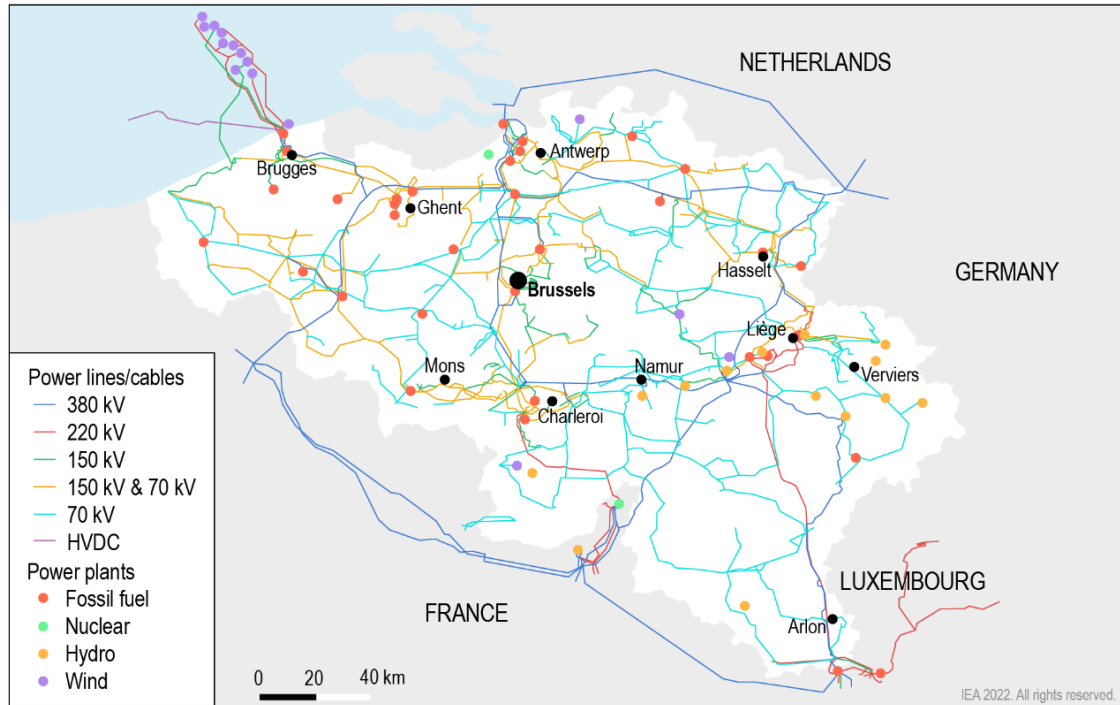


Table 7.4 Belgium’s electricity interconnectors, 2020

Substation 1		Substation 2		Line rating	
Name	Location	Name	Location	Kilovolts	Amps
Monceau	Wallonia, Belgium	Chooz	France	220 AC	1 058
Aubange		Schiffflange		220 AC	1 037
Aubange		Sanem		220 AC	1 037
Aubange		Moulaine		220 AC	1 160
Aubange		Moulaine		220 AC	1 160
Achene		Lonny		380 AC	1 999
Alegro		Oberzier		Germany	380 DC
Van Eyck	Flanders, Belgium	Maasbracht	Netherlands	380 AC	2 186
Van Eyck		Maasbracht		380 AC	1 999
Zandvliet		Rilland		380 AC	2 499
Zandvliet		Rilland		380 AC	2 499
Avelgem		Mastaing	France	380 AC	1 999
Avelgem		Avelin		380 AC	2 322
Gezelle		Kent		United Kingdom	380 DC

Elia operates the interconnections in co-operation with TSOs in the connected countries, with cross-border capacity allocated under common European market rules. Under EU rules, Belgium has binding targets for cross-border electricity interconnection capacity. The target is based on the ratio of interconnection import capacity and domestic generation capacity. Belgium met its 2020 target of 24% and has a 2030 target of 33%.

Distribution

Belgium's distribution system is composed of medium- and low-voltage networks (below 30 kV) and serves the majority of electricity consumers, with 4 825 659 connection points in 2020. Belgium's municipalities have a legal monopoly on electricity and gas distribution and own the electricity and gas distribution networks. Nearly all municipalities have transferred responsibility for electricity and gas distribution to inter-municipal companies, which are the DSO for the assigned section of the network. In 2019, there were 16 electricity DSOs in Belgium, 10 in Flanders, 5 in Wallonia and 1 (Sibelga) in the Brussels-Capital Region.

Electricity security

Belgium has electricity crisis management policies in line with national, regional and EU-level obligations. The Directorate-General for Energy (DGE) of the Federal Public Service Economy (FPS Economy), under the guidance of the federal Minister for Energy, is working on the implementation of the EU Risk Preparedness Regulation for the electricity sector (EU Regulation 2019/941). The Risk Preparedness Regulation provides a framework for EU member states to establish risk preparedness plans, enhancing rules for co-operation between member states to prevent, prepare for and manage electricity crises. Accordingly, at the national level, the Risk Preparedness Plan of Belgium which is being prepared pursuant to the Risk Preparedness Regulation will offer a framework for existing contingency procedures and measures and will serve as a starting point for further actions concerning the prevention, preparation for and mitigation of electricity crises. The first version of the Belgian Risk Preparedness Plan for the Electricity Sector was finalised in January 2022. The majority of the identified measures and procedures have already been implemented. Work to implement the remaining measures started in mid-2021.

In addition to the EU Risk Preparedness Regulation, the core national legal framework for electricity crisis management in Belgium consists of two key documents:

- the Royal Decree of 22 April 2019 on the technical regulation concerning the operation and access to the transmission network (the Federal Grid Code)
- the Ministerial Decree of 3 June 2005 on the establishment of the load-shedding plan of the electricity network.

The Federal Grid Code creates a legal basis for the Ministerial Decree of 3 June 2005 on the establishment of the load-shedding plan. In turn, the load-shedding plan as defined in the ministerial decree is embedded in the System Defence Plan developed by the electricity TSO, Elia. To ensure a level of risk preparedness at the level of the TSO, the federal Minister for Energy is granted approval authority concerning the TSO's System Defence Plan, the Restoration Plan and the Test Plan, pursuant to the Federal Grid Code.

Emergency response and management

Belgium has a comprehensive electricity security framework in place to manage short-term emergency situations and to assure the resilience of its infrastructure against disruptions. In line with requirements imposed by the EU Risk Preparedness Regulation, Belgium has developed numerous electricity crisis scenarios to assist in identifying the necessary emergency response measures to deal with electricity shortfalls. The procedures for dealing with very short-term, sudden shortfalls have to be updated in light of structural changes in the crisis management legal framework.

In the event of an emergency situation within the Belgian electricity system, a load-shedding plan can be activated as a central element of Belgium's short-term electricity emergency response measures. The load-shedding plan, established in accordance with the Federal Grid Code as already discussed, is developed by Elia, which is responsible for implementing the plan to address disruptions of the electricity system. The Decree of 3 June 2005 sets rules on the order for disconnecting and reconnecting consumers.

The current load-shedding plan can be activated both automatically, in the event of a sudden frequency drop on the high-voltage grid, or manually, as a last-resort measure in case of an anticipated power shortage. If regular measures taken by Elia to address a system disruption are not sufficient, Elia must notify the federal Minister for Energy and the National Crisis Centre of the threat of an electricity shortfall. If the initially proposed measures are insufficient, Elia will be required by the government to activate the manual load-shedding plan to reduce the energy demand of a limited number of consumers for the time necessary. This involves disconnecting DSOs' substations from the grid to keep the system balanced and prevent a general blackout across all of Belgium. If this plan is activated, various high-voltage substations belonging to a single load-shedding group will have to be disconnected simultaneously.

Furthermore, since 2018, Elia has contracted a strategic reserve to ensure security of supply at times of short-term problems with nuclear power plants, as well as the envisaged phase-out of nuclear by 2025, discussed later. The strategic reserve aims at meeting peak demand during winter periods when the market fails to do so. It takes two forms: the strategic reserve delivered by generation units (SGR) and the strategic reserve delivered by a reduction in the offtake on the demand side (SDR). Each year the Minister for Energy may instruct Elia to define the strategic reserve for the upcoming winter period, specifying the required strategic reserve volume in MW.

After a tender process based on rules set by Elia in consultation with the market players, the CREG and the federal government, the volumes and prices of the reserves can be imposed on the selected tenderers for the required period. The remuneration varies, depending on whether the suppliers are offering SGR or SDR. The remuneration for the SGR covers the expenses incurred by the supplier for keeping available and generating the energy at Elia's request, taking account of the cost of the fuels and overheads, and for the period of activation and the volume injected in MWh. For the SDR, suppliers are remunerated for the availability of the contracted capacity and for the activation of the SDR.

Electricity system performance

The Belgian electricity transmission and distribution networks are supported through notable investments by the TSO and DSOs to minimise the number, duration and impact of system disruptions and level of losses. In this context, the system average interruption frequency index (SAIFI: average number of unplanned power system outages per year), the system average interruption duration index (SAIDI: average number of minutes of unplanned power system outages per year) and energy not supplied (ENS: MWh of electricity demand requested but not supplied per year) are good parameters of the reliability of the grid.

In 2020, the SAIDI and ENS value for the transmission network sharply declined compared to 2019 while the value for SAIFI increased (Table 7.5). The TSO indicates that in 2019 there was one big customer interruption of around 500 MWh caused by the customer, in 2018 there was an interruption of around 450 MWh at a substation due to a third party and in 2017 a customer lost around 1 500 MWh due to a fault at their installation. SAIFI and SAIDI for the distribution network declined in 2020 compared to both 2019 and the five-year average (Table 7.6). In 2020, the average SAIFI and SAIDI indicators in the EU-27 were 0.92 and 1.01, which indicates that the electricity distribution network in Belgium is relatively reliable among EU member countries.

Table 7.5 Change of values by supply indicators for transmission networks in Belgium, 2016-2020

Indicator	2016	2017	2018	2019	2020	5-year average
SAIFI (interruptions)	0.09	0.06	0.09	0.07	0.14	0.09
SAIDI (minutes)	40.14	245.92	62.28	93.25	25.80	93.48
ENS (MWh)	451.65	1927.80	711.25	732.15	417.10	847.99

Table 7.6 Change of values by supply indicators for distribution networks in Belgium, 2016-2020

Indicator	2016	2017	2018	2019	2020	5-year average
SAIFI (interruptions)	0.57	0.53	0.43	0.66	0.41	0.52
SAIDI (hours)	0.5	0.5	0.4	0.6	0.4	0.5

Assessment

The Belgian electricity sector will be subject to major changes in the next decade. First, the share of renewables in the electricity generation mix is expected to almost double, from an estimated 20.9% in 2020 to more than 37% in 2030. Second, Belgium's nuclear power plants, which currently produce almost half of the electricity generated in the country, will be phased out under current law before the end of 2025.

To ensure electricity supply during the nuclear phase-out and beyond, Belgium has developed a CRM. The CRM represents a notable change, as Belgium has an energy-only electricity market (payment only for generation delivered to consumers). The first CRM auction took place in October 2021 and awarded payments to 4.4 GW of capacity, mainly natural gas (2.0 GW existing and 1.6 GW new). The regional environmental permit of one of the proposed gas plants was refused. In March 2022, the federal government cancelled the contract for this plant and instructed the electricity TSO to reopen the October 2021 auction to select additional projects from already submitted bids to ensure electricity adequacy in the 2025 delivery year. It is expected that this will result in a new CRM contract with a gas-fired power plant of similar capacity (around 0.8 GW) that has all the needed permits in place.

The auction results raise some concerns on the ability of all technologies to compete in the auction process and on increasing carbon intensity of generation. The CRM aims to be technology neutral, but in the first auction, a single technology (natural gas CCGT) accounted for 87.2% of submitted bids and 80.6% of selected capacity (3.6 GW). Almost all support for the construction of new projects also went to gas CCGT (1.6 GW). The only other new projects winning support were around 40 MW of battery storage. The auction did award support to 0.4 GW of existing DSR capacity (9.8% of selected capacity). The auction did not attract any bids from renewable generation (new or existing) or new DSR capacity. The federal government should examine the auction rules and consider revisions that would increase the technological diversity of bids and awarded support in future auctions.

The results of the first CRM auction also show that natural gas will play a much larger role in Belgium's energy system and this will increase the carbon intensity of electricity supply and increase GHG emissions. Belgium has rules requiring that new gas-fired power plants achieve certain emissions reductions by 2035 and by 2045, and that they are carbon-neutral by 2050. The IEA emphasises the need to develop a clear vision on the long-term role of gas-fired plants in the Belgian electricity system, especially in the context of Belgium's goals for renewable generation and decarbonisation. The IEA recommends developing a clear plan to reduce the climate impacts of gas-fired generation, to provide guidance to investors and avoid stranded assets.

The federal government has expressed concerns over the timely deployment of new projects selected in the CRM (e.g. delays in regional permits, legal challenges, etc.). The federal government should closely monitor the CRM results, including progress on the deployment of new projects selected in the auctions, and work with the regional governments to identify and mitigate risks to timely deployment. This includes ensuring that permitting requests are processed and delivered in a transparent and timely manner and that supporting infrastructure (electricity and gas networks) is in place.

CRMs can have high costs and distort electricity markets and price formation. They should therefore only be implemented as a last-resort measure, after the expectation of adequacy problems has been convincingly established. Additionally, CRMs should be designed to minimise market distortions and harness competitive pressures as much as possible to lower the overall costs of the CRM. As Belgium moves forward with implementing its CRM, it should pay close attention to these potential impacts and be ready to make adjustments to the CRM as needed.

In light of the Russian invasion of Ukraine and goals to reduce fossil fuel dependency, the federal government decided in March 2022 to take the necessary steps to extend 2 GW of nuclear capacity by ten years. The extension of the 2 GW of nuclear capacity requires notable investments at Belgium's two nuclear plants and completion of complex regulatory processes. It is expected that no nuclear generation will be available the winter of 2025-26 and that the steps needed to complete the extension of the 2 GW of capacity will not be completed until 2026 or later.

Belgium's electricity system is highly interconnected with its neighbouring countries. Two new cross-border connections have been constructed in recent years and the Belgian electricity system is now connected to all four neighbouring EU member states and the United Kingdom. Total interconnection capacity has increased to 6.5 GW (compared to peak demand of 13.8 GW in 2019) and a corresponding interconnection level of 24% (based on the ratio of interconnection import capacity and generation capacity), which means Belgium has met its EU 2020 interconnection target (24%). Belgium has set a 2030 interconnection target of 33% that will require a continued commitment to interconnection investments and co-operation with its neighbouring countries.

The wholesale electricity market in Belgium remains highly concentrated. In 2019, one generation company (Electrabel) covered 72% of the generation market, similar to previous years. Nonetheless, competitive pressure in the wholesale electricity market has most likely increased due to increased interconnection capacity enabling cross-border trade. The future development of the level of concentration is uncertain and highly dependent on the outcome of the CRM, and to a lesser extent on the outcomes of the auctions for offshore wind generation and developments in distributed generation and demand response.

The electricity switching rate for households in Belgium was 23% in 2019, the highest switching rate in Europe. Furthermore, steps have been taken in recent years to improve the efficient functioning of the retail market. Specifically, customer-oriented provisions of the EU Clean Energy Package are in the process of being implemented by regional governments, the roll-out of smart meters has continued and a new law has been proposed to address the high share of inactive customers with high-priced energy contracts. However, the Belgian retail market for electricity has remained moderately to highly concentrated and important barriers and distortions remain.

The IEA highlights the recommendation from its 2016 energy policy review of Belgium to evaluate the possibilities to improve price signals and to remove cost elements that are unrelated to the supply of electricity. Since the 2016 review, the non-supply related part of the electricity bill has remained high. Analysis by the CREG shows that approximately one-third of the electricity price paid by households is made up of taxes and levies. Of the remaining two-thirds, a substantial part is earmarked for public service obligations charged through both the retail price and the TSO and DSO tariff. High electricity prices hamper electrification of hard to decarbonise sectors like transport and residential heating.

As the Belgian energy system decarbonises and electrification increases, the importance of the efficient functioning of retail markets for electricity grows. Increasingly, electricity retail customers will evolve from simple consumers with predictable consumption patterns to active participants with increasingly diverse and less predictable consumption and generation patterns. Existing trends and research confirm growth in small-scale solar, EV fleet, increasing electrification of residential heating and installation of small-scale

batteries. These developments underscore the importance of a market design that sends appropriate price signals to drive the behaviour of retail customers, minimise distortions and cross-subsidies, and incentivise the market to develop new and innovative retail propositions.

The presence of smart meters is a precondition to an efficient retail market. Each of the regional governments has targets for the installation of smart meters. Flanders is aiming for 80% of connections to have smart meter by the end of 2024 (100% by 2029). In Wallonia and the Brussels-Capital Region, complete or near-complete coverage is not expected until after 2030. The IEA emphasises smart meters are enablers of retail market development, not simply a technology to accompany market developments already taking place. The timeline for smart meter installation in Wallonia and the Brussels-Capital Region can impede retail market development and should be accelerated. The Brussels-Capital Region has indicated that the revision of its electricity ordinance could lead to an accelerated roll-out. Wallonia has indicated it will not accelerate the roll-out, but that incentives are provided for switching to a smart meter.

Flanders, Wallonia and the Brussels-Capital Region have separate retail electricity markets. This results in important regulatory differences between the regions, for instance when it comes to supply licensing and compliance, regulations on data access, rules on dynamic pricing, and DSO tariff structures. Furthermore, disparate implementation of provisions in the EU Electricity Directive on active customers, citizen energy communities and aggregation is likely to impede interregional participation in energy communities, aggregation of flexibilities and exchange of electricity through peer-to-peer platforms. Although the IEA understands and respects the inter-governmental division of competencies, disparate market frameworks create major impediments to suppliers and other market participants that want to develop innovative retail propositions. A February 2021 report by the European Commission on retail markets similarly emphasises the negative effects of this regulatory divergence.

Belgium has a well-developed, highly interconnected and reliable electricity network. At regular intervals, the TSO and DSOs publish network development plans (NDP) outlining their planned infrastructure expansions and reinforcements. Timely and sufficient expansion and reinforcement of electricity grids and the use of flexibility instruments is crucial to allow for effective expansion of renewable electricity generation, electrification of industrial demand, a growing EV fleet, small-scale solar PV, demand-side management, and new import and export flows.

For this purpose it is essential that NDPs are based on the most up-to-date information, have an appropriate forward horizon and take developments in other connected networks into account. Currently, the TSO develops a new NDP every four years and considers a ten-year forward horizon. The NDPs of DSOs have varying, much shorter forward horizons, and are established every year or two. More frequent revision of the transmission NDP, a longer forward horizon for distribution NDPs and a harmonisation of planning cycles for NDPs would reduce the risk of future market developments being impeded by lagging network development. Flanders has drawn up the legal framework to meet this requirement.

Recommendations

The government of Belgium should:

- ❑ Work with the regional governments to ensure the lifetime extension of 2 GW of nuclear generation and projects selected in the capacity remuneration mechanism can be completed in a timely and cost effective manner.
- ❑ Assess without delay the need to extend the strategic reserve beyond 2022 up to the expected implementation of the capacity remuneration mechanism in 2025 and, if the need is established, promptly start notification procedures.
- ❑ Together with the regional governments, evaluate possibilities to improve price signals in the electricity retail market by removing cost elements that are unrelated to the supply, distribution or transmission of electricity.
- ❑ Encourage a more ambitious roll-out of smart meters in Wallonia and the Brussels-Capital Region.
- ❑ Together with the regional governments, work to minimise barriers to retail market development by harmonising regional market regulations, in particular when implementing the revised EU Electricity Directive.
- ❑ Revise the transmission network development plan more frequently and encourage regional governments to pursue a more harmonised approach for establishing distribution network development plans with longer outlooks.

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8. Nuclear

Key data (2020)

Number of reactors: seven reactors, two power plants

Installed capacity: 5.94 GW

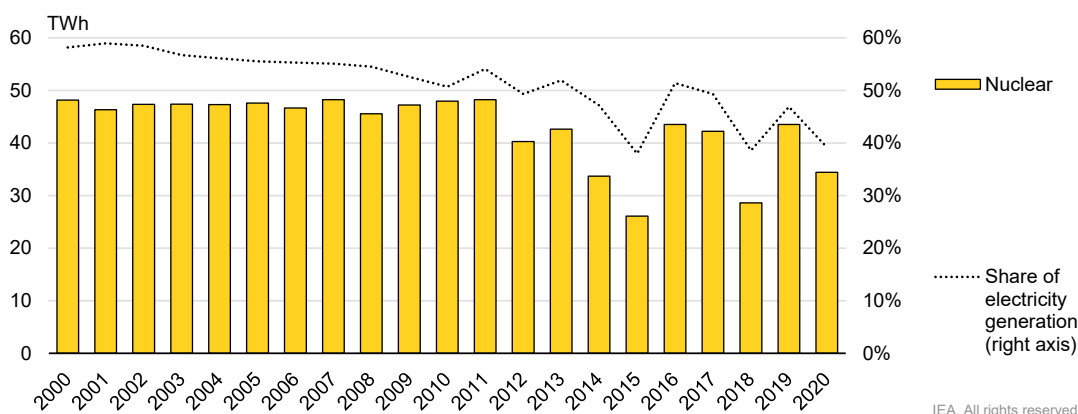
Electricity generation: 34.4 TWh, -28% since 2010

Share of nuclear: 17.8% of total energy supply, 39.2% of electricity generation

Overview

Nuclear energy has historically provided over half of Belgium's electricity generation (Figure 8.1). Belgium has seven nuclear reactors located at two nuclear power plants: Doel in Flanders (four reactors) and Tihange in Wallonia (three reactors), with a combined generation capacity of 5.94 GW (Table 8.1). From 2012 to 2020, electricity generation from nuclear experienced notable annual variations resulting from a combination of technical, regulatory, policy and external factors, and leading to an average capacity factor of 68.3%. In 2020, all seven of Belgium's reactors were once again fully operational, with nuclear availability reaching up to 92% in 2021.

Figure 8.1 Electricity generation from nuclear and share of total in Belgium, 2000-2020



Nuclear covered almost half of total electricity generation in Belgium in 2020. Starting in 2012, strong fluctuations of nuclear energy resulted from temporary shutdowns of reactors.

Source: IEA (2022), *World Energy Balances* (database), <https://www.iea.org/data-and-statistics/data-product/world-energy-balances>.

All seven of Belgium's reactors are operated by the private company Electrabel, a wholly owned subsidiary of ENGIE. Electrabel owns 50% of Tihange 1, 89.8% of Tihange 2 and Tihange 3, 100% of Doel 1 and 2, and 89.8% of Doel 3 and 4. The private company Luminus owns 10.2% of Tihange 2 and 3 and Doel 3 and 4. EDF Belgium owns a 63.5% stake in Luminus, and also holds a 50% stake in Tihange 1.

Table 8.1 Nuclear capacity in Belgium in 2020 and connection dates

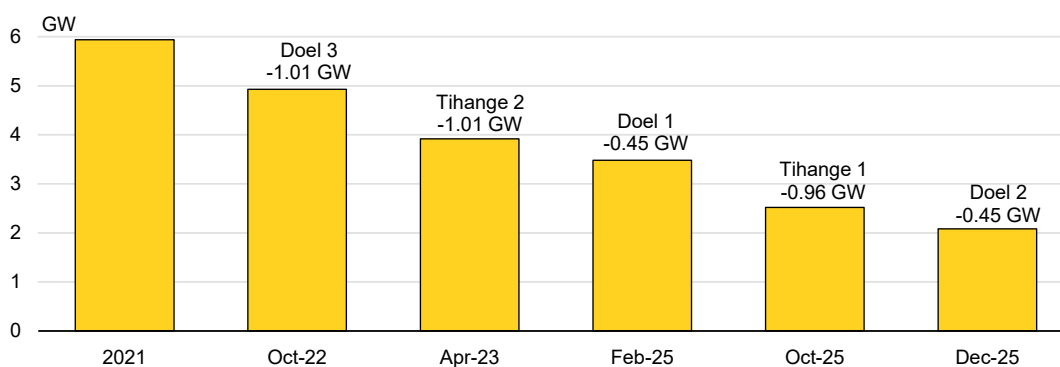
	Reference unit power (GW)	Started commercial operation
Doel 1	0.45	1975
Doel 2	0.45	1975
Doel 3	1.01	1982
Doel 4	1.04	1985
<i>Doel total</i>	2.93	
Tihange 1	0.96	1975
Tihange 2	1.01	1983
Tihange 3	1.04	1985
<i>Tihange total</i>	3.01	
Nuclear total	5.94	

Nuclear policy

The federal government is responsible for Belgium's nuclear energy policy, which is focused on phasing out most nuclear electricity generation in a secure manner by 2025; ensuring safe disposal of nuclear waste and spent reactor fuel; and maintaining expertise in nuclear energy RD&D. The Federal Agency for Nuclear Control is the regulatory body in charge of nuclear safety, licensing and delicensing, under the supervision of the Minister for the Interior.

Belgium's federal Law of 31 January 2003 requires the phase-out of all nuclear electricity generation in the country. The law was amended in 2013 and 2015 to provide for the Tihange 1, Doel 1 and 2 reactors to remain operational until 2025. In light of the Russian invasion of Ukraine and goals to reduce fossil fuel dependency, the federal government decided in March 2022 to take the necessary steps to extend 2 GW of nuclear capacity (Tihange 3 and Doel 4) by ten years, including modifying the 2003 law. Under this new arrangement, most of Belgium's nuclear generation capacity will be phased out by 2025 (Figure 8.2).

Following a decision of the Court of Justice of the European Union, the Belgian constitutional court ruled that the law passed in 2015 to grant ten-year extensions to Doel 1 and 2 should have been preceded by environmental impact assessments. The Belgian court concluded that it would allow the law to remain in force until the end of 2022 for adoption of a new law enabling extended operation of these units that is properly preceded by the needed environmental impact assessment. Following this ruling, the federal government and Electrabel initiated preparation of the environmental impact assessment with independent environmental experts. All affected parties within a radius of 1 000 km of the Doel plant were notified in 2020. National and transboundary consultations with the general public and relevant competent authorities were carried out in 2021. Consultations with affected parties are still ongoing.

Figure 8.2 Planned reductions in nuclear generation capacity in Belgium, 2021-2025

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To ensure electricity supply during the nuclear phase-out and beyond, the federal government has developed a CRM that uses auctions to support the deployment of additional generation capacity and retention of existing capacity. The first CRM auction was conducted in October 2021 and awarded payments to 4.4 GW of capacity, mainly to natural gas – both existing plants (2.0 GW) and for two new plants (1.6 GW) – and smaller amounts to existing co-generation, DSR and other technologies. The regional environmental permit of one of the proposed new gas plants was refused in November 2021. In March 2022, the federal government cancelled the CRM contract for this plant and instructed the electricity TSO to reopen the October 2021 auction to select additional projects from already submitted bids to ensure electricity adequacy in the 2025 delivery year. It is expected that this will result in a new CRM contract with a gas-fired power plant of similar capacity (around 0.8 GW) that has all the needed permits in place.

Nuclear fuel

Belgium has no mining, conversion, enrichment, reprocessing or fuel manufacturing activities. In the past, Belgium operated two fuel manufacturing facilities in Dessel, which ceased operations in 2006 and 2015. The private company Synatom provides Electrabel with the enriched uranium to manufacture new fuel assemblies for the Doel and Tihange reactors. Synatom secures the supply of uranium through medium- and long-term contracts with several uranium exporters and negotiates enrichment contracts with the companies Urenco (the Netherlands), Orano (France) and Tenex (Russian Federation). Synatom holds strategic stocks of uranium to accommodate potential adjustments depending on price fluctuations and technical constraints arising at the reactors.

Nuclear waste management

The National Agency for Radioactive Waste and Enriched Fissile Materials (NIRAS/ONDRAF) is entrusted by law with the safe transportation, treatment, conditioning, storage and disposal of all radioactive waste produced in Belgium. It works under the supervision of the Minister of Energy and the Minister of the Economy. The NIRAS/ONDRAF performs its activities through the industrial subsidiary Belgoprocess.

In 2016, a ministerial decree approved the first National Programme for the Management of Spent Fuel and Radioactive Waste, which provides a strategic framework for the management of Belgium's radioactive waste and spent fuel that is in line with EU directives

(Kingdom of Belgium, 2011). In 2013, the NIRAS/ONDRAF applied to the Federal Agency for Nuclear Control for a licence to build and operate a new disposal facility for low-level nuclear waste in Dessel, Belgium. The permitting process is still ongoing. To address concerns of the local community, the two local partnerships (STORA and MONA, involving the municipalities of Dessel, Mol and NIRAS/ONDRAF) are participating in the process for issuing the environmental licence.

In 2020, the NIRAS/ONDRAF conducted a public consultation on a draft plan for long-term management of high-level and long-lived waste, proposing a geological disposal system in Belgium (ONDRAF, 2018). The government plans to adopt a national programme for the long-term management of high-level and/or long-lived nuclear waste and spent fuel management that meets EU obligations.

Decommissioning

According to federal regulations, the decommissioning of nuclear power plants, and facilities handling nuclear fuel and radioactive waste, is subject to prior authorisation by the Federal Agency for Nuclear Control, which develops specific regulatory processes to ensure safe decommissioning and monitors each step of the process. Belgium gained experience in decommissioning nuclear facilities as of 1987, with several projects already completed (e.g. the Thetis reactor, Eurochemic's main building and the Belgonucléaire fuel manufacturing facility), while others are still ongoing (e.g. the Franco-Belge de Fabrication de Combustible fuel manufacturing facility).

Funding system of decommissioning and waste management

In Belgium, all costs arising from the decommissioning and handling of radioactive waste generated in nuclear reactors are fully borne by the nuclear operator, Electrabel, with no limitation in time. Synatom is in charge of collecting Electrabel's contributions and also of the management of the associated funds to finance decommissioning and waste management activities for Belgium's reactors. Synatom's funds are split into two different compartments:

- **Decommissioning Fund:** to cover all the activities from final facility shutdown to final site release, including costs for all waste categories except spent nuclear fuel.
- **Spent Nuclear Fuel Fund:** to finance all costs associated with spent nuclear fuel assemblies, from interim storage to final disposal, as well as its conditioning and reprocessing. ONDRAF will manage the final disposal of all radioactive waste via payments from this fund.

Every three years, Synatom submits the basic characteristics and cost calculations of decommissioning and waste management to the Commission for Nuclear Provisions, which verifies the long-term adequacy and availability of the funding of these activities.

Nuclear energy RD&D

In 2020, nuclear RD&D accounted for a large share of the federal spending on RD&D (around 41%). The main areas of nuclear RD&D include spent fuel management, waste management, decommissioning, nuclear medicine and fusion. The federal government places a priority on maintaining nuclear energy RD&D expertise, particularly in relation to responsible management of radioactive waste and spent nuclear fuel to support the safe

operation and decommissioning of nuclear power plants in Belgium and abroad. Belgium's NECP reaffirms federal support for RD&D on nuclear fission and fusion.

Belgium is making a major investment in nuclear RD&D through the (Multi-purpose hYbrid Research Reactor for High-tech Applications) MYRRHA research facility. MYRRHA is the world's first large-scale accelerator-driven system that consists of a subcritical nuclear reactor driven by a high-power linear accelerator. MYRRHA will support a range of nuclear RD&D, including work related to the long-term management of high-level radioactive waste such as partitioning, transmutation, accelerator technology and fusion. In 2018, the federal government decided to have MYRRHA built at the SCK CEN site in Mol, Belgium. The total budget for MYRRHA is estimated at EUR 1.6 billion, of which the federal government has already committed to fund EUR 558 million. The rest will have to be funded by other EU countries and international partners. The project is planned in three phases to be completed between 2026 and 2036 (World Nuclear News, 2018).

Belgium seeks to maintain expertise in nuclear RD&D and in 2022, committed EUR 100 million over four years for research supporting the development of small modular nuclear reactors.

Assessment

Belgium's nuclear reactors have historically provided over half of Belgium's electricity generation. In 2019, the Belgian nuclear fleet generated 46 TWh and 47% of the total electricity generation. Current nuclear energy policy is focused on phasing out most nuclear electricity generation in a secure manner by 2025. In light of the Russian invasion of Ukraine and goals to reduce fossil fuel dependency, the federal government decided in March 2022 to take the necessary steps to extend 2 GW of nuclear capacity (Tihange 3 and Doel 4) by ten years. Phasing out most nuclear electricity generation will have a large impact on the Belgian electricity system, including higher GHG emissions and potential challenges to maintaining security of electricity supply.

Achieving a timely extension of 2 GW of nuclear capacity will be challenging, given the regulatory and technical constraints associated with lifetime extensions of nuclear reactors. The government has indicated that the extension cannot be completed by the winter of 2025, but hopes to have the 2 GW operational in 2026. The experience from the lifetime extensions of Belgium's Tihange 1 and Doel 1 and 2 reactors shows that at least four to five years are necessary for reactors undergoing lifetime extensions to be fully operational. The Federal Agency for Nuclear Control is open to postponing non-essential upgrades to secure a realistic schedule. In addition, legal challenges (e.g. the need of a new environmental impact assessment for licence extensions), potential delay in regulatory processes, project risks and/or other unforeseen events could delay the completion of the lifetime extension. Unless swift action is taken, it is unlikely that necessary investments and regulatory procedures will be completed in time to allow Tihange 3 and Doel 4 to continue operations beyond 2025.

Belgium has developed a CRM that aims to ensure security of electricity supply during and beyond the nuclear phase-out. The October 2021 CRM auction awarded payments to 4.4 GW of capacity, mainly to natural gas generation. The regional environmental permit of one of the proposed new gas plants was refused in November 2021. In March 2022, the federal government cancelled the CRM contract for this plant and instructed the electricity

TSO to reopen the October 2021 auction to select additional projects from already submitted bids to ensure electricity adequacy in the 2025 delivery year. It is expected that this will result in a new CRM contract with a gas-fired power plant of similar capacity (around 0.8 GW) that has all the needed permits in place.

Nuclear power is the main low-carbon source of electricity generation in Belgium, representing 70% of the low-carbon electricity generation. It is likely that phasing out most nuclear generation will result in increased gas-fired generation and higher CO₂ emissions. To limit this increase in emissions, the deployment of clean technologies such as wind, solar PV and decarbonised gases, as well as electricity system flexibility and energy efficiency measures, should be intensified. At the same time, nuclear lifetime extensions are an affordable low-carbon option (IEA, 2020). Electrabel invested USD 1.4 billion in the refurbishment of Tihange 1 and the Doel 1 and 2 units (USD 750 per kilowatt electrical capacity, kW_e) for a 10-year extension of operations (Engie-Electrabel).

In the latest five-year inventory report published in 2018, NIRAS/ONDRAF concluded that additional funding is needed to ensure the safe and secure decommissioning of Belgium's reactors and management of spent fuel. Taking into account these inputs and the revised scenario for the decommissioning of the Belgian nuclear fleet, the Commission for Nuclear Provisions estimated an increase of EUR 2.1 billion in necessary funding (EUR 6 billion for the Decommissioning Fund and EUR 7.8 billion for the Spent Nuclear Fuel Fund). These outcomes show that the governance system in place effectively identifies potential cost increases and enables the implementation of necessary corrective measures.

Until 2020, up to 75% of the Spent Nuclear Fuel Fund could be lent back to Electrabel (upon credit rating and solvency requirements). This practice ended in 2020 and Electrabel is committed to reimburse the loans related to the provisions for the spent fuel management by 2025 (EUR 4.7 billion). This will considerably improve the reliability and availability of funding by decreasing the fund's degree of risk exposure with a significant margin.

As a result, Synatom will become one of the largest fund managers in Belgium by 2025, with capital surpassing EUR 10 billion (Synatom, 2021). A new investment policy and governance framework will be required, since capital management will play a more dominant role in Synatom. Electrabel has already announced that the governance structure of Synatom will be overhauled to increase its capability, with the upcoming hiring of two external fund administrators with financial expertise (NEA, 2021). In parallel, the federal government is examining the possibility of using Synatom funds (without taking over responsibility) to support the energy transition, while taking measures to ensure the availability and adequacy of these funds in the future. Such government intervention, if not properly managed, could impact on the future availability of funds and therefore the decommissioning and waste management activities. It increases the risk exposure of Electrabel and eventually Belgian taxpayers. The federal government already holds a golden share in Synatom, giving it the right to veto any decision against the country's energy policy interest and the adequate management of the decommissioning and waste management funds.

Electrabel is responsible for the decommissioning of Belgium's entire nuclear fleet. An immediate dismantling strategy has been considered, with first licensing and preparatory works underway. Since 1987, Belgium has acquired valuable experience in the decommissioning of fuel reprocessing facilities and experimental reactors. Nevertheless,

these activities have been carried out by other organisations such as SCK CEN and Belgoprocess, with limited involvement of Electrabel. Decommissioning of nuclear power reactors will be a first-of-kind project in Belgium and for Electrabel. The various actors responsible for decommissioning should take a programmatic approach that capitalises on lessons learnt to progressively reduce the cost for decommissioning Belgium's reactors as the nuclear phase-out proceeds. In addition, the decommissioning of the nuclear fleet is an opportunity for Belgium to develop valuable industrial know-how that could be used for the decommissioning of other reactors around the world.

Timely availability of storage facilities for nuclear waste and spent fuel is essential for the successful decommissioning of the Belgian nuclear fleet. Expansion of the waste storage facilities to accommodate higher volumes of low- and mid-level waste was approved in 2018. This expansion should be completed by 2022. The construction of additional waste storage facilities at the sites of Doel and Tihange for dry interim storage of the spent fuel should be completed by 2023 (Tihange) and 2025 (Doel). These timelines are consistent with the nuclear phase-out plans and should not inhibit the immediate dismantling of the plants.

In 2020, ONDRAF conducted a public consultation on its draft national policy for the long-term management of high-level waste, proposing a geological disposal system on Belgian territory. The government has indicated that it plans to adopt a national policy for the long-term management of nuclear waste. Given that the decommissioning of the reactors will begin shortly after the first closures in 2022, the government should accelerate its efforts to establish a permanent site for long-term storage of nuclear waste and spent fuel from Belgium's reactors.

A large share of federal spending on energy RD&D is directed to nuclear energy. In the light of the nuclear phase-out, the federal government should maintain (or even increase) nuclear energy RD&D efforts to sustain workforce capabilities in Belgium, mainly leveraging the MYRRHA nuclear research facility. The nuclear phase-out could result in a net loss of know-how which, if not properly managed with long-term policies, could have detrimental consequences for Belgium's ability to perform nuclear activities in the future. In 2022, Belgium announced EUR 100 million in funding for research on small modular reactors.

Recommendations

The government of Belgium should:

- Take quick action to ensure that the extension of 2 GW of nuclear capacity by ten years can be completed in a timely and cost-effective manner.
- Ensure that envisaged reforms of the management and investment policy of the decommissioning and waste management funds do not hamper the timely availability of these funds.
- Finalise the national long-term strategies for high-level waste management. Next steps include the definition of key milestones and identification of a disposal site, with associated preliminary studies, while ensuring timely involvement of relevant stakeholders and local communities.
- Develop a national nuclear sector plan that provides long-term visibility on remaining nuclear activities and fosters collaboration among national and international organisations in key areas (especially decommissioning and long-term management of high-level radioactive waste) and ensures the continued availability of a skilled workforce.

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9. Natural gas

Key data (2020)

Domestic production: 6 mcm

Net imports: 18.2 bcm (21.7 bcm imports, 3.4 bcm exports), +4% since 2009

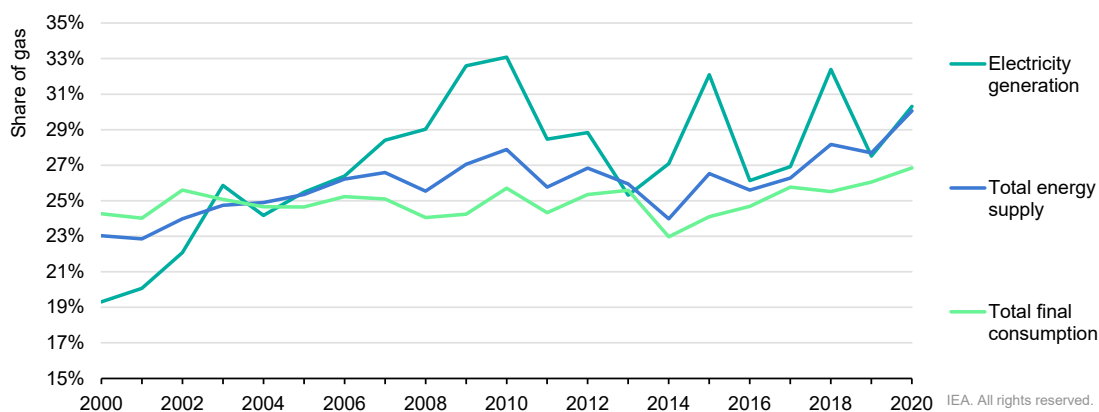
Share of gas: 0% of domestic energy production, 28% of TES, 27% of electricity generation, 26% of TFC

Gas consumption by sector: 18.5 bcm (industry 40%, power generation 26%, residential 22%, commercial 12%, other energy 6%), +1% since 2009

Overview

From 2010 to 2020, the shares of natural gas in TES and TFC increased overall, but with notable annual variations driven by changes in heating demand, industrial gas demand and gas-fired electricity generation (Figure 9.1).

Figure 9.1 Share of natural gas in the energy system in Belgium, 2000-2020



The share of natural gas in electricity generation experienced large fluctuations, driven by nuclear reactor shutdowns, the growing share of renewables and electricity imports.

Source: IEA (2021a), *World Energy Statistics and Balances* (database), <https://iea.org/statistics>.

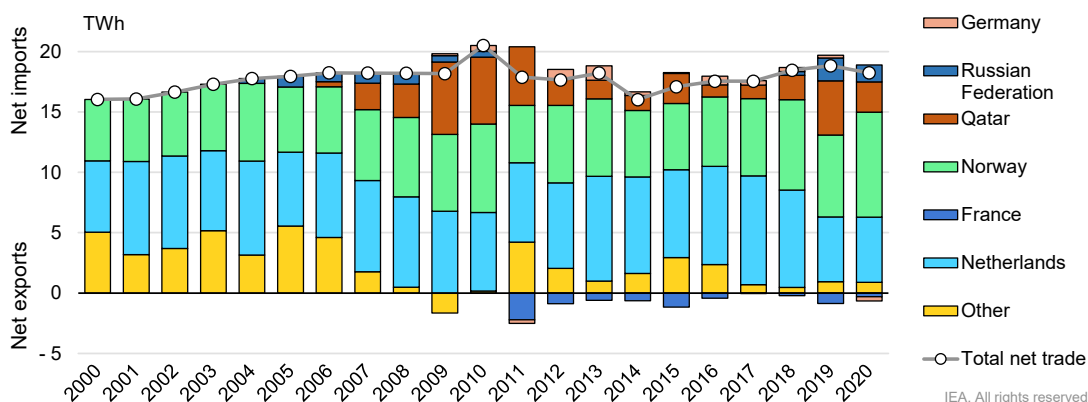
The share of gas in TES ranged from 24% to 30%, while the share of gas in TFC ranged from 23% to 27%. The share of gas in electricity generation experienced larger fluctuations, from 25% to 33%, driven mainly by temporary shutdowns of Belgium's nuclear reactors as well as market competition with growing renewable generation and electricity imports.

Structural changes in the gas market in Belgium and its neighbouring countries forced adjustments of Belgium's natural gas policy, notably to convert the L-gas network to high-calorific natural gas (H-gas). This change is needed as a result of the upcoming end of gas supplies from the Groningen gas field in the Netherlands. Another challenge for the federal and regional governments is to address decarbonisation of the gas sector and the introduction of low-carbon gases.

Supply and demand

Almost all of Belgium's gas supply is imported and it has only a very small gas production (just 6 million cubic metres [mcm] in 2020, compared to 18.5 billion cubic metres [bcm] of demand). Most of Belgium's natural gas imports are used to cover domestic gas demand, but a notable share of gas imports transits through Belgium's gas network to other countries (Figure 9.2). Gas trade is supported via cross-border pipelines with France, Germany and the Netherlands; subsea pipelines with Norway and the United Kingdom; and Belgium's only LNG terminal located in Zeebrugge. From 2010 to 2020, the majority of Belgium's natural gas supply (70-94%) was imported via pipeline (mainly from the Netherlands and Norway), with the remainder imported via the LNG terminal (mainly from Qatar). In 2020, Belgium's net gas imports were 18.2 bcm (21.7 bcm imports and 3.4 bcm exports).

Figure 9.2 Belgium's natural gas net trade by country, 2000-2020



The Netherlands and Norway are Belgium's main sources of gas imports. The Groningen phase-out reduced imports from the Netherlands in 2019, leading to higher LNG imports.

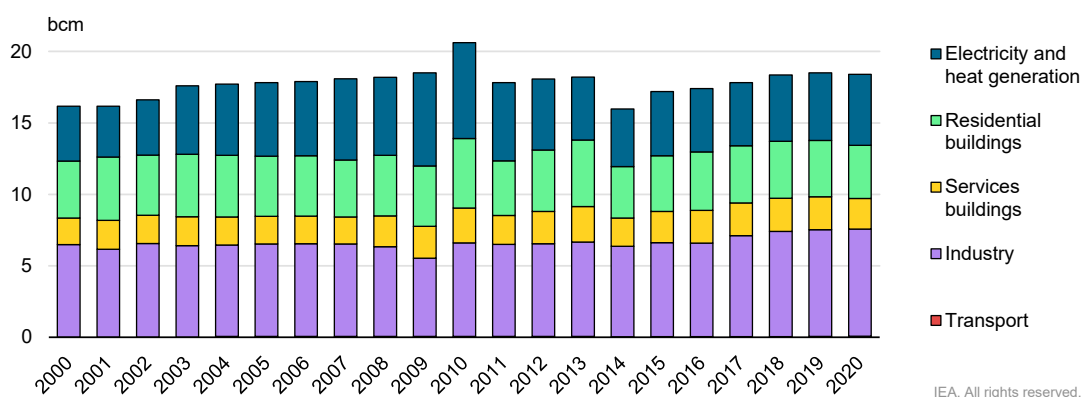
Source: IEA (2021a), *World Energy Statistics and Balances* (database), <https://iea.org/statistics>.

A significant share of Belgium's gas imports is covered by L-gas produced from the Groningen gas field in the Netherlands, which will stop production in mid-2022, although under current plans, parts of the field will be kept open as a backup gas source with full closure likely between mid-2025 and mid-2028 (Platts, 2021). L-gas is delivered to consumers (primarily households) through a dedicated L-gas network that extends from the Netherlands through Belgium and parts of northern France and Germany. The supply of L-gas will be maintained at a reduced level after the closure of Groningen via stations in the Netherlands that convert H-gas to L-gas. Belgium is adapting its L-gas infrastructure to support H-gas and expects to complete this process by 2024. As a result of the Groningen phase-out, the share of Belgium's gas imports from the Netherlands fell notably from 44% in 2018 to 29% in 2019 and 30% in 2020, and is expected to continue to decline.

The reduction of imports from the Netherlands in 2019 resulted in a notable increase in LNG imports from Qatar and the Russian Federation.

Belgium's gas demand peaked in 2010 at 20.6 bcm, mainly because of exceptionally cold weather that increased demand for gas heating in residential buildings. After 2010, gas demand returned to historically normal levels and experienced a slight increase until 2014, when there was a major drop in demand for gas heating and gas-fired electricity generation. Since then, gas demand has steadily increased again, reaching 18.4 bcm in 2020 (Figure 9.3). Industry is the largest natural gas consuming sector (41% of gas demand in 2020), followed by electricity and heat generation (27%), residential buildings (20%), and service sector buildings (12%). There is a small demand for natural gas in transport (0.1 bcm in 2020).

Figure 9.3 Natural gas demand by sector in Belgium, 2000-2020



Belgium's natural gas demand has increased steadily since 2014, after an annual drop in demand for gas heating and gas-fired electricity generation in 2014.

Source: IEA (2021a), *World Energy Statistics and Balances* (database), <https://iea.org/statistics>.

Gas policy

Belgium's energy policy supports the efficient use of natural gas. In line with the target to reduce Belgium's GHG emissions by at least 35% by 2030 versus 2005 levels, Belgium is working to reduce natural gas demand, especially in the residential sector, where natural gas is the main source of heating. There is also support for reducing gas demand in industry through various energy efficiency programmes.

The federal government is committed to phasing out most nuclear electricity generation by 2025 (see Chapter 8). To ensure security of electricity supply as nuclear generation is reduced, Belgium created a CRM to support the deployment of new capacity and retention/upgrading of existing capacity. The first CRM auction was conducted in October 2021 and awarded payments to 4.4 GW of capacity, mainly to natural gas (2.0 GW for existing gas plants and 1.6 GW for two gas new plants) (see Chapter 7).

The phase-out of most nuclear generation and the CRM will likely lead to increased gas-fired electricity generation and higher gas demand. Belgium will have to anticipate how increased gas demand will impact energy security and costs, and the achievement of

Belgium's GHG emissions reductions targets. In the longer term, Belgium aims to significantly reduce natural gas demand in line with energy transition and climate neutrality goals. According to the federal government, natural gas will only play a marginal role in the gas mix for electricity production in Belgium towards 2050; however, Belgium does not have a clear strategy on how to decarbonise the gas sector.

The regional governments are taking notable steps to reduce gas demand. Flanders aims to increase the rate of replacing and optimising existing natural gas boilers in residential buildings and has set an obligation that gas heating appliances must be serviced every two years by a qualified engineer. Flanders has also taken measures to discourage further expansion of its natural gas distribution network. A decree of 10 March 2017 removed the target requiring gas DSOs to reach a degree of gas connection of 95-99% by 2020. A decree of 10 October 2020 states that gas DSOs will only provide a gas connection to new large housing projects to support district heating with co-generation, or when renewable energy is the main heating source. Flanders is preparing strategies to decarbonise its gas supply, with a road map for industry released in 2020 (Deloitte, 2022).

There are no legal restrictions on gas connections in Wallonia, but a gas DSO may refuse a connection request if it is uneconomic for the DSO. Wallonia has announced that it will evaluate support for renewable gases to support a phased decarbonisation of the gas sector. The Brussels-Capital Region plans to gradually phase out natural gas starting in 2030, and is considering a ban on new cooking and heating appliances using natural gas, butane and propane starting in 2030.

Belgium's energy policy also sees a role for low-carbon hydrogen in decarbonising the gas supply. In November 2021, the Council of Ministers approved the federal Hydrogen Strategy, which lays out the federal government's vision for low-carbon hydrogen in Belgium's economy and energy sector through 2050 (see Chapter 2). The focus is mainly on becoming an import and trading hub, and on using hydrogen to decarbonise industry and heavy transport (and potentially other sectors in the long term). The strategy contains specific targets for expanding hydrogen transport infrastructure, including commissioning a minimum of 100-160 km of new hydrogen pipelines by 2026, partly supported by EUR 95 million from Belgium's EU-funded National Recovery and Resilience Plan. There is also a 2030 target for hydrogen interconnections with all its neighbouring countries. The strategy emphasises the opportunity to repurpose natural gas infrastructure, especially infrastructure that will no longer be used after the conversion from L-gas to H-gas.

The regional governments have introduced strategies and support schemes for the production of biomethane and hydrogen and are supporting several EU projects of common interest on hydrogen. Flanders has a detailed regional Hydrogen Strategy covering production and demand. It includes targets for large- and small-scale electrolysis with combined capacity of at least 221 MW by 2025 and 560 MW by 2030. It also targets decarbonising current natural gas hydrogen production and greatly expanding hydrogen import and transport infrastructure. It provides 2025 and 2030 goals for increased use of hydrogen in industry, transport and buildings. In October 2021, Flanders and the European Investment Bank signed a memorandum of understanding to collaborate on financing and implementing hydrogen projects in Flanders.

The Heat Plan approved by the Flemish government in 2017 encourages support for biomethane, with an annual budget of EUR 10.5 million. In Wallonia, significant progress for the Biomethane Strategy was realised during 2020, as three biomethane production

(and injection) facilities have applied for certification to be eligible for guarantees of origin. The first injections of biomethane started successfully in October 2020. Wallonia is also considering establishing a support mechanism to encourage the construction of hydrogen-related infrastructure, and the taxation of hydrogen vehicles will be reviewed to fine-tune the Walloon objectives in terms of developing alternative fuels.

L-gas to H-gas conversion

Belgium's energy policy places a strong focus on maintaining security of supply. In particular, Belgium is ensuring that the phase-out of production from the Groningen gas field does not impact gas supply. Belgium is co-operating with France, Germany and the Netherlands through the Pentalateral Gas Platform, which allows the Netherlands to provide timely and detailed information on the reduction in L-gas supply and supports collaborative efforts to reduce L-gas demand by switching supply and gas infrastructure to H-gas and by lowering overall gas demand.

In Belgium, the planning and implementation of the L-gas to H-gas conversion is co-ordinated by the Federation of Electricity and Gas Network Operators (Synergrid) under the supervision of the DGE. Synergrid has developed a plan to complete the conversion of all L-gas infrastructure to H-gas, which is based on repurposing as much of the existing Belgian infrastructure as possible with a view to reducing costs and the time needed (Fluxys, 2021a). The plan identifies regional L-gas clusters to be converted in phases and includes detailed estimates of the number of connections and corresponding gas demand that will be transferred to H-gas. Evaluations carried out by Fluxys Belgium indicate that the existing H-gas entry capacity is sufficient to absorb the L-gas market into the H-gas transport network. The required adaptations of the network to enable the conversion have been identified and integrated into the Conversion Plan.

The Conversion Plan is updated annually to account for optimisation opportunities and is formally approved for a period of two years to enable timely communication to all stakeholders. Synergrid handles communication with gas suppliers. The TSO and DSOs handle communication with their end users, who must receive a letter at least two years before the actual conversion. Consumers are responsible for having the compatibility of their gas appliance checked by a professional. The Belgian natural gas association (Gas.be) informs and provides training to gas appliance installers and professionals and a website (www.gaschanges.be/en) has been established to provide detailed information on the Conversion Plan.

Progress on conversion is reported to the L-Gas Market Conversion Monitoring Task Force, established in 2019 to monitor and co-ordinate the conversion projects in Belgium, France, Germany and the Netherlands. The task force supervises the production of a report compiled twice a year assessing the adequacy of L-gas supply from the Netherlands. The report is produced by the IEA, the European Network of Transmission System Operators for Gas, Gasunie Transport Services (GTS, the gas TSO of the Netherlands), and the Dutch Ministry of Economic Affairs and Climate Policy. The third edition of the report was published in February 2021 and covers market developments through the gas year 2019/20; provides an update on the progress of the conversion programmes, with a special focus on the impact of the Covid-19 induced lockdowns in 2020; and details planned conversion activities through the gas year 2021/22 (IEA et al., 2021).

Due to a faster than expected progress on infrastructure conversion, Belgium now aims for the full conversion of its gas supplies and infrastructure to H-gas by 2024. This requires converting more than 1.6 million connections. As of 2020, around 130 000 connections had been converted.

Social tariff

To address energy poverty and ensure energy access, Belgium has a social tariff that lowers the gas and electricity bills of residential consumers that meet certain socio-economic requirements. The cost of the social tariff is covered by a fee charged to all energy consumers in Belgium (see Chapter 2). From 2017 to 2019, there was a steady increase in the number of gas consumers receiving the social tariff (Table 9.1). In 2020, eligibility for the social tariff was expanded in response to the Covid-19 pandemic, resulting in a large increase in the number of gas consumers receiving it (CREG, 2021).

Table 9.1 Natural gas social tariff consumers covered and cost reduction in Belgium, 2017-2020

Year	Natural gas social tariff		
	Consumers covered		Reduction versus average retail tariff
	Number	Share of consumers	
2017	251 855	9.4%	-40.7%
2018	260 461	9.7%	-48.2%
2019	266 346	9.9%	-37.6%
2020	295 937	10.0%	NA

Market structure

Belgium's gas market has been liberalised and opened to competition since 2007. There is legal separation between commercial activities and network operations. Use of the gas networks is open to any company wishing to supply gas to end users; consumers are free to choose the supplier of their choice and prices are determined by market forces.

Regulatory responsibilities over the Belgian gas market are divided between the federal regulator, the CREG, and the three regional regulators: the VREG in Flanders, the CWaPE in Wallonia and the Brugel in the Brussels-Capital Region. The regulatory authorities are independent, both from market players and from policy makers. The CREG is responsible for the natural gas transmission system, including approval of transmission tariffs, and also advises the federal government on gas and electricity markets. The VREG, CWaPE and Brugel approve distribution grid tariffs and regulate natural gas distribution and compliance with regional public service obligations. They also advise each regional government on the operation of gas and electricity markets. The regional regulators monitor retail market competition in their respective regions, while the CREG monitors wholesale market competition.

The private company Fluxys Belgium is the Belgian gas TSO. Fluxys Belgium also owns and operates Belgium's only large-scale gas storage facility at Loenhout. Fluxys LNG (a 100% subsidiary of Fluxys Belgium) owns and operates the Zeebrugge LNG facility (Fluxys, 2021b). The private company Fluxys Holding owns 90% of the shares in Fluxys Belgium, while the Belgian state holds a golden share, which is able to outvote all other shares in certain specified circumstances. The remaining shares are traded on the Euronext Brussels Stock Exchange.

Wholesale market

In 2015, Belgium and Luxembourg merged their wholesale gas markets into the single BeLux market. BeLux is composed of the integrated H-gas market in Belgium and Luxembourg and the L-gas market in Belgium. Under BeLux, the Belgian and Luxembourg gas networks form a single entry/exit zone, with Belgium's ZTP hub as the virtual trading point. In 2019, there were around 70 participants active on the ZTP hub and around 220 TWh of natural gas was traded, twice as much as in 2017 (110 TWh). In 2019, spot products (day-ahead, intraday, etc.) made up 39% of traded volumes at the ZTP hub. Medium-duration contracts (monthly, quarterly and seasonal) represented 55% and long-duration products accounted for 6%. The churn rate of the ZTP hub was 1.9 in 2019, notably lower than the churn rate of up to 5 seen in recent years and indicating low liquidity (ACER and CEER, 2020). The interconnection between Belgium and Luxembourg is no longer a commercial point (no interconnection tariffs are charged) and a new capacity product manages flows on the Remich interconnection between Luxembourg and Germany and links the ZTP with the German NCG trading hub (Horslen, 2015).

To support the operation of the BeLux market, Belgium amended its gas law permitting Fluxys to devolve its commercial balancing activity to an operator for the combined market and extending the CREG's jurisdiction to cover the new operator. In June 2020, the energy regulators of Belgium (CREG) and Luxembourg (ILR) assigned the role of BeLux balancing market operator to the private company Balansys, which is owned 50% by Fluxys Belgium and 50% by Luxembourg's gas TSO (Creos Luxembourg). Balansys' main responsibility is market-based balancing of the BeLux area, including aggregating the balancing positions of the network users, purchasing and selling gas for balancing purposes, and invoicing balancing charges to the network users (Balansys, 2021). The BeLux market is overseen by both the CREG and ILR.

In 2019, 26 companies were authorised to participate as suppliers in the BeLux wholesale gas market. BeLux is a dynamic and competitive wholesale gas market. Only two suppliers have a market share above 9%: Engie-Electrabel (26.2%) and EDF Luminus (12.9%); 15 have market shares ranging from 8.8% (Eni) to 1%; while 8 suppliers have a market share less than 1%. In 2019, the HHI³ score for the BeLux market was 1 367 points, the third-lowest in the EU after the United Kingdom (834 points) and France (1 221 points), indicating a competitive market (ACER and CEER, 2020).

³ The HHI is an indicator for market competition. It ranges between 0 for an infinite number of small firms (maximum competition) and 10 000 for one firm with 100% market share (no competition). An HHI above 2 000 signifies a highly concentrated market with a small number of firms.

Retail market

Flanders, Wallonia and the Brussels-Capital Region each have separate retail gas markets overseen by their respective energy regulators, with different tariff structures and market rules. Belgium's retail gas markets are less competitive compared to the BeLux wholesale market. In 2019, the household and industry segments of Belgium's combined retail gas markets both had HHI scores close to 2 000 points (the seventh-lowest score for households and the tenth-lowest for industry in the EU), indicating a moderate level of market concentration (ACER and CEER, 2020). The HHI scores of Belgium's gas retail markets show significant regional differences: 1 945 in Flanders, 2 377 in Wallonia and 4 433 in the Brussels-Capital Region.

In 2019, 42 retail gas suppliers were active in Belgium, with the largest suppliers having dominant market shares in all three regional markets (CREG, 2020). In Flanders, the top four retail gas suppliers accounted for 69.6% of gas supplied in 2019: Electrabel (37.9%), Luminus (13.7%), Eneco Belgium (10.6%) and Lampiris (7.4%). These companies also dominate the retail gas supply in Wallonia, accounting for 75.2% in 2019: Electrabel (35.1%), Luminus (18.4%), Lampiris (15.3%) and Eneco Belgium (6.4%). In the Brussels-Capital Region, the market is even more concentrated, with Electrabel accounting for 54.3% of the gas supply in 2019, followed by Lampiris (17.1%) and Luminus (10.2%).

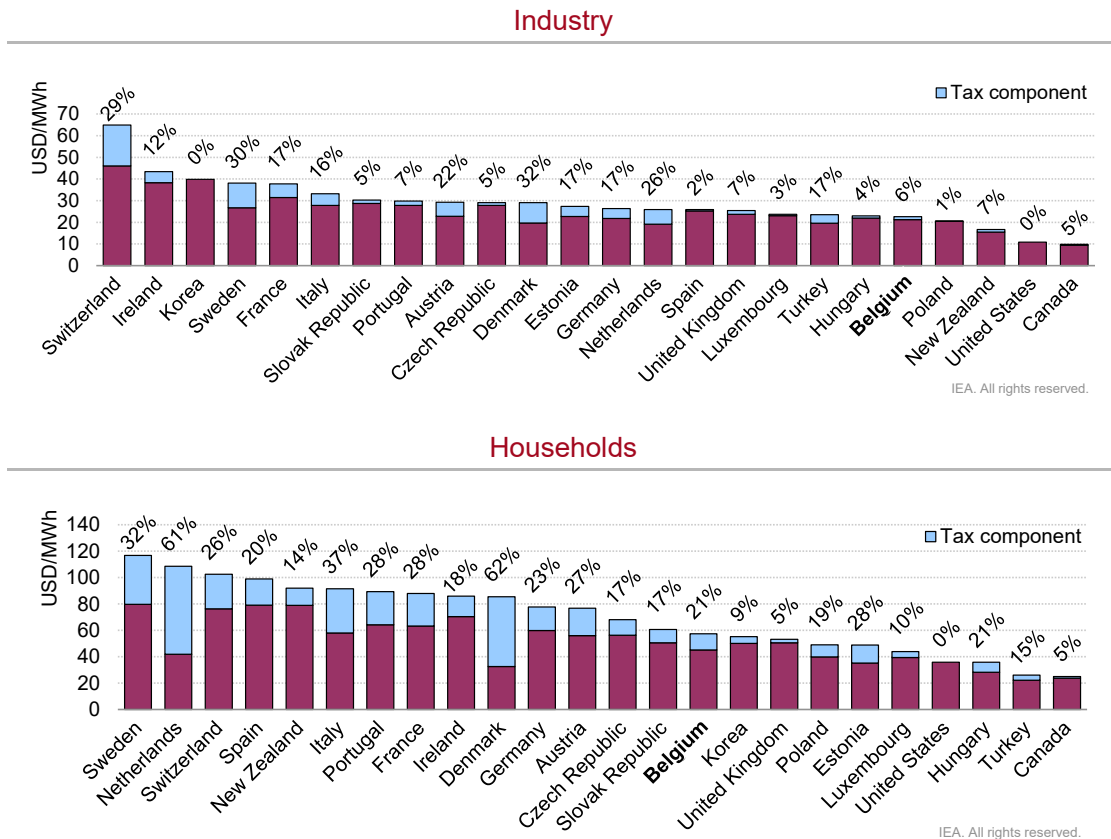
The annual switching rate of gas retail customers in 2019 was 17%, up from 13% in 2018. However, the rate has been variable over the past decade, fluctuating between 12% and 19%. The switching rate in Flanders in 2019 was 28.5% (one of the highest rates in Europe), while the rate in Wallonia was only 5.6%. In the Brussels-Capital Region, the rate was 7.3% for households and 12.3% for SMEs in 2019.

Retail prices and taxation

Retail natural gas prices in Belgium are composed of wholesale gas costs, network tariffs, federal taxes and VAT. In 2019, the average retail gas price for household consumers (excluding VAT) consisted mostly of wholesale gas costs (60.5%), followed by distribution tariffs (32.5%), transmissions tariffs (3.5%) and federal taxes (3.5%). In 2020, Belgium's natural gas industry price was the fifth-lowest among IEA member countries (22.6 USD/MWh, with a low tax rate of 6%), while the household gas price was the tenth-lowest among IEA member countries (57.4 USD/MWh, with a 21% tax rate) (Figure 9.4).

From 2009 to 2019, Belgium's industry and household natural gas prices followed trends similar to those of its neighbouring countries (Figure 9.5). The industry price for gas in Belgium fell sharply from 2013 to 2016, spiked in 2018, and in 2019 was close to prices seen in Luxembourg, the Netherlands and the United Kingdom. Household gas prices in Belgium followed a similar trend to industry prices and in 2019 were below the median price among Belgium's neighbouring countries.

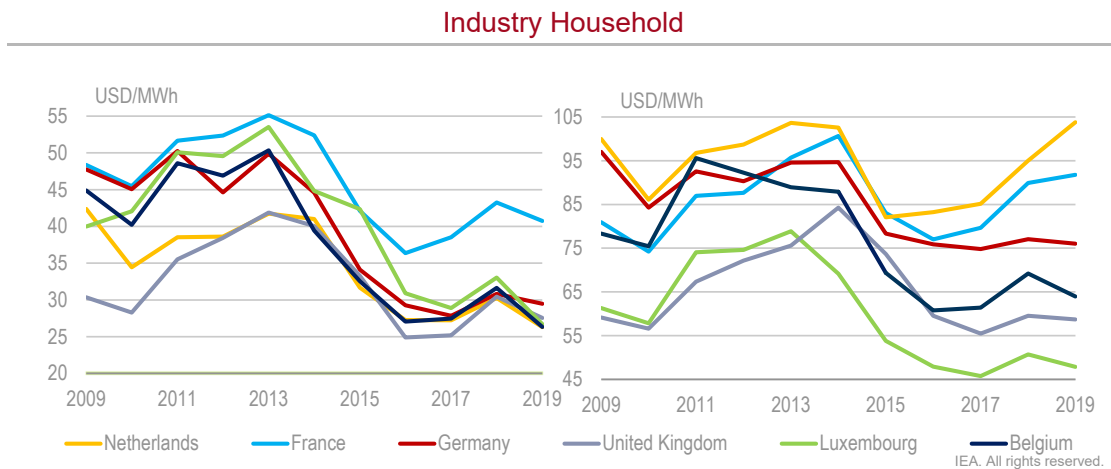
Figure 9.4 Industrial and household gas prices in IEA member countries, 2020



Note: 2020 prices are not available for Australia, Finland, Greece, Japan or Mexico.

Source: IEA (2021b), Energy Prices and Taxes 2020 (database), <https://www.iea.org/data-and-statistics>.

Figure 9.5 Industrial and household gas prices in selected IEA member countries, 2009-2019



Belgium's industry and household prices both followed similar price trends as its neighbouring countries and were below the median price of those countries in 2019.

Note: Price data from Belgium are not available from 2000 to 2008.

Source: IEA (2021b), Energy Prices and Taxes 2020 (database), <https://www.iea.org/data-and-statistics>.

Infrastructure

Belgium has a well-developed and highly interconnected natural gas network that supplies domestic gas demand and acts as a hub supporting flows between France, Germany, Luxembourg, the Netherlands and the United Kingdom and to the broader European market. Belgium has two gas transmission systems: one for receiving, transporting and distributing L-gas, and another for H-gas. Belgium is in the process of converting its L-gas network to support H-gas, which is expected to be completed by 2024.

The gas TSO's indicative investment plan for 2020-29 aims for a total investment of EUR 644 million in the gas transmission network, the Zeebrugge LNG terminal and the Loenhout storage facility (Fluxys, 2021c). The main elements of the plan are conversion of the L-gas network to H-gas, infrastructure to support new gas-fired power stations expected as a result of the nuclear phase-out, the increase in LNG regasification capacity at the terminal in Zeebrugge, and adaptation and modernisation of the network.

Pipeline interconnection points

The Belgian transmission grid has a high level of interconnectivity with adjacent transmission grids, offering extensive access to the Northwest European market and its production facilities (Figure 9.6). Belgium has 17 cross-border pipeline interconnection points, with 13 serving the H-gas network and 4 serving the L-gas network (Table 9.2). The H-gas interconnections supply domestic H-gas demand and transit H-gas regionally and to the broader European market. The Alveringem interconnection point is the most recent H-gas interconnection (commissioned in 2015) and connects Belgium's H-gas network to the LNG terminal in Dunkirk, France. The L-gas interconnections supply domestic L-gas demand and transit L-gas to France.

Table 9.2 Belgium's gas network's capacity, February 2021

Network	Interconnection points	Maximum capacity (GWh/h)	
		Import	Export
H-gas	13	144	108
L-gas	4	27	10
Total	17	171	118

Source: EC (2019), Preventive Action Plan Belgium, https://ec.europa.eu/energy/sites/ener/files/documents/20190808_preventive_action_plan_belgium_2019.pdf.

LNG terminal

Belgium has one LNG terminal located in the Port of Zeebrugge, which supplies Belgium and the European market with H-gas. It is operated by Fluxys LNG, which completed a major expansion of the terminal in December 2019, adding a fifth storage tank with an LNG storage capacity of 0.18 mcm. Following the expansion, the terminal's LNG storage capacity increased from 0.39 mcm to 0.57 mcm (around 347 mcm of natural gas). The LNG infrastructure in Zeebrugge has an annual throughput capacity of 9 bcm. Activity at the terminal reached a record high in 2019, with 90 LNG carriers unloading 11.3 mcm of LNG (CREG, 2019). The LNG terminal can handle LNG carriers with LNG capacities from 0.08 mcm to 0.27 mcm.

Figure 9.6 Gas infrastructure in Belgium

Fluxys LNG is considering increasing the Zeebrugge Terminal regasification capacity through a further expansion. The Indicative Investment Plan of Fluxys Belgium and Fluxys LNG 2021-2030 indicates construction of new regasification capacity to increase the stand-alone send out capacity to 8.2 gigawatt hours per hour (GWh/h) and then up to 10.5 GWh/h. The final investment decision for the increased stand-alone send out capacity was taken by Fluxys LNG in February 2021; the commissioning of the first step is expected early 2024 and the commissioning of the second step early 2026 (LNG Industry, 2021).

Transmission network

Belgium has two natural gas transmission networks, one for H-gas and another for L-gas, which are physically separate and operated independently from each other by the gas TSO (Fluxys Belgium). Belgium's combined H-gas and L-gas transmission networks are composed of 4 000 km of high-pressure gas pipelines that supply gas directly to over 230 large industrial end users and power stations and over 70 receiving stations that supply Belgium's gas distributions networks (Fluxys, 2021d). The network has three main high-pressure pipelines for the transportation of gas within Belgium and to neighbouring countries. The VTN-RTR H-gas pipeline is bi-directional and runs from the interconnection with the United Kingdom and the Zeebrugge LNG terminal to interconnections with Germany and the Netherlands. The Segeo H-gas pipeline runs from the Netherlands to France. The Poppel-Blaregnies pipeline supplies L-gas from the Netherlands to Belgium and France (EC, 2019).

Distribution network

Belgium's distribution network is composed of separate distribution networks for L-gas and H-gas with medium- and low-pressure pipelines and serves the majority of gas consumers in the residential, commercial, and small and medium-sized industrial sectors. In 2020, Belgium's gas distribution system had around 2.7 million connection points. Belgium's

municipalities have a legal monopoly on gas and electricity distribution and own the gas and electricity distribution networks. Nearly all municipalities have transferred responsibility for the operation of the gas and electricity distribution networks to inter-municipal companies, which are the DSOs for the assigned section of the gas distribution network. In 2019, there were 17 DSOs in Belgium: 11 in Flanders; 5 in Wallonia, with ORES and RESA serving most of the region; and 1 in the Brussels-Capital Region (Sibelga).

Storage

Belgium has one underground natural gas storage facility connected with the H-gas transmissions system in Loenhout. The facility is operated by Fluxys Belgium and can be used by any gas supplier. It has a maximum storage capacity of 680 mcm, a maximum injection capacity of 7.8 mcm per day and a maximum withdrawal capacity of 15.0 mcm per day. The facility is used for seasonal gas storage and is highly flexible. Considering that annual gas consumption was 18.5 bcm in 2019, the gas storage facility can cover the equivalent of around 13 days of Belgium's average gas demand. Short-term gas storage is also available at the Zeebrugge LNG terminal, which has a capacity of around 347 mcm of natural gas.

The Loenhout storage facility gives suppliers a flexible source of natural gas and allows them to ensure the continuity of deliveries to end users. Belgium does not have any storage for L-gas, other than line-pack. Currently, Belgium uses the Dutch L-gas fields as swing supplier to provide flexibility in L-gas supply.

Gas emergency response policy

Belgium maintains a high degree of natural gas supply security through a combination of several measures, including underground commercial gas storage and well-established safety standards of the supply infrastructure by the TSO and DSOs. Belgium's natural gas emergency response policies are in line with EU Regulation 2017/1938 concerning measures to safeguard the security of gas supply ("the SoS Regulation").

The DGE establishes regional and national risk assessments. Moreover, based on those assessments, the DGE also needs to prepare a National Preventive Action Plan and an Emergency Plan as parts of the emergency planning at national, regional and EU level, in concertation with the CREG and the TSO (Fluxys Belgium). These assessments and plans are revised every four years unless the circumstances warrant a more frequent update. Also, the Law of 12 April 1965 on the transport of gaseous and other products by pipelines ("Gas Act") designates the DGE as the competent authority to ensure the implementation of the measures provided for in the SoS Regulation. In the event of (a threat of) a crisis on the gas market, the Gas Act authorises the implementation of necessary safeguard measures.

The DGE is the competent authority for the security of gas supply and co-ordinates emergency planning and communication with government agencies and supranational institutions. The TSO has the responsibility to manage the response to a national gas emergency and is the first one to give practical instructions to the shippers and suppliers to adjust the gas flows as foreseen in the specific emergency plan.

Gas emergency response measures

Gas security in Belgium is supported by a variety of emergency response measures, including both supply-side and demand-side measures. The Emergency Plan defines three levels of gas crisis (Table 9.3). The DGE or Fluxys is responsible for declaring an emergency as well as the crises level. During an emergency, top priority is given to supplying gas to the protected consumers, mainly residential consumers and other consumers providing critical services. Protected consumers made up 62% of peak gas consumption in 2019.

At the early-warning level, there will likely not be any immediate intervention by the competent authority. The event can and should be managed by market-based measures alone. Network users are required to take measures to help balance the grid, such as increase imports and/or reduce exports, temporarily suspend storage injections, and calls on interruptible supply contracts. All measures and procedures available at the early-warning level are still applicable at the alert level. In addition, in case of an alert level, the TSO may request network users to voluntarily alter their nominations as far as possible in order to safeguard the security of gas supply to protected customers in particular.

Table 9.3 The crisis levels of the gas supply in Belgium

Early-warning level	where there is concrete, serious and reliable information that an event which is likely to result in significant deterioration of the gas supply situation may occur and is likely to lead to the alert or the emergency level being triggered
Alert level	where a disruption of gas supply or exceptionally high gas demand results in significant deterioration of the gas supply; the market is still able to manage the disruption or demand without the need to resort to non-market based measures
Emergency level	where there is exceptionally high gas demand, significant disruption or deterioration of gas supply and all relevant market-based measures have been implemented but the gas supply is insufficient to meet the remaining gas demand; non-market based measures have to be introduced with a view, in particular, to safeguarding gas supplies to protected customers

Source: EC (2020), Emergency Plan Belgium,
https://ec.europa.eu/energy/sites/ener/files/documents/23062020_emergency_plan_gas_belgium_2020.pdf

The emergency level will be activated by the TSO when the market-based measures alone are no longer sufficient to guarantee contracted gas supplies to all end consumers. A number of measures can be applied:

- Call to reduce natural gas consumption: the competent authority can issue a call to end users to voluntarily consume less gas.
- Constraint on firm capacity or curtailment of non-protected customers (administrative and/or technical disconnection): the TSO can request that non-protected end users (industrial end users and gas-fired power plants) reduce or stop their consumption.
- Enforced withdrawal of gas in storage: to safeguard the gas supply to protected customers, the TSO has the right to use gas stored in Belgium. There are no requirements for Belgian gas companies to keep emergency gas reserves. Companies with contracts for gas storage in Belgium are obliged to fill at least 90% of contracted storage volumes by 1 November each year, and to maintain a level of gas storage above 30% of their contracted volume until 15 February.

Network resilience

As mentioned above, Belgium has two separate gas networks: one for H-gas and one for L-gas. This division of two networks is an important factor when considering secured gas supply and network resilience of Belgium. The N-1 indicator⁴ is applied by distinguishing between H-gas and L-gas networks in Belgium. For H-gas, the Belgian network holds multiple entry points and is fully capable of meeting an exceptional peak demand, even if the most important injection point (the interconnector Zeebrugge Terminal) is out of service, with the N-1 factor at 273% in 2018.

For the L-gas network, there is only one entry point on Belgian territory, just as there is only one supplier country, the Netherlands, with the N-1 factor at 18% in 2018. However, the interconnection point supplying the Belgian network with L-gas is, in fact, made up of two underground pipelines. According to the latest Preventive Action Plan, the probability of both pipes being simultaneously taken out of service is fairly limited, even in the event of a major accident with a rupture of one of the two pipes and an explosion. Applied to each of the pipes individually and given that both pipes have the same transport capacity, the N-1 indicator leads to ratios of 81% for 2018 (CREG, 2020).

Assessment

Without domestic natural gas production, Belgium imports natural gas via cross-border pipelines, subsea pipelines and Belgium's only LNG terminal located in Zeebrugge. Natural gas net imports reached 18.8 bcm in 2019, mainly from the Netherlands and Norway. L-gas produced in the Netherlands accounted for 22% of Belgium's gas supply in 2020.

Belgian gas demand reached 18.5 bcm in 2019, led by the demand from industry, which accounted for 40% of total gas demand in 2019, followed by electricity and heat generation, residential buildings, and service sector buildings. Until 2030, Belgian gas consumption is expected to be on the rise, mainly due to an increase in gas-fired electricity generation as a consequence of the planned phase-out of nuclear electricity generation from 2022 to 2025. As regards the anticipated increase of gas demand in the coming years, the federal government needs to co-ordinate with the regional governments to develop integrated plans to meet the future gas demand in advance of the planned nuclear phase-out.

Efficient use of natural gas and reducing GHG emissions are one of Belgium's key energy policies. The federal and regional governments are working on gas demand reduction, but with considerable differences between the regions regarding concrete policy measures and approaches, such as the regulation on limiting expansion of its natural gas distribution grid in Flanders and the promotion of renewable gas in Wallonia. The Brussels-Capital Region is planning a gradual phase-out of natural gas starting in 2030.

Regional governments have developed some specific policy measures and quantitative targets towards future decarbonisation of the gas sector with a variety of strategies, including the production of biomethane and hydrogen. Nevertheless, an integrated

⁴ The N-1 criterion is an indicator to evaluate the supply resilience of a network. A network complies with this indicator if it has enough technical capacity to satisfy total demand in the event of disruption of the single largest component of the infrastructure.

strategy or plan, with specific targets for the share of low-carbon gases in the future gas mix, has not been presented. The federal and regional governments should work to develop strategies that clearly support national-level decarbonisation and include quantitative targets to track progress.

Another issue relevant for gas security in Belgium is the conversion of its L-gas network to H-gas. As production of L-gas from the Groningen field in the Netherlands is gradually decreasing and expected to end in mid-2022, the government is taking steps to ensure that this does not impact security of gas supply. The infrastructure conversion in Belgium is progressing faster than anticipated, and the federal government intends to complete the transition to H-gas by 2024, several years ahead of schedule. This timely planning of the relevant mitigation measures should be commended.

Moreover, the progress of the conversion is also discussed by the L-Gas Market Conversion Monitoring Task Force set up in 2019 with representatives from Belgium, France, Germany and the Netherlands, which monitors the progress of conversion in all affected countries. As all four countries are involved in the L-gas market shift, this regional approach should be continued for maintaining security of gas supply in Belgium. At the same time, the conversion from L-gas should be used as an opportunity to reduce gas demand, notably by encouraging consumers to switch from natural gas to electricity, renewables or other low-carbon sources to achieve the country's GHG reduction target.

As the Belgian gas market was liberalised in 2007, any company wishing to supply gas can access the gas networks, and choice of gas supplier is left to the discretion of the consumer. In 2019, 26 companies were active on the Belgian wholesale market for natural gas. The top three suppliers (Engie-Electrabel, EDF Luminus and Eni) had a market share of 48% in 2019, down from 55% in 2018. Wholesale gas prices in Belgium follow the pattern of gas prices in neighbouring countries.

The three regions have separate retail gas markets. Retail gas prices in Belgium in 2019 were low compared to IEA member countries, both for industry and for households. Residential consumers that meet certain socio-economic criteria can buy gas at a social tariff; the costs for this are borne by all gas consumers via a surcharge. More than 10% of consumers are eligible for this social tariff. While the need to protect vulnerable households is an understandable priority, the IEA points out that policy mechanisms that artificially reduce the cost for energy products can distort markets, and can increase energy consumption and related GHG emissions, and should preferably be ended. There are other measures to combat energy poverty without the risks and limitation associated with direct payments and a strong focus should be placed on building renovations that reduce energy demand and costs (see Chapter 2).

Supplier switching rates vary significantly between the regions. In 2019, in the Flemish Region, the switching rate was 28.5% whereas Wallonia and the Brussels-Capital Region had quite low switching rates (5.56% and 2.3%, respectively).

Belgium's gas supply is supported by its well-developed and highly interconnected natural gas network, which acts as a hub in the European gas network. There are two separate gas markets and gas transmission systems in Belgium: one for distribution of L-gas and another for H-gas, both managed by Fluxys Belgium, the national gas TSO. Regional governments in Flanders, Wallonia and the Brussels-Capital Region have legal monopolies on gas distribution in each region, where local DSOs are responsible for gas distribution.

Gas security in Belgium is supported by a variety of emergency response measures, including both supply-side and demand-side measures. In the event of a natural gas supply disruption, the DGE is the lead government department for the sector, while the TSO and the gas companies are responsible for the operational management of an emergency. In case of a severe gas emergency, implementation of non-market based measures can be warranted if gas cannot be delivered through market-based and operational measures alone. A number of measures such as constraint on firm capacity or curtailment of non-protected customers and withdrawal of gas in storage can be activated as non-market measures to mitigate the impact of a gas disruption.

Recommendations

The government of Belgium should:

- Develop integrated plans to meet future gas demand under different scenarios; in particular, plan for the potential increase of gas consumption in the electricity generation sector to offset the impact of the planned phase-out of nuclear power generation.
- Develop strategies and plans for decarbonising the gas sector, including mid- to long-term targets for low-carbon gases such as biomethane and hydrogen, in close co-ordination with regional governments, some of which have already introduced their own strategies.
- Continue sound planning and implementation of the conversion from L-gas to H-gas in concert with neighbouring countries, taking into account the required flexibility for peak demand and security of supply, and considering opportunities for electrification.

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10. Oil

Key data (2020)

Net imports of crude oil: 529.1 kb/d (total imports 578.2 kb/d, total exports 49.1 kb/d), +7.7% from 2010 to 2019, -22% from 2019 to 2020

Domestic oil products production: 585 kb/d (diesel 45%, other products 14%, motor gasoline 12%, naphtha 10%, fuel oil 8%, liquified petroleum gas 6%, kerosene 3%), +1.5% from 2010 to 2019, -21% from 2019 to 2020

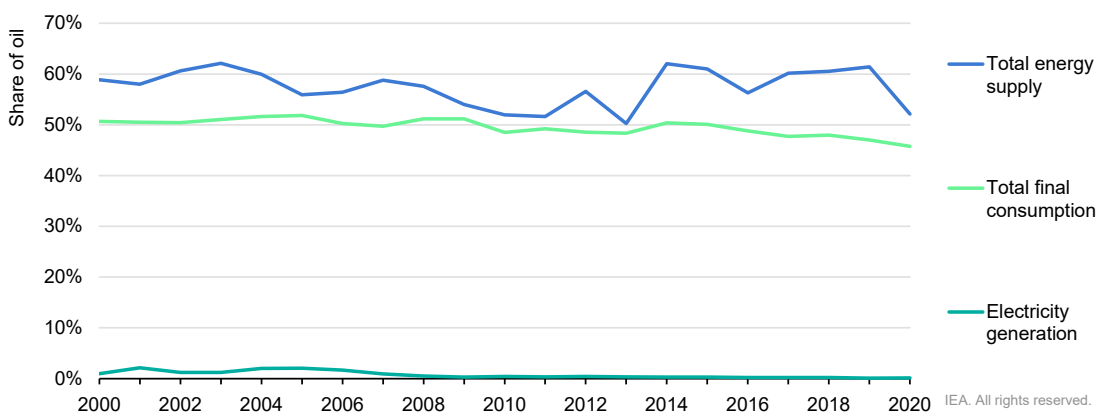
Net imports of oil products: 12.9 kb/d (total imports 521.5 kb/d, total exports 508.6 kb/d)

Oil consumption by sector: 542.3 kb/d (industry 32%, transport 29%, international bunkers 24%, residential buildings 10%, service buildings 3%), -3% from 2010 to 2019, -14% from 2019 to 2020

Overview

Oil is Belgium's main energy source, covering the largest share of TES and TFC. From 2010 to 2020, the share of oil in TES fluctuated between a maximum of 62% in 2014 and a minimum of 50% in 2013, while the share of oil in TFC experienced an overall decline from 49% in 2010 to 46% in 2020 (Figure 10.1).

Figure 10.1 Share of oil in the energy sector in Belgium, 2000-2020



Oil is the main energy source in Belgium, covering the largest shares of total final consumption and total energy supply.

Source: IEA (2021a), *World Energy Statistics and Balances* (database), <https://www.iea.org/data-and-statistics>.

In 2020, oil products covered 89% of transport energy demand, 40% of industry energy demand (including feedstock) and 27% of building energy demand, which is notably higher than the IEA average of 8% in 2019. Oil plays a minor role in electricity generation, accounting for 0.1% of generation in 2020. Belgium has no domestic crude oil production and no proven oil reserves, relying entirely on imports for its crude oil supply. However, Belgium has a large refining and petrochemical sector and is a net exporter of oil products.

The federal and regional governments aim to reduce oil demand, notably in the heating sector, where oil is still used by a large number of households, and in the transport sector. To reduce oil demand for transportation, the federal government should reduce or eliminate taxes on advanced biofuels.

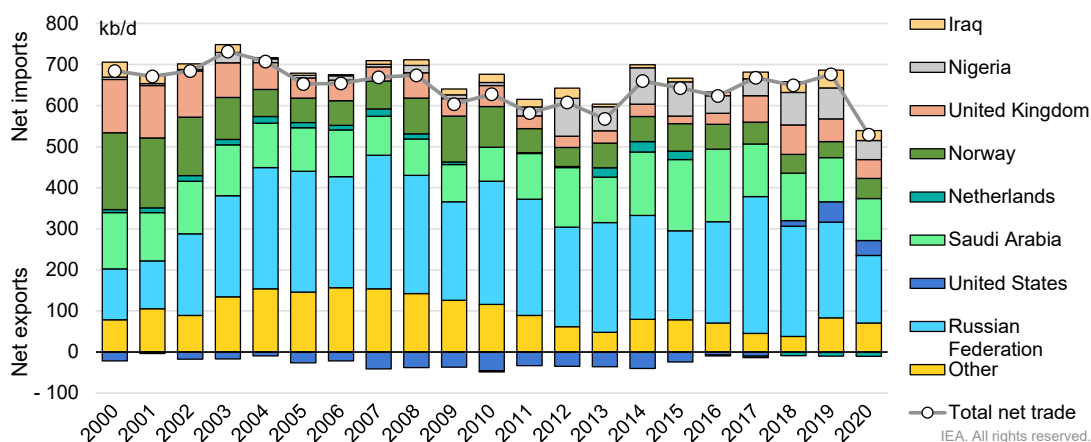
Belgium still operates a price-cap mechanism for most oil products. As the mechanism substantially hinders market penetration of new low-carbon fuels, and thereby the decarbonisation of the oil sector, the government should consider abolishing it.

Supply and demand

Crude oil trade

In 2019, Belgium's crude oil net imports, including small shares of natural gas liquids and refinery feedstocks, was 529 thousand barrels per day (kb/d) (578 kb/d imports and 49 kb/d exports). Belgium's location on the coast of Western Europe near major shipping routes allows imports from numerous countries (Figure 10.2). Belgium's crude oil supply arrives mainly via ship at the Port of Antwerp. In 2020, Belgium's crude imports came primarily from the Russian Federation (31%), followed by Saudi Arabia (19%), Norway (9.3%), Nigeria (8.7%), the United Kingdom (8.7%), the United States (7%) and Iraq (4.6%), with the remaining 12.8% from other countries. All of Belgium's crude oil and natural gas liquids imports are used domestically by the country's large refining and petrochemical industry. Belgium exports a small amount of refinery feedstocks, historically mostly to the United States via ship and since 2016 to the Netherlands via pipeline.

Figure 10.2 Belgium's net oil trade by country, 2000-2020



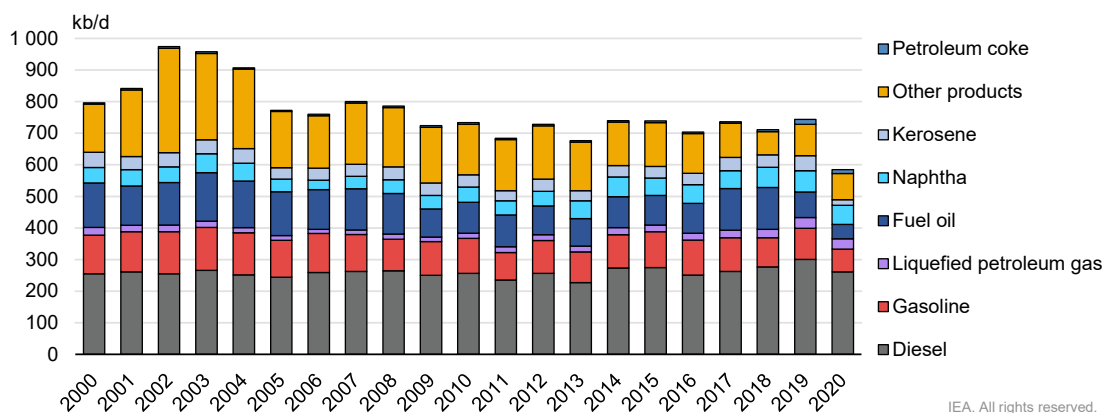
Belgium relies entirely on crude oil imports for its supply, and exports a small amount of refinery feedstocks to the United States and the Netherlands.

Source: IEA (2021a), *World Energy Statistics and Balances* (database), <https://www.iea.org/data-and-statistics>.

Oil products production and trade

Belgium's production of oil products fluctuates based on regional demand and market competition, but was relatively stable from 2009 to 2019, with the lowest production (676 kb/d) in 2013 and the highest (744 kb/d) in 2019 (Figure 10.3). In 2020, the refinery output decreased to 585 kb/d as demand dropped due to the Covid-19 pandemic. The mix of oil products from Belgian refineries has been relatively stable and in 2019, production consisted of 45% diesel, 12% gasoline, 10% naphtha, 8% fuel oil, 6% LPG, 2% petroleum coke and 14% other products. In 2020, production dropped especially for kerosene (-62% since 2019), fuel oil (-44%) and gasoline (-27%).

Figure 10.3 Oil products production in Belgium, 2000-2020

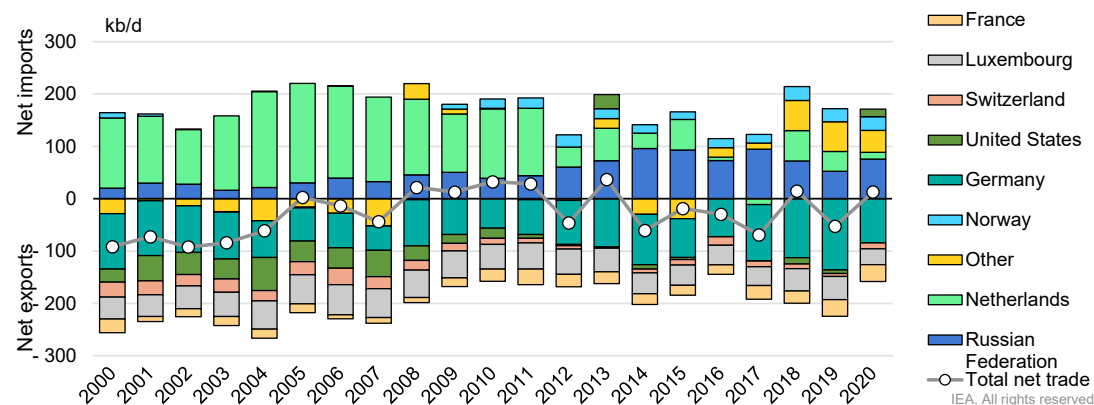


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Belgium's oil products production fluctuates based on regional demand and market competition, but has been stable since 2009.

Source: IEA (2021a), *World Energy Statistics and Balances* (database), <https://www.iea.org/data-and-statistics>.

Figure 10.4 Belgium's oil products net trade by country, 2000-2020



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Belgium's oil products trade includes imports and exports to a wide array of countries, and net trade fluctuated between net imports and net exports, based on market conditions.

Source: IEA (2021a), *World Energy Statistics and Balances* (database), <https://www.iea.org/data-and-statistics>.

In 2020, domestic demand exceeded refinery output for most oil products excluding gasoline, ethane and petroleum coke. Belgium's oil products net trade has fluctuated consistently between net imports and net exports based on market conditions (Figure 10.4).

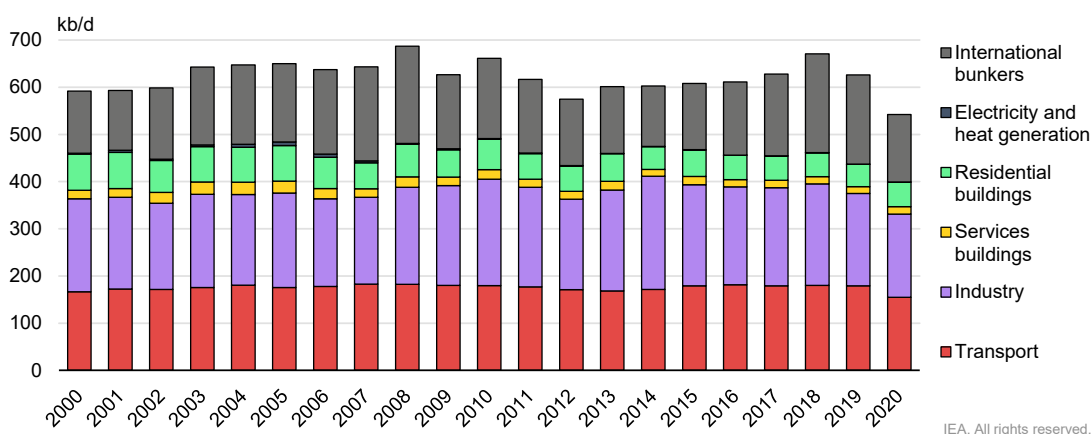
From 2010 to 2020, net imports of oil products became more diversified with the traditional reliance on imports from the Netherlands giving way to a supply also from countries including the Russian Federation and the United States. Net exports remained focused on the neighbouring countries of Germany, Luxembourg and France. In 2020, Belgium's net oil products trade was 12.9 kb/d of imports (522 kb/d imports and 509 kb/d exports) with most net exports going to Germany (85 kb/d), France (32 kb/d), and Luxembourg (30 kb/d), and net imports coming from the Russian Federation (76 kb/d), Norway (26 kb/d), the United States (14 kb/d), and the Netherlands (13 kb/d).

Oil demand

Belgium's oil demand peaked in 2008 at 687 kb/d and experienced an overall decline through 2012 to 575 kb/d. From 2012 to 2018, oil demand experienced a steady increase, reaching 671 kb/d in 2018, before steeply declining in 2019 to 626 kb/d and dropping in 2020 to 542 kb/d as a consequence of the Covid-19 pandemic (Figure 10.5). Belgium's oil demand comes mainly from industry (32% of demand in 2020), domestic transportation (29%), and bunker fuels used for international navigation and aviation (26%). A notable share of oil demand comes from oil-based heating in buildings (13% of demand in 2020), while electricity generation accounted for just 0.04% of oil demand.

Industry sector oil demand increased from 2007 to a historic peak of 240 kb/d in 2014, but has since experienced an overall decline to 196 kb/d in 2019 and 176 kb/d in 2020. Demand for bunker fuels experienced notable fluctuations ranging, from 129 kb/d in 2014 to 209 kb/d in 2018. Domestic transport oil demand, which comes mostly from road transport, peaked at 181 kb/d in 2016, decreased slightly to 179 kb/d in 2019, then dropped to 155 kb/d in 2020 due to the travel restrictions caused by the Covid-19 pandemic. As a result of unusually cold weather, building oil demand peaked in 2010 at 85 kb/d (64 kb/d residential and 20 kb/d service sector). Since 2010, oil demand in both residential and service sector buildings has experienced an overall decline, and in 2020 building oil demand was at 61 kb/d (52 kb/d residential and 16 kb/d service sector).

Figure 10.5 Oil demand by sector in Belgium, 2000-2020



Belgium's oil demand has fluctuated, with a peak in 2008, a decrease until 2012 and a steady increase until 2018. Demand then decreased by 6% in 2019 and 14% in 2020.

Source: IEA (2021a), *World Energy Statistics and Balances* (database), <https://www.iea.org/data-and-statistics>.

By product, in 2019, diesel has accounted for the largest share of oil products demand (45%), while naphtha, used primarily for chemical industry processes, accounted for the second-largest share (19%). LPG accounted for 11% of oil products demand and is mainly used in industry, with a small share coming from LPG powered vehicles. Motor gasoline accounted for 10% of oil products demand.

Oil policy

Belgium's energy policy is focused on reducing oil demand while ensuring security of oil supply. Belgium does not have a specific oil demand reduction target, but the NECP defines a wide range of measures that will drive significantly lower oil demand in line with Belgium's target to reduce GHG emissions from sectors outside of the EU ETS by 35% by 2030 versus 2005 levels (see Chapter 2). As oil is used in most sectors of Belgium's economy, responsibility for oil policy and demand reduction measures are divided between the federal and regional governments. The federal government is responsible for the taxation of oil products, security and quality of Belgium's oil supply, and transportation biofuels blending. The regional governments set policy in key areas affecting oil demand, such as vehicle taxation, urban planning, transport policy, and energy efficiency in buildings and industry.

Belgium aims to reform federal taxation to make it more climate- and environmentally friendly, following the polluter-pays principle and sending price signals driving decarbonisation. In support of this tax reform, the federal government will carry out a study in consultation with the regional governments to be published in 2022 with a goal to propose fiscal reforms by late 2023. The federal government has indicated that this reform is an opportunity to create price signals that will reduce oil demand. The federal government is also using tax policy to favour gasoline vehicles over diesel vehicles. The excise on diesel has been progressively increased to bring it in line with the excise on gasoline. Since July 2018, the excises on diesel and gasoline are the same (EUR 600.16 per 1 000 litres). The federal government has established a working group analysing the possibility to further increase the excise duty on diesel.

In 2021, Belgium sent the European Commission a required inventory of energy subsidies, including those for fossil fuels. In 2019, the subsidies with the largest forgone tax revenues were the reduced excises for heating oil (EUR 2.1 billion in forgone federal tax revenue) and the tax and fiscal treatment of company cars (approximately EUR 2 billion in forgone federal tax revenue). The federal government will examine options to eliminate fossil fuel subsidies as part of the reform of taxation to make taxation climate- and environmentally friendly, and has committed to developing an action plan to gradually phase-out fossil fuel subsidies. The regional governments have also taken steps to eliminate support for oil-based heating in buildings.

The regional governments are taking other steps to reduce oil demand from buildings. Flanders aims to gradually reduce oil heating in buildings. There is a legislative proposal in the Flemish Parliament to ban the installation of oil heating when there is a possibility of connecting to the gas grid. Wallonia is working on a plan to encourage replacing oil heating with less carbon-intensive alternatives including renewables, district heating and gas. The Brussels-Capital Region aims to end all fossil fuel-based heating by 2050. In support of

this goal, it is considering legislation to ban the installation of new oil heating systems starting in 2025 and subsidies for the replacement of oil heating with more efficient and less emitting options.

The federal government's Social Heating Fund provides residential consumers that meet certain socio-economic requirements with direct payments covering a portion of the costs for oil-based heating (kerosene, propane, heating oil). Payments depend on the price paid for the fuel and range from EUR 210-300 per year per household. The Social Heating Fund is financed through a federal contribution charge to consumers purchasing oil products intended for heating. From 2015 to 2019, the number of households receiving payments from the Social Heating Fund decreased from 96 588 (2% of households) to 85 813 (1.73% of households).

The main federal measure to reduce transport oil demand is a biofuels blending mandate, which requires all companies selling road transportation fuels (including diesel and gasoline) to blend a certain share of biofuels by energy content (9.55% in 2021). The NECP proposes annual increases in the required share of biofuels blending to reach 13.9% in 2030 (see Chapter 5). The federal government is also pushing to reduce oil demand by changing company car fiscal incentives to favour EVs (see Chapter 4).

Regional governments aim to lower transport oil demand through price signals that favour the adoption of EVs and low-emission vehicles. The regional governments are responsible for vehicle taxation, which is proportional to vehicle emissions, while EVs are exempt from vehicle taxes. This provides financial incentives to purchase lower emission (and more efficient) vehicles. The regional governments support EVs through the deployment of charging infrastructure. They also have a variety of programmes and targets that reduce oil demand through modal shifts away from the use of private cars. These include targets for electrification of government and public transport vehicles, for reductions in passenger kilometres, and for phasing out diesel and gasoline cars. The regional governments also have mobility plans pushing for more public transportation, improved logistics, and more walking and cycling (see Chapter 4).

Retail market structure

A number of major companies are involved in oil products supply in Belgium. Market shares for gasoline and road diesel indicate a competitive market. For both gasoline and road diesel, Total has the largest market share (around 30%). The main suppliers are Total, Varo Energy, Kuwait Petroleum, ExxonMobil, Lukoil, Shell and Van Raak Distributie for road diesels, and together account for more than 90% of road fuel sales.

As of March 2021, over 3 000 of service stations were in operation in Belgium. This number has not significantly changed since 2016. Market shares in terms of the number of filling stations are competitive, with the top three companies (Kuwait Petroleum, Etablissementen J. Maes Zonen and Belgian Shell) accounting for only one-fifth of the total number of stations. The market for heating gasoil is more concentrated, with more than two-thirds of the market share in the hands of three major companies: Total (41.4%), Varo Energy (20.4%) and ExxonMobil (9.6%).

Prices and taxation

Belgium sets maximum prices for most oil products through a price-capping mechanism, with maximum prices based on a contract between the federal government and the Belgian Petroleum Federation, the official representative of the main oil companies active in the fields of refining, marketing, distribution and storage in Belgium. The contract is reviewed every three years, but can be terminated at any time by either party. Cancellation of the contract would result in a return to the previous price-capping mechanism, where prices are set directly by the federal government (FPS Economy, 2020).

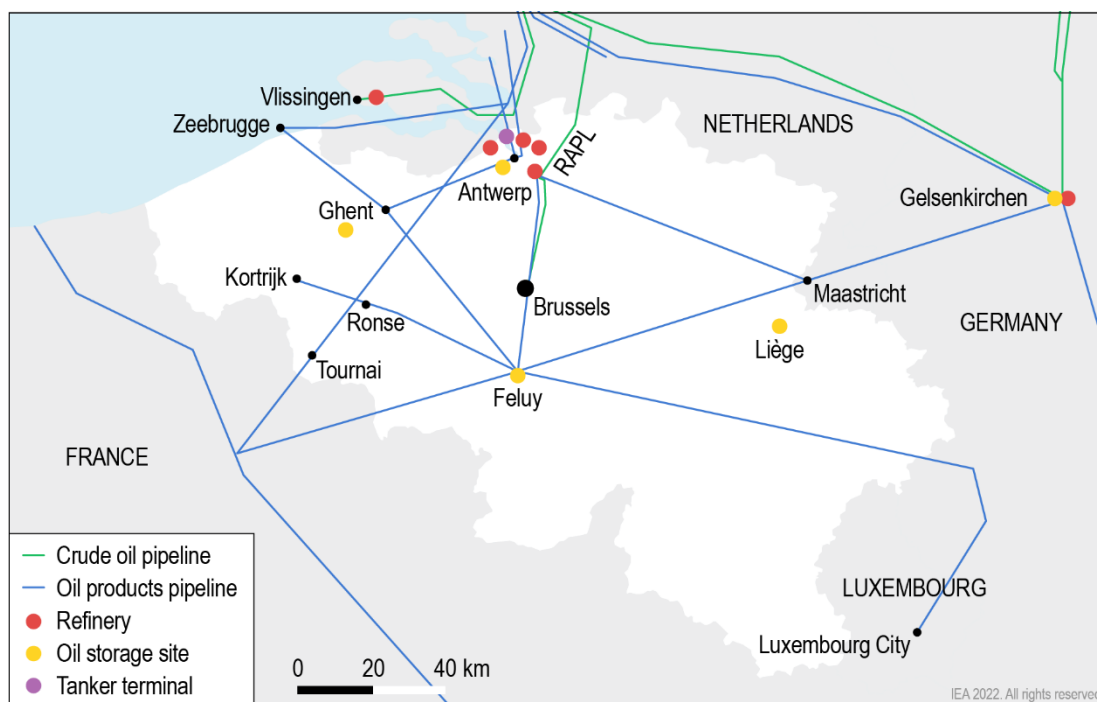
The most recent contract requires maximum prices to be set for gasoline, diesel, heating gasoil, other kerosene, propane, LPG and heavy fuel oil. Maximum prices are based on Argus quotations of finished product prices on the Rotterdam market plus a maximum gross distribution margin per product (set by the contract). The DGE of the Federal Public Service Economy (FPS Economy) calculates maximum prices each workday according to the contract and publishes these prices on line and communicates them by e-mail and fax to retail suppliers. Since July 2017, LPG products sold in bottles or other mobile containers are no longer subject to a maximum price.

Taxes and fees on oil products include an excise duty, a special excise duty, an energy levy, VAT, and federal contributions supporting the oil stockholding entity (APETRA) and the fund for soil remediation projects at service stations. The prices of oil products intended for heating (propane, kerosene and heating oil) include a contribution to the Social Heating Fund. There are notable tax exemptions or reductions for certain uses of oil products, especially related to industry and agriculture, with the overall effect that industry and businesses pay lower tax rates than households.

In the third quarter of 2020, Belgium's price for automotive diesel was the second-highest among IEA member countries (1.58 USD per litre [USD/L], with a tax rate of 62%) compared to the IEA average of 1.24 USD/L and a tax rate of 53%. Belgium's price for premium unleaded gasoline (95 RON) was the eighth-highest among IEA member countries (1.61 USD/L, with a tax rate at 61%), compared to the IEA average of 1.40 USD/L and a tax rate of 59%. For light fuel (a major source of heating in Belgium), Belgium's price was the third-lowest among IEA member countries (0.52 USD/L and a 22% tax rate), compared to the IEA average of 0.77 USD/L and a tax rate of 34%.

Infrastructure

Belgium has well-developed oil infrastructures, including a large import terminal at the Port of Antwerp, several large refineries, notable oil storage capacity and extensive pipeline infrastructure (Figure 10.6). Belgium's oil infrastructure and its central location in Europe give it an important role in regional oil products trade.

Figure 10.6 Oil infrastructure in Belgium

Oil imports

The Port of Antwerp is Belgium's main sea terminal for oil trade (both crude and oil products), and is a major refuelling site for international shipping. The Port of Antwerp is also home to most of Belgium's refining and chemical production capacity. The smaller Port of Zeebrugge is served by two oil products pipelines and has a storage for marine bunker fuels and a terminal for refuelling of international shipping.

The Rotterdam Antwerp Pipeline (RAPL) is Belgium's only cross-border pipeline for crude oil trade. It connects the major crude import terminals and refining facilities of the Port of Antwerp and the Port of Rotterdam in the Netherlands and has a capacity of 650 thousand tonnes per year (RAPL, 2021). Historically, the RAPL was used to deliver crude oil from the Netherlands to Belgium, but since 2016 it has been used to export refinery feedstocks from Belgium to the Netherlands.

Transportation

Crude oil and oil products in Belgium are mainly transported through pipelines, including the Central European Pipeline System (CEPS) and the RAPL. Oil products are also imported and transported via inland waterways, rail and trucks. The Port of Antwerp is Belgium's central hub for oil transportation, with over 1 000 km of pipelines for around 50 different oil products (Port of Antwerp, 2019).

The CEPS is a North Atlantic Treaty Organization (NATO) pipeline network that runs through Belgium, France, Germany, Luxembourg and the Netherlands, comprising 6 000 km of pipelines and connecting to roughly 8.2 million barrels (mb) of oil storage capacity. NATO maintains this distribution system primarily to provide fuel supply support to military bases. However, the pipeline's surplus capacity is leased for civilian transportation of oil products. The contracts between NATO and the oil companies using

the CEPS are based on market prices and supervised by Belgium's Federal Ministry of Economic Affairs (NATO, 2017).

Refining

Belgium's four refineries are strategically located near the Port of Antwerp and have a combined crude distillation capacity of 679 kb/d, equivalent to 33 million tonnes (Mt) per year. The refinery owned by Total (with a capacity of 353 kb/d) and the refinery owned by ExxonMobil (with a capacity of 326 kb/d) together account for 85% of Belgium's refining capacity. Both can produce a high yield of light and middle distillates, and are among the largest refineries in Europe. Notable improvements have recently been made in both of these refineries. During 2018 and 2019, a delayed coker unit was installed at the ExxonMobil refinery, greatly improving the thermal cracking-coking capacity and increasing the output of lighter oil fractions. In the Total refinery, a de-asphalting unit was installed, allowing transformation of heavy oil fractions into light products. Total also made investments to improve its petrochemical plant and refinery. Refinery gross output in 2020 was 578.2 kb/d, down from 744.0 kb/d in 2019 primarily due to the demand reduction caused by the Covid-19 pandemic.

As a refining hub, Belgium depends to a large extent on imports of crude oil, while the refining sector allows Belgium to produce a large number of oil products within the country. To bolster the growth of the refining sector by improving refinery-utilisation, and therefore of the domestic production of oil products, the federal government deems that the refining industry needs continuous support. In fact, Belgium has a plan to promote investment in refineries to ensure as much independence as possible, both nationally and internationally, during the period 2020-30 (EC, 2019).

Belgium has collaborated with the EU Refining Forum in recent years. The aim of the forum is to provide an opportunity for the industry, EU countries, members of the European Parliament, the European Commission and other stakeholders to discuss planned and future regulatory proposals with potentially significant impacts on the EU oil refining industry and on the EU's security of supply of petroleum products. The current discussion focuses on the role of the EU refining industry in the coming years and how it will address climate change, the competitive challenges refining and other energy-intensive industries face, and their contribution to the clean energy transition.

Storage

In 2020, Belgium had 50 oil storage facilities with a total capacity of 110.4 mb, mainly for oil products. All oil storage capacity in Belgium is privately owned and operated and is used mainly to support commercial operations, but also to provide emergency reserves to address supply disruptions. The majority of Belgium's oil storage (44%) is located at the Port of Antwerp to support the large concentration of refineries and petrochemical facilities.

Oil emergency response and stockholding

The Petroleum Agency (APETRA) is a public company owned by the federal government that is responsible for purchasing and managing emergency stocks of crude oil and oil products to ensure Belgium's security of oil supply and to meet international oil reserve obligations. APETRA holds oil stocks under long-term contracts in private storage facilities. It is funded by a fee charged on most oil products consumed in Belgium (APETRA, 2021).

The National Oil Board (NOB) is responsible for the supply and distribution of crude oil and oil products during an emergency. It has a mandate to restrict demand and share available supplies in the event of an oil supply shortage. The NOB is also responsible for activities related to Belgium's international commitments in energy crisis management. The NOB is an advisory body, comprised of representatives from the DGE, APETRA, the cabinet of the minister and the crisis cell of the FPS Economy.

Belgium's response to oil supply shortages in emergency situations is primarily governed by the 1976 Law Approving the Agreement on the IEA's International Energy Programme and the Compulsory Stockholding Act (CSA). The Law Approving the Agreement provides for a very general legal framework aimed to protect Belgium's oil supply. The CSA implements EU Directive 2009/119/EC and lays out a specific legal framework concerning the protection of Belgium's energy supply by stockholding crude oil and other petroleum products. Moreover, new decrees which have been adopted in recent years bolster the legal framework of Belgian oil emergency response, including Royal Decree of 19 December 2018 concerning the update of the Belgian oil National Emergency Strategy Organisation (NESO) and Royal Decree of 5 February 2019 establishing measures in an emergency oil supply.

Oil emergency response policy in Belgium is the responsibility of the federal Minister for Energy, in consultation with the Council of Ministers. Under the federal Minister for Energy, the DGE, within the framework of the NOB, serves as the core of the Belgian oil NESO. The NESO team is responsible for advising the federal Minister of Energy on maintaining and implementing emergency response measures during a supply disruption. The NOB is responsible for monitoring domestic oil markets and for data collection.

The NOB has a central role to co-ordinate with the federal Minister for Energy and the Council of Ministers in case of an oil supply crisis and to advise the federal Minister for Energy on the method of the release of stocks and co-ordinates the duration, nature and number of stocks to be released. The board also organises emergency response exercises in collaboration with APETRA and in communication with the oil industry on a regular basis.

A key component of the Belgian oil emergency response is a stock drawdown, and the CSA lays down the use of oil emergency stocks. According to the law, at the time of requiring emergency response, the federal Minister for Energy is entitled to decide to temporarily use part of the compulsory emergency stocks and may authorise a temporary reduction of them. In case of potential international or national supply problems, if the DGE decides that a meeting of the NOB is needed, the NOB will discuss the situation and form an opinion. Provided that the NOB deems that there is a crisis situation, this advice is transferred by the DGE to the federal Minister for Energy. Upon approval by the minister, the NOB shall advise on the nature, amount and duration of stocks to be released and implement crisis measures in close co-ordination with APETRA.

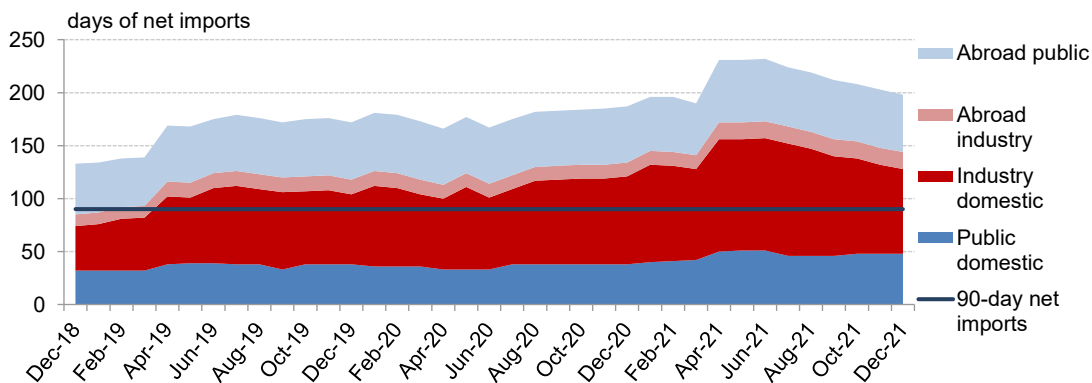
Emergency oil reserves

The CSA forms the legal backbone of the Belgian legislation on compulsory oil stocks. APETRA is the sole manager of the Belgian compulsory oil stocks. According to the CSA, APETRA needs to hold oil stocks equivalent to at least 90 days of net imports, and of which in 2021 at least 30% should be key products that account for more than 75% of oil product demand (in 2021 key products were diesel, heating oil and gasoline). The CSA requires that APETRA's crude stocks be less than 60% of APETRA's total stocks and product stocks held abroad should be less than 30% of total product stocks.

Belgium meets its stockholding obligation to the IEA by holding public stocks managed by APETRA. All Belgian oil emergency stocks are APETRA's agency stocks; there is no compulsory stockholding obligation on the Belgian oil industry. Belgium has a strong track record of compliance with the IEA 90-day obligation (Figure 10.7). As of end-December 2021, Belgium held stocks equivalent to 198 days of net imports (101 days of which are public stocks and 96 days are commercial industry stocks). According to the IEA methodology, the total volume of stocks held was 56.0 mb, around 30.7 mb in excess of the quantity required to meet the 90-day obligation (25.6 mb). As of end-March 2021, APETRA's oil stocks on national territory consisted of 98% of middle distillates and 2% of motor gasoline, while Belgium held 17.1 mb of oil stocks abroad (in France, Germany and the Netherlands), of which 89% consisted of crude oil stored in caverns in Germany.

Oil stocks owned by APETRA for emergency purposes are stored in storage facilities the agency rents in Belgium and its neighbouring countries. APETRA currently rents storage capacity in 16 storage facilities in Belgium with a total storage capacity of 11.4 mb, mainly for middle distillates. All of APETRA's crude oil storage is in Germany and has a capacity of 15.3 mb. APETRA also uses storage facilities for middle distillates, gasoline and jet fuel in France, Germany and the Netherlands; together these facilities have a storage capacity of 2.5 mb. The storage capacities are rented through contracts between 3 and 15 years and are allocated through competitive tenders. APETRA does not operate the facilities and has no responsibility for transporting oil coming from these facilities.

Figure 10.7 Emergency oil stocks by type in Belgium, December 2021



Belgium's oil stocks have consistently been above the IEA's 90-day emergency oil stock level requirement.

Source: IEA (2021b), *Monthly Oil Data Service*, <https://www.iea.org/data-and-statistics>.

Assessment

Oil is the principal energy source in Belgium, covering the largest share of energy supply and demand. From 2012, oil demand rose steadily, reaching 670.0 kb/d in 2018, before steeply declining to 625.4 kb/d in 2019. Belgium's oil demand comes mainly from industry (29% of demand in 2019), bunker fuels used for international navigation and aviation (30%), and domestic transportation (29%). A notable share of oil demand comes from oil-based heating in buildings (11% of demand in 2019). Belgium's oil supply is supported by its well-developed oil infrastructure, including the import terminal at the Port of Antwerp,

four major refineries, abundant oil storage capacity, and extensive pipeline infrastructure for domestic and cross-border transportation.

Belgium's energy policy is focused on reducing oil demand while ensuring security of oil supply. Belgium's NECP defines a wide range of measures that will drive lower oil demand in line with target to reduce GHG emissions from non-ETS sectors by 35% by 2030 versus 2005 levels. Belgium's main measures for reducing oil demand focus on the buildings and transport sectors. As oil is used in most sectors of Belgium's economy, responsibility for oil policy and demand reductions measures are divided between the federal and regional governments.

The regional governments are working to reduce building oil demand. Flanders is planning to ban the replacement of existing oil-based heating systems when a connection to the gas grid is possible from 2022 onwards. Wallonia is working on a plan to encourage replacing oil heating with less carbon-intensive alternatives including renewables, district heating and gas. The Brussels-Capital Region plans to gradually phase out oil-based heating. In 2019, oil covered 24% of building energy demand, which is notably higher than the IEA average of 8%. Belgium should accelerate the transition away from oil-based heating, with a focus on electrification and renewable energy.

Belgium aims to reduce transport oil demand through taxation that favours more efficient vehicles and EVs, and through the promotion of EV charging infrastructure and a modal shift away from private cars. The main federal measure to reduce transport oil demand is a biofuels blending mandate, which requires all companies selling road transportation fuels to blend a certain share of biofuels by energy content (9.55% in 2021). The NECP proposes annual increases in the required share of biofuels blending to reach 13.9% in 2030. However, there are no tax incentives to promote the use of biofuels in the transport sector. The federal government should examine biofuels taxation in the upcoming review of fiscal policy and consider decreasing or eliminating taxes on advanced biofuels to limit price impacts and further promote biofuels deployment in the transport sector. This could help support a cost-effective achievement of Belgium's target for renewable energy in transport, while limiting the social impacts of transport fuel costs.

Implementation of the federal and regional oil demand reduction policies would result in a significant reduction in Belgium's oil demand. The Belgian Petroleum Federation estimates that if the oil demand reduction measures of the NECP are put in place, fuel demand from passenger cars would decrease by 45% between 2018 and 2030. The increased EU-wide 55% GHG reduction target could require even stronger reductions in Belgium's oil demand. This reduction in fuel consumption will affect economic conditions of fuel distribution; distribution companies and service stations will need to change their business models. In this respect, the Belgian authorities should discuss, with the oil industry, including distribution companies on how to address expected future transformations of the oil distribution system, and with the business continuity of relevant industries in the medium and long term.

The oil demand reduction measures needed to meet climate goals will also have a major impact on Belgium's economically critical refining sector. The Belgian authorities should work with the oil sector to increase efficiency, lower emissions, and support a transition to the production of low-carbon fuels and feedstocks. It is commendable that Belgium closely co-operates with its neighbouring countries and collaborates with the EU Refining Forum in this area.

The federal government sets maximum prices for most oil products through a price-capping mechanism. Price caps are currently set for gasoline, diesel, heating oil, kerosene, propane, heavy fuel oil and LPG (except LPG sold in bottles or mobile containers). Price-setting mechanisms have long disappeared in most IEA member countries, resulting in dynamic retail markets for transport fuels without negative impacts on consumers. The price-setting mechanism adds administrative burdens and costs for the federal government and Belgium's oil companies, while providing no clear benefits. In the third quarter of 2020, Belgium's price for automotive diesel was the second-highest among IEA member countries while the price for premium unleaded gasoline was the eighth-highest. The price-setting mechanism is also a potential barrier to the adoption of sustainable biofuels and other new low-carbon fuels as they lack a reference price. The IEA has consistently recommended that Belgium abolish the maximum price mechanism (most recently in the 2016 and 2013 energy policy reviews). The Belgian Petroleum Federation has also notified the government of its preference for a free market pricing system. The federal government should abolish the price-setting mechanism.

Recommendations

The government of Belgium should:

- Examine biofuels taxation in the upcoming review of fiscal policy and consider decreasing or eliminating taxes on advanced biofuels, to limit price impacts and further promote biofuels deployment in the transport sector.
- Work with the Belgian oil sector to increase efficiency, lower emissions and support a transition to the production of low-carbon fuels and feedstocks.
- End the maximum price mechanism to promote effective competition in the sector and facilitate the introduction of renewable fuels.

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ANNEX A: Review team and supporting stakeholders

Review criteria

The Shared Goals, adopted by the IEA Ministers at their 4 June 1993 meeting in Paris, provide the evaluation criteria for the in-depth reviews. [The IEA Shared Goals are available online.](#)

Review team and preparation of the report

The IEA's in-depth review visit of Belgium took place virtually from 26 April to 7 May 2021. The review team met with government officials, energy suppliers, market participants, interest groups, consumer associations, research institutions and other stakeholders. This report was drafted based on information obtained in these meetings, the review team's assessment of Belgium's energy policy, the government's response to the IEA energy policy questionnaire and subsequent research by the IEA. The members of the team were

IEA member countries

Mr. Astrid Sontag, Switzerland (team leader)

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Ms. Aneta Ciszewska, Poland

Ms. Işın Ünver Baş, Turkey

Mr. René Nastoupil, Czech Republic

Mr. Ermin Kloppenborg, Netherlands

Mr. Morten Anker, Norway

European Union

Ms. Clémence Bruand

Nuclear Energy Agency

Mr. Antonio Vaya Soler

International Energy Agency

Mr. Aad van Bohemen

Mr. Shuto Fukuoka

Mr. Peter Journeay-Kaler

The team is grateful for the co-operation and assistance of the many people who supported the review. Thanks to their hospitality, openness and willingness to share information, the visit was highly informative, productive and enjoyable. The team expresses its gratitude to Minister Tinne van der Straeten and Director General for Energy Nancy Mahieu, whose comments helped frame all the discussions during the review. The team also extends a special thanks to Mr. Lenhard Vanhoorn for his tireless efforts in co-ordinating the review visit, prompt responses to the team's many requests, and patience throughout the weeks leading up to and during the review.

The review was prepared under the guidance of Mr. Aad van Bohemen, Head of the Energy Policy and Security Division, IEA. Mr. Peter Journey-Kaler managed the review and is the author of the report. Mr. Shuto Fukuoka and Ms Kiyomi Hyoe co-ordinated the emergency response component of the review and contributed to the chapters on oil, natural gas and electricity. Mr. Alessio Scanziani wrote the chapter on energy efficiency. Mr. Antonio Vaya Soler wrote the chapter on nuclear energy. Mr. Alessio Scanziani, Ms. Clémence Lizé, Ms. Alan Choi, Ms. Myriam Badri and Ms. Jiyul Shin prepared and drafted the sections relating to energy data contained in each chapter. Helpful comments, chapter reviews and updates were provided by the following IEA staff: Ms. Sara Moarif, Mr. Kieran McNamara, Ms. Jinsun Lim, Ms. Vida Rozite, Mr. Simon Bennet, Mr. Pablo Hevia-Kock, Mr. Gergely Molnar and Ms. Toril Bosoni.

Special thanks to the IEA secretariat with regard to the data, publication and editing. Ms. Astrid Dumond, Ms. Isabelle Nonain-Semelin and Ms. Taline Shahinian managed the layout and publication. Ms. Roberta Quadrelli, Mr. Steve Gervais, Mr Arnau Risquez Martin and Ms. Laura Mari Martinez provided support on statistics. Ms. Therese Walsh managed the editing process. Mr. Jad Mouawad and Mr. Jethro Mullen supported the press launch. Ms. Jennifer Allain was the editor.

Meetings were held with the following organisations

Agoria

Belgian Ambassador OECD-UNESCO Paris

Belgian Biodiesel Board (BBB)

Belgian Bioethanol Association (BBA)

Belgian Competition Authority

Belgian ESCO Association (BELESCO)

Belgian Federation of Fuel Dealers (BrafcO)

Belgian Nuclear Research Centre (SCK CEN)

Belgian Petroleum Federation

Belgian Science Policy Office (BELSPO)

Bond Beter Leefmilieu

Brugel

Brussels Agency of Innovation (Innoviris)

Brussels-Capital administration

Cabinet Brussels Minister Maron

Cabinet Federal Minister of Energy

Cabinet Flemish Minister Demir

Cabinet Walloon Minister Henry

Commission for Electricity and Gas Regulation (CREG)
Elia
EnergyVille/Imec
EnergyVille/KULeuven
FEBEG/member Engie-Electrabel
Federal Buildings Agency
Federal Minister of Energy
Federal Planning Bureau
Federal Public Service (FPS) Economy
Federal Public Service (FPS) Environment
Federal Public Service (FPS) Finance
Federal Public Service (FPS) Foreign Affairs
Federation of Belgian Electricity and Gas Companies (FEBEG)
Federation of Belgian Industrial Energy Consumers (FEBELIEC)
Federation of Enterprises in Belgium (VBO/FEB)
Federation of Renewable Energy Producers (EDORA)
Flemish administration
Flemish Regulator for Electricity and Gas (VREG)
Fluxys
Greenpeace
Inter Environnement Wallonie
Organisation for Sustainable Energy (ODE) Vlaanderen
Petroleum Agency (APETRA)
Synergrid
Testaankoop/Test Achats
University of Liège
University of Mons
Walloon administration
Walloon Commission for Energy (CWaPE)

ANNEX B: Glossary and list of abbreviations

In this report, abbreviations and acronyms are substituted for a number of terms used within the International Energy Agency. While these terms generally have been written out on first mention, this glossary provides a quick and central reference for the abbreviations used.

Acronyms and abbreviations

AC	alternating current
CCGT	combined-cycle gas turbine
CCIEP	Coordination Committee for International Environmental Policy
CCUS	carbon capture, utilisation and storage
CEPS	Central European Pipeline System
CREG	Commission for Electricity and Gas Regulation <i>Commission de Régulation de l'Électricité et du Gaz</i>
CRM	capacity remuneration mechanism
CSA	Compulsory Stockholding Act
DGE	Directorate-General for Energy
DLR	dynamic line rating
DSO	distribution system operator
DSR	demand-side response
EC	European Commission
EED	Energy Efficiency Directive
ENS	energy not supplied
ESD	Effort Sharing Decision
ESR	Effort Sharing Regulation
ETS	Emissions Trading System
EU	European Union
EUR	euro
EV	electric vehicle
FEC	final energy consumption
FPS	Federal Public Service
GDP	gross domestic product
GHG	greenhouse gas
GTS	Gasunie Transport Services
H-gas	high-calorific gas
HHI	Herfindahl-Hirschmann Index
HVDC	high-voltage direct current
IEA	International Energy Agency
L-gas	low-calorific gas

LNG	liquefied natural gas
LPG	liquefied petroleum gas
LULUCF	land use, land-use change and forestry
NATO	North Atlantic Treaty Organization
NCC	National Climate Commission
NDP	network development plan
NECP	National Energy and Climate Plan
NESO	National Emergency Strategy Organisation
NOB	National Oil Board
OECD	Organisation for Economic Co-operation and Development
ONDRAF	National Agency for Radioactive Waste and Enriched Fissile Materials <i>Organisme national des déchets radioactifs et des matières fissiles enrichies</i>
PEC	primary energy consumption
PHEV	plug-in hybrid electric vehicle
PREC	Regional Program for a Circular Economy <i>Programme Régional d'Économie Circulaire</i>
PV	photovoltaics
RAPL	Rotterdam Antwerp Pipeline
R&D	research and development
RD&D	research, development and demonstration
RED	Renewable Energy Directive
SAIDI	System average interruption duration index
SAIFI	System average interruption frequency index
SDR	strategic reserve delivered by a reduction in the offtake on the demand side
SET Plan	Strategic Energy Technology Plan
SGR	strategic reserve delivered by generation units
SME	small and medium-sized enterprise
STI	science, technology and innovation
TES	total energy supply
TFC	total final consumption
TFEC	total final energy consumption
TSO	transmission system operator
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States dollar
VAT	value-added tax

Units of measure

bcm	billion cubic metres
GW	gigawatt

ANNEXES

GWh	gigawatt-hour
kb/d	thousand barrels per day
km	kilometre
kV	kilovolt
L	litre
mcm	million cubic metres
ktoe	kilotonne of oil equivalent
kW _e	kilowatt electrical
kWh	kilowatt-hour
MJ	megajoule
Mt	million tonnes
Mt CO ₂	million tonnes of carbon dioxide
Mt CO ₂ -eq	million tonnes of carbon dioxide equivalent
MW	megawatt
t CO ₂	tonne of carbon dioxide
TJ	terajoule
toe	tonne of oil equivalent
TWh	terawatt-hour

ANNEX C: Statistical notes

Statistical notes

- Unless otherwise noted, all GDP data are in USD 2015 prices and purchasing power parity.
- *Total energy supply (TES)* comprises production + imports – exports – international marine and aviation bunkers ± stock changes. This equals the total supply of energy that is consumed domestically, either in transformation (e.g. power generation and refining) or in final use.
- *Total final consumption (TFC)* is the final consumption of energy (electricity, heat and fuels, such as natural gas and oil products) by end users, not including the transformation sector (e.g. power generation and refining).
- *Total final energy consumption (TFEC)* excludes non-energy use which is counted in TFC. TFEC provides a more accurate assessment of the share of energy demand covered by renewable energy and is better aligned with the European Union's gross final energy consumption metric, which is used to set EU member states' renewable energy targets.
- The primary energy equivalent of nuclear electricity is calculated from the gross generation by assuming a 33% conversion efficiency. The calculation to be carried out is the following: gross electricity generation in TWh x 0.086/0.33 = primary energy equivalent in Mtoe.
- *Bioenergy* refers to solid and liquid biofuels, renewable waste, and biogas and excludes non-renewable waste.
- *Buildings* includes the energy use of the residential sector (residential buildings) and commercial and public service sectors (service sector buildings).
- *Transport* excludes international aviation and navigation.
- *Industry* includes both energy and non-energy use of the industry sector, agriculture, forestry and fishing.
- *Non-energy use* refers to fuels used as raw materials, and not used as fuel or transformed into another fuel. This comprises typically raw materials used in the chemical and petrochemical sector.
- *IEA30* is the equivalent of a weighted average of 30 IEA member countries.
- "*CO₂ emissions from fuel combustion*" have been estimated using the IPCC Tier I Sectorial Approach methodology from the 2006 IPCC Guidelines. Emissions from international marine and aviation bunkers are not included in national totals.

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Energy Policy Review

The International Energy Agency (IEA) regularly conducts in-depth peer reviews of the energy policies of its member countries. This process supports energy policy development and encourages the exchange of international best practices and experiences to help drive secure, affordable and clean energy transitions.

Belgium's energy and climate policies push for energy transition through expanding renewable electricity generation and electrifying energy demand, especially for transport. Policies focus on maintaining affordable access to energy with the double aim of protecting vulnerable consumers and ensuring industrial competitiveness.

Belgium has made notable progress on deploying offshore wind and increasing the share of electric vehicles. However, fossil fuels still dominate the country's energy mix, a dependence that is expected to increase. All sectors have considerable work ahead of them to meet Belgium's targets for increasing the share of renewables, lowering energy demand and reducing emissions.

The IEA provides a range of energy policy recommendations in this report to help Belgium smoothly manage the transition to an efficient and flexible carbon-neutral energy system.