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CONNECTING REALITY WITH CLIMATE GOALS: CASE STUDIES OF GAS DISTRIBUTION SYSTEM PLANNING AND REGULATION

Country Report Belgium

Bram Claeys (RAP)
Malte Bei der Wieden (Öko-Institut)
Veit Bürger (Öko-Institut)
Carmen Loschke (Öko-Institut)
Jan Rosenow (RAP)
Sibylle Braungardt (Öko-Institut)
Tilman Hesse (Öko-Institut)
Marc Stobbe (Öko-Institut)

Background and objectives

- Fossil gas consumption in the EU must decline rapidly to meet energy and climate targets, as well as in the context of energy security concerns, and gas price volatility.
- Declining gas demand will lead to higher grid fees for remaining customers as fewer people use the gas infrastructure, with potential high increases of grid fees.
- Proposals to replace fossil gas with hydrogen face technical and economic challenges, with hydrogen being less efficient and more expensive for heating compared to electrification and district heating.
- Continued investment in gas infrastructure without a decommissioning plan risks stranded assets, as the long lifespans of gas grids do not align with decreasing gas usage and climate targets.
- Regulations are beginning to address these issues, with some countries taking steps towards orderly gas grid decommissioning to manage costs and transition to alternative energy sources efficiently.
- In view of these challenges ahead, the objectives of this country sheet are to
  - provide an overview the status quo of gas consumption and gas distribution networks
  - Outline how regulations related to the gas grid embrace this challenge and identify gaps
  - Highlight opportunities for stakeholders to interact in the process

Summary of the country report for Belgium

- Belgium has a higher-than-average share of gas in its energy mix: 25% of final energy consumption, compared to an EU average of 20%. Gas generally dominates the heating sector, although especially in the Southern part of the country, oil heating still is strong due to a less developed gas distribution grid. As 5 out of 7 nuclear reactors will be closed in 2025, the share of gas in electricity production will likely increase in the medium term.
- Belgium has no explicit target to phase-out fossil gas at the distribution level. It does have such a target for oil heating. In the Brussels and Flemish regions, from 2025 no more gas connections can be installed in new buildings or deep energy renovations.
- Independent energy and climate scenario studies for Belgium show clearly that decarbonization of buildings is most cost-efficient through energy efficiency, solar PV and heat pumps, district heating and woody biomass. While gas DSO's keep the door to hydrogen and biomethane open, there's growing recognition this won't be a one-for-one replacement. Flemish and Walloon DSO's recognize hydrogen and biomethane will go to industry and perhaps some transport.
- The biggest handicap for heat pumps in Belgium is the imbalance between lower-taxed gas and heavily taxed electricity. The political debate to shift levies and taxes is very slow going. Perhaps the new legislature starting this year will make progress.
- Belgium has a regulated social tariff for gas, electricity and district heating. Along with other social energy measures, this protected vulnerable households relatively well in the energy crisis of 2022-2023.
- Interesting: The gas transmission network has targeted depreciation rates in its tariff methodology, with the aim to have the gas transmission network written off by 2050. Such a targeted depreciation does not exist on the distribution level. This will be subject of consultation and parliamentary discussions in 2025. Stakeholders can engage in public consultations on the gas grid investment plans and network tariff methodologies, so they have an opportunity to weigh in on the topic.

Content and structure of the country report

1. **Development of Fossil Gas Consumption + Heating Market/Systems:** This chapter provides an overview of historical trends and current statistics regarding fossil gas usage and the evolution of heating systems.
2. **Distribution Network - Development and Current State:** This section discusses the infrastructure that supports the distribution of gas, including an assessment of its development over time and its condition today.
3. **Network Regulation, Costs vulnerable and low-income Energy Users:** Here, we analyze the regulatory framework governing the distribution network and detail the associated costs of maintaining and expanding this infrastructure.
4. **Current and Anticipated Role of Alternative Gases:** This chapter evaluates the expected role of alternative gases like biogas and hydrogen in transitioning away from fossil fuels, including current applications and future projections.
5. **Alignment with Climate Scenarios:** We explore how gas grid planning is aligned with national climate goals, examining scenarios that aim to reduce greenhouse gas emissions.
6. **Transparency of Information and Stakeholder Input:** The final section discusses transparency and highlights opportunities for stakeholder engagement.

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1 Development of fossil gas consumption + heating market/systems

2 Distribution Network - Development and Current State

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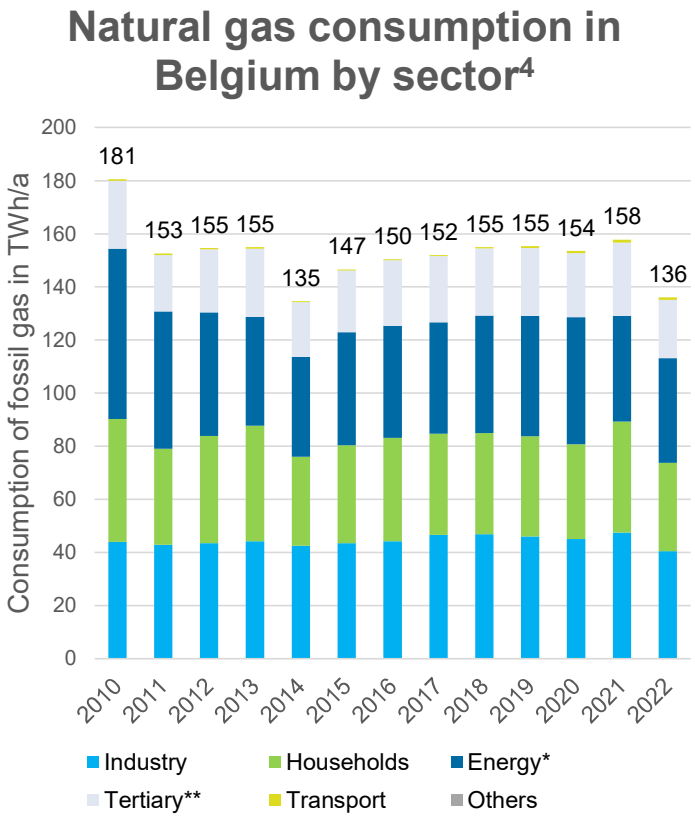
5 Alignment with Climate Scenarios

6 Transparency of Information and Opportunities for stakeholder involvement

Evolution of fossil gas consumption

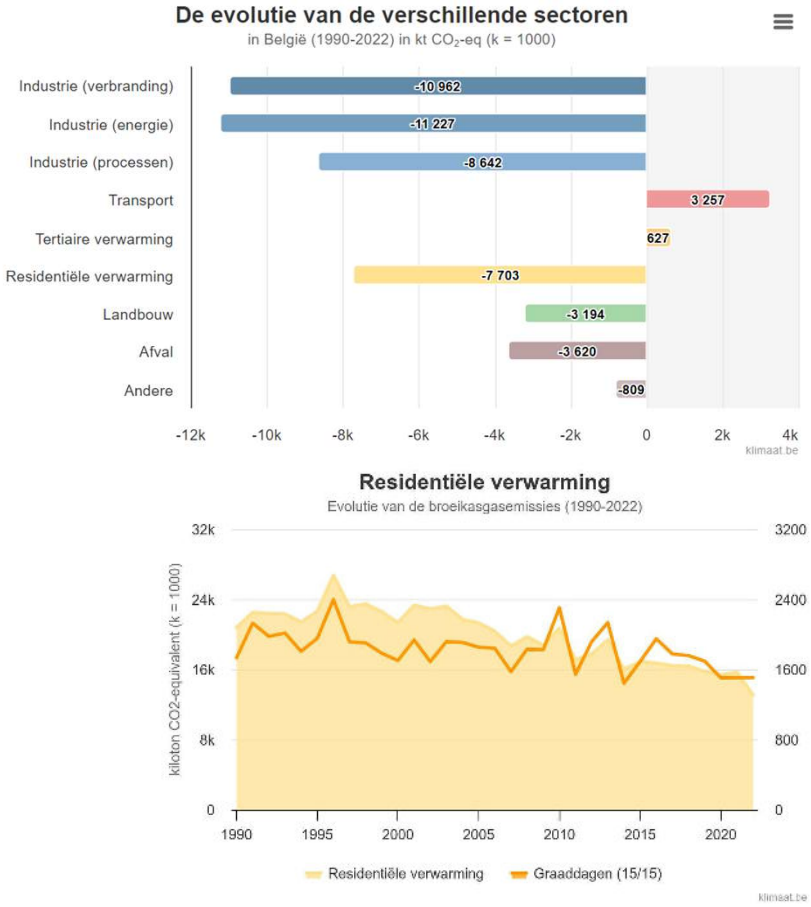
- Fossil gas is used as fuel for 24,7% of final energy demand in Belgium in 2022.[1]
  - Buildings (residential and tertiary), energy production and industry each take up roughly a third of the fossil gas use.[1]
  - Share of gas in **electricity production**: 25% in 2023 (down from 27% in 2022) a historic low.[3] Electricity production is still dominated by nuclear. In 2025 all but 2 nuclear reactors will be shut down. This will likely lead to an increase in the share of gas in electricity production in the medium term.
  - Share of gas in **residential heating**: 66% of number of residential heating systems in 2020, but 45% of residential heating energy consumption (heating oil: 21% / 39% respectively).[1]
- Final energy consumption varies greatly depending on weather conditions. Years with a harsher winter, such as 2013 and 2021, show higher final consumption of heating fuels. That impact is mainly visible in natural gas consumption.[5]
- As a result of Russia's invasion of Ukraine, final energy consumption, like primary energy consumption, drops very sharply in 2022 (-9.4% vs. compared to 2021). The decrease is mainly noticeable in the consumption of natural gas (-18.3% compared to 2021) and petroleum products (-6.5% compared to 2021).[2]



Sources: [1]Federale Overheidsdienst Economie (FOD Econ) (2023); [2]Federale Overheidsdienst Economie (FOD Econ) (2024); [3]Elia (2024); [4]Eurostat (2024) *Energy sector = Transformation input - energy use; **Tertiary sector = commercial and public services + agriculture and forestry + fishing.; [5]Federatie van de Belgische Elektriciteits- en Gasbedrijven (FEBEG) (2024)

Heating in Belgium

- Contribution of heating to Belgian GHG emissions (2022).[1]
  - Residential heating: 12,6%
  - Tertiary (Commercial) sector heating: 4,8%
- The graph above summarises the impact of the main sectors on the national trend (1990-2022). It shows an increase in emissions from road transport (+15.8%). Emissions from the tertiary sector (heating of buildings) are also increasing (+14.5%). Emissions from the residential sector, on the other hand, have decreased by 37.1%. The other sectors have also seen significant decreases over the whole of the period 1990-2022.
- In the residential sector (lower graph), fuel consumption increased by 17.4% between 1990 and 2003. This is mainly due to the increase in the number of buildings (+26% between 1991 and 2001). The climate causes annual variations. More recently, higher energy prices (especially in 2022) and improved insulation of buildings have probably helped to reduce consumption.

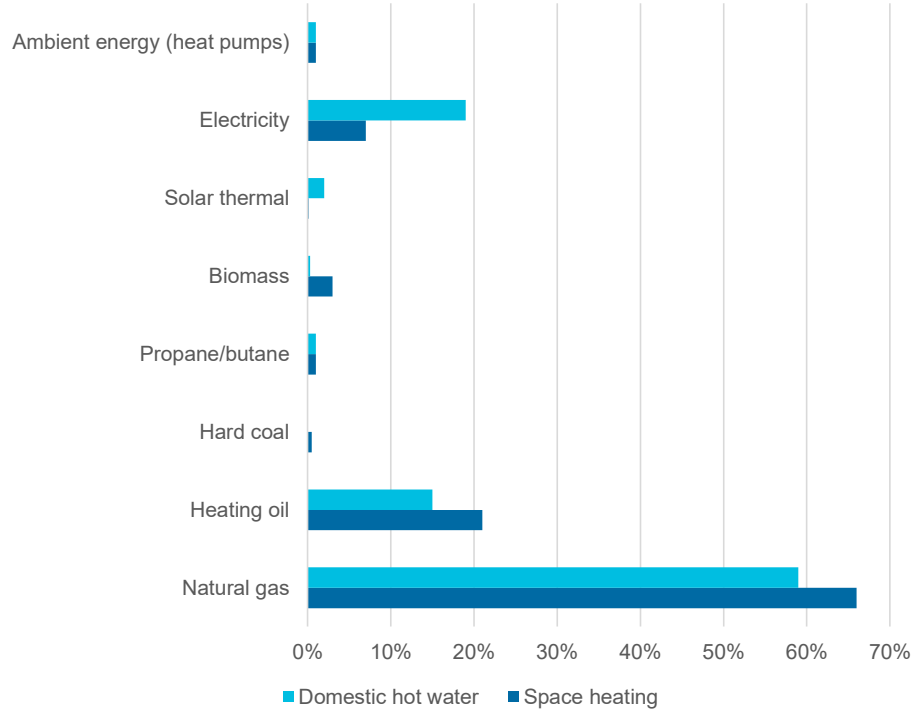


Source: [1]Federale Overheidsdienst Leefmilieu (2024)

Heating in Belgium

- Detailed and recent data about heating technologies and market shares are hard to get by in Belgium. Some are only available for one region, not the entire country. Other data is only available for members of business associations. The most complete overview presents the 2020 government's household budget survey (Statbel).[1]
- From the 2020 survey: fossil gas is used by 66% of households for space heating, and by 59% for Domestic Hot Water (DHW). Heating oil is the second most prevalent space heating source. Electric boilers are second for DHW.
- 2023 market data (Climafed).[2]
  - Fossil gas and fuel oil boilers sales drop by 1/3.
  - Solar water heaters fell 35% (after positive 2022)
  - Heat pump sales rose 140% in the first 6 months of 2023, but growth halted in final months of 2023. Annual sales stand at +68%.

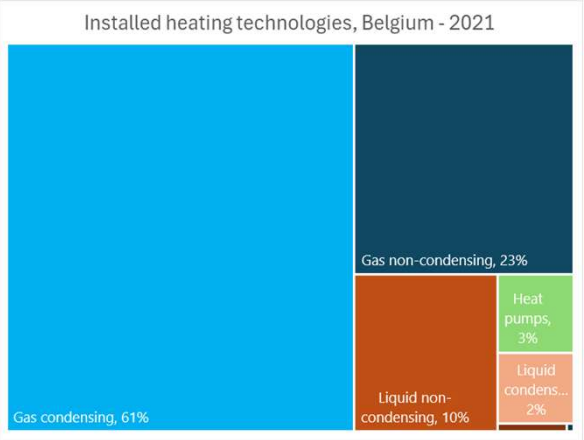
Energy sources for heating and domestic hot water by Belgian households[1]

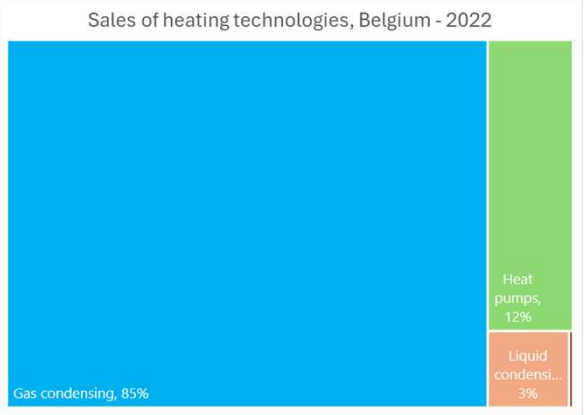


Sources: [1]Statbel (2020); [2]Climafed (2024)

Heating technology market data

- Data on the Belgian market for heating technologies is available from the European Heating Industry's 2023 market report.[1]
  - Sales of new heating appliances in Begium are dominated by condensing gas boilers. Heat pump share is still small, but currently second (at a considerable distance) in new sales behind gas boilers, yet ahead of oil furnaces.
  - Condensing gas boiler sales stood at 213.500 in 2022 (85% of heater sales in 2022), a reduction of 12.000 units compared to 2021. This in a year with record high gas prices.
  - Heat pumps come in second in terms of sales, at 30.000 in 2022, or 12% of the market. In 2021 heat pumps represented about 3% of the overall stock of installed systems in Belgium.
  - Most common heat pump technology for space heating: Air-water.[2]

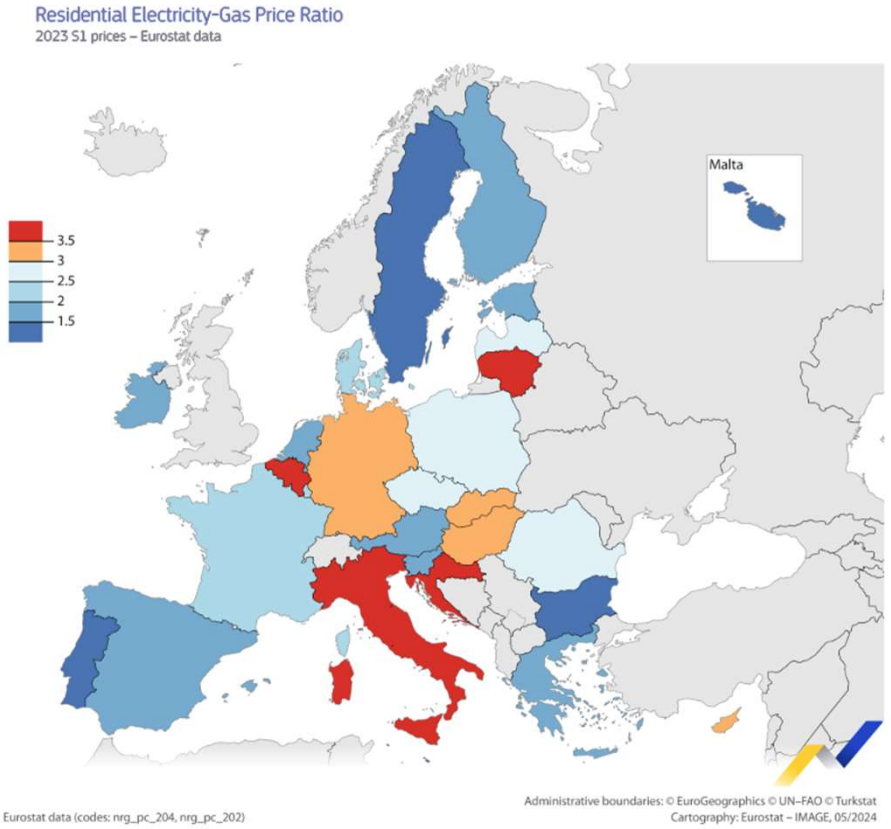




Sources: [1]EHI (2023); [2]Joint Research Center (2024)

Return on heat pump investment

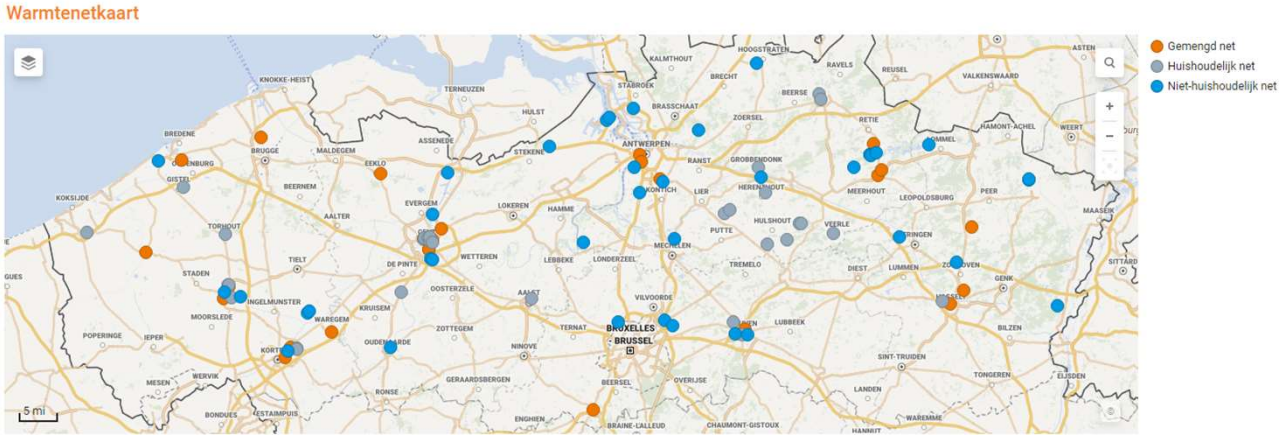
- Belgium has one of the highest electricity to gas price ratios in Europe.[1]
- A favourable electricity-gas price ratio and subsidies are key to supporting the uptake of heat pumps. The electricity/gas price ratio indicates the cost difference for using electricity rather than gas for space heating. Heat pumps are more efficient than gas boilers and become competitive when the electricity price is lower than around three times the gas price.
- The increase in overall prices risk adversely affecting households, and especially low-income households.
- In Belgium, 5.1% of households are not able to keep their home adequately warm and 3.2% have arrears on their utility bills. Subsidies covering 70% of the installation cost, up to a maximum of EUR 6,400, are available. However, the subsidies available depend on certain conditions and vary between the Belgian regions.



Sources: [1]Joint Research Center (2024)

District heating in Belgium

- The use of district heating is limited, despite the significant potential for (industrial) waste heat recovery.
- Currently 0,5% of heating end use served via district heating.[1]
- In 2022 there were 98 district heating systems in Flanders, with a renewable share of 34%.[2] In 2022 district heating supplied a total of 946 GWh heating energy mostly to non-residential customers. The number of district heating systems grew significantly from only 58 in 2019. Another 19 are planned.
- In Wallonia there are about 100 district heating systems, for a combined capacity of 80 MWth.[3]



Sources: [1]Renouvelle (2022); [2]Vlaamse Regulator Elektriciteit en Gas (2023); [3]Parlement de Wallonie (2023)

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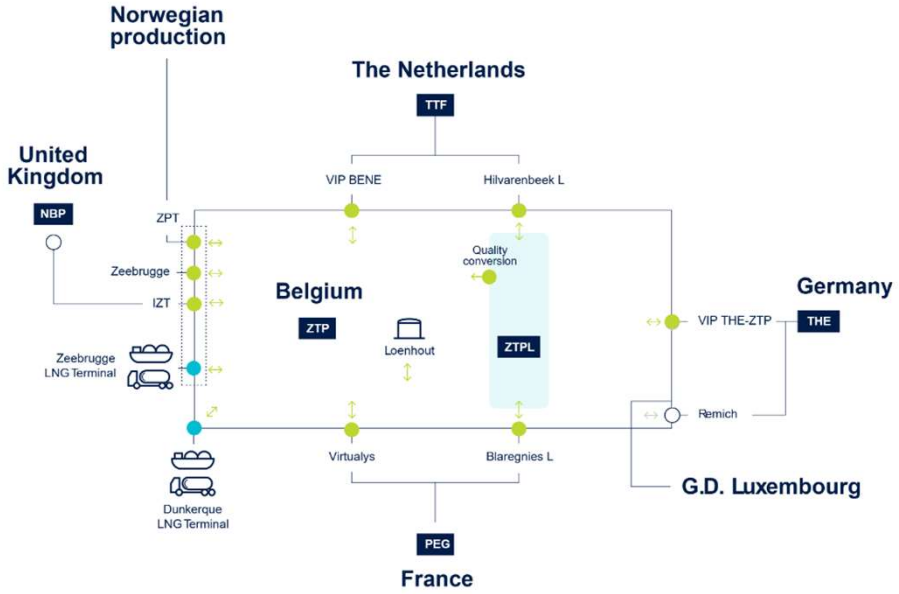
Gas network operators

- There is one Belgian transmission system operator (TSO), Fluxys, which owns and operates the fossil gas transmission network in Belgium.[1]
  - 4,000 km of gas transmission pipeline, connections to Norway, UK, Netherlands, Germany, France, GD Luxemburg
  - LNG terminal Zeebrugge 174 TWh regasification p.a.
  - Loenhout storage (aquifer) of 9 TWh
- There are 5 gas distribution system operators in Belgium. Total pipeline length about 75.000km.[2]
  - Fluvius (58,000 km) in Flanders (management company for 11 intercommunales), 2,36 million connections
  - Sibelga (2,900 km) in Brussels
  - ORES (10,000km), RESA (4,000 km), REW (550 km) in Wallonia
- As low calorific gas from the Netherlands will no longer be available (NL export stop), between 2018 and 2024 1.6 million gas users will be switched to “rich” (high calorific) gas[3], an operation that was budgeted to cost €500M.

Belgian gas transmission interconnection points

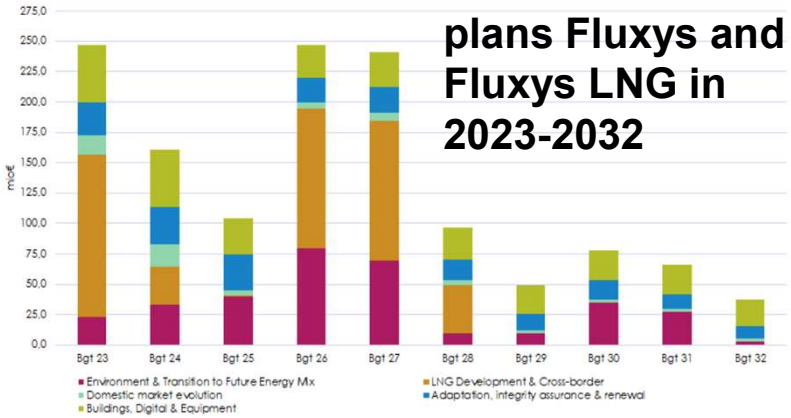


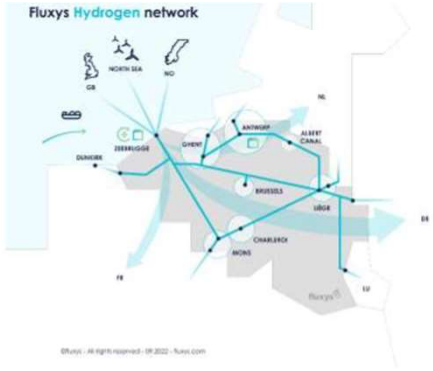
Sources: [1]Fluxys (2024); [2]Synergrid (2024); [3]Gas verandert (2017)

Gas infrastructure evolution – Transmission

- Transmission – Fluxys:[1]
  - No new natural gas transmission pipelines planned in Belgium
  - Investment plan 2023-2032 foresees €434M to increase regasification capacity in Zeebrugge, plus reinforce the grid to enable different directions (post-war)
  - Investment in H_2 and CO_2 infrastructure not included in (regulated) network plan
    - H_2 indicative budget of €676M by 2032
    - CO_2 indicative €861M by 2031

Investment plans Fluxys and Fluxys LNG in 2023-2032

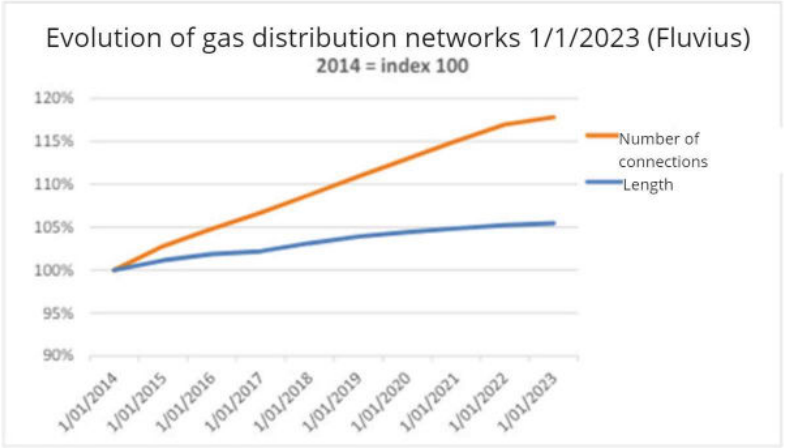




Source: [1]Fluxys (2023)

Gas infrastructure evolution – Flemish region

- Fluvius
  - Energy decree until 2017 included obligation on Fluvius to expand gas distribution across region until 95% of buildings could connect to gas if they wanted to. This obligation was dropped in 2017.
    - Status 1/1/2023: 93% connectable, 71% connected, share of connected buildings is stagnating.[1] Comparing this to Wallonia: 43% of homes are in a street with the gas grid present.[3]
  - Length of gas distribution network in Flanders is stagnating.
  - New buildings can no longer be connected to gas grid (from 2025).[2]
    - From 2021 gas connection was no longer allowed in new collective projects, except as supporting heat source or in collective cogeneration.
  - In 2023 an additional biomethane injection plant on Gaselwest's natural gas distribution network was commissioned. This brings the number of injection plants on natural gas distribution networks in Flanders to 4.

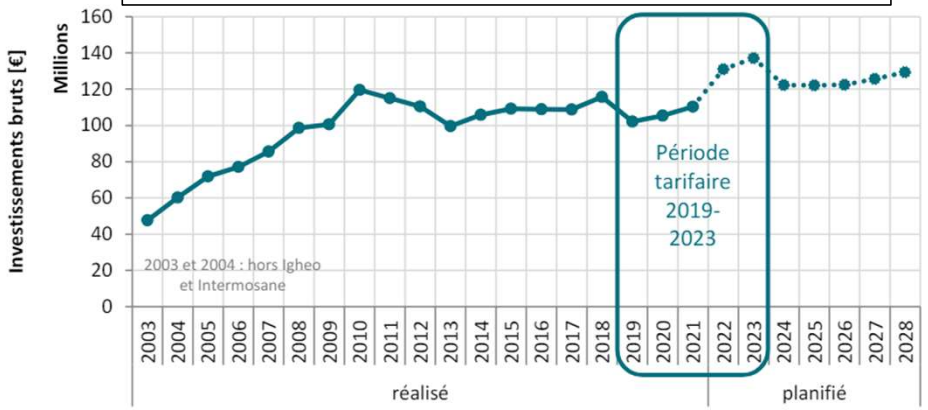


Sources: [1]VREG (2024); [2]Vlaanderen (2024); [3]Parlemant de Wallonie (2023a)

Gas infrastructure evolution – Walloon region

- Wallonia
  - Gas DSO's saw continued growth of gas clients and network until 2021. Stable in recent years (COVID, Ukraine war).[1]
    - 7-9% of investment budget of gas DSOs to be spent on promotion of gas (until 2026)
  - Biggest gas DSO ORES projects 25-33% of gas distributed could be biomethane by 2030 (=3TWh). Currently (end 2023) there's 3 injection projects, serving demand of 10k households.[2]
  - Conversion to High calorific gas ongoing, finalising in 2024.
  - Network stabilising, only 7 km of new pipeline installed in 2023, 4,500 new gas connections.

Evolution of investments in gas distribution network in Walloon region[1]

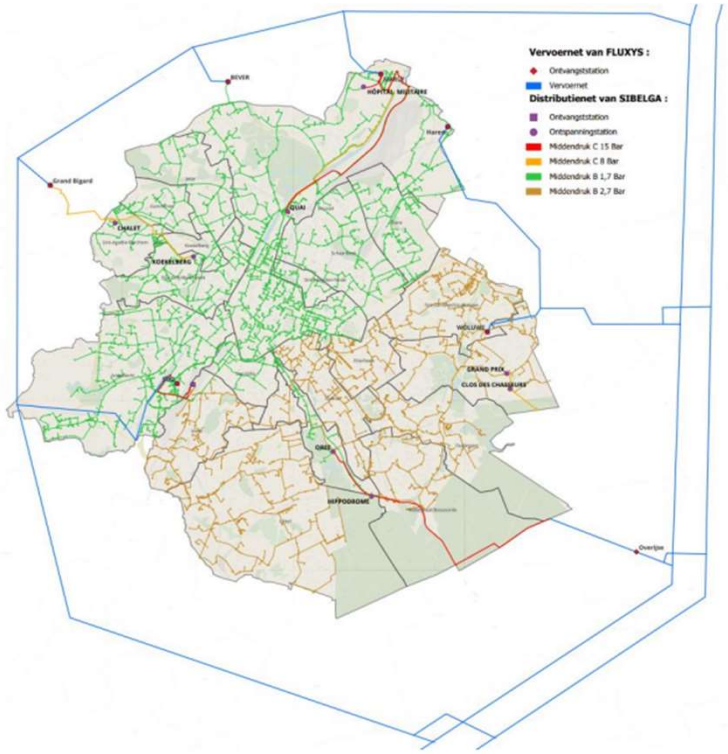


Sources: [1]CWaPE (2022); [2]ORES (2024)

Gas infrastructure evolution – Brussels capital region

- Brussels
  - Number of connections (192k) and length of pipelines (2930km) stable across 2021-2023 (Sibelga annual report 2024).[2]
  - Sibelga investment plan 2024-2028.[1]
    - Past investments in conversion to H-gas completed
    - Complete coverage in Brussels capital region
    - Now maintenance and replacement of cast iron (limited)
    - Future: important role for H_2 and biomethane

Brussels gas network[2]



Sources: [1]Sibelga (2023); [2]Sibelga (2024)

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Gas grid regulation

- Network development: Separate 10-yea network development plans exist for the transmission grid of Fluxys and for the 5 distribution system operators. Forecasts for future demand of gaseous fuels, including natural gas, hydrogen, and biomethane, are prepared for network planning. The forecasts for natural gas refer to European and Belgian climate targets, but the link is not clear. The current transmission development plan (2023-2032) assumes a natural gas demand in 2030 at about the current level.[1] The plans do not specify to which extent fossil gas demand will be replaced by biomethane or hydrogen.
- Network regulation: The gas law of 2021, regulates the transport of gas in pipelines, obligation of the TSO, tariff methodology procedures.[2] The DSO's regulatory framework is specified per region, with dedicated decrees.[3, 4, 5] Within their grid area distribution grid operators are obliged to connect customers on request. Important exceptions to this rule: Flanders restricts gas connections to new buildings since 2021, with a full ban on connections to new builds or deep energy renovations from 2025. Additionally, costs for new connections to existing buildings are no longer capped, increasing the cost to connect to the gas grid. In the Brussels Capital Region, gas connections are also banned for new buildings or deep renovations from 2025.
- Grid charges: The gas law and various regional decrees regulate the determination of grid charges using a revenue cap regime. Grid charges are regulated by CREG for the TSO and VREG in Flanders, CWaPE in Wallonia and BRUGEL in Brussels for the DSOs in the respective regions.
- Depreciation: Targeted depreciation percentages are applied for the transmission network, so that all natural gas transmission assets are phased out by 2050.[6] At the distribution level, the investments are amortised over 50 years for pipelines, 10 to 33 years for other equipment. In 2023, the residual value of the distribution grid lines in Flanders that will not be amortised in 2050 was estimated at €2,2 billion.[7]

Sources: [1]Fluxys (2023); [2]Wet 18/5/2021; [3]Decreet 8/5/2009; [4]Décret (2002); [5]Ordonnantie (2004); [6]DNV (2022); [7]Vlaams Parlement (2023)

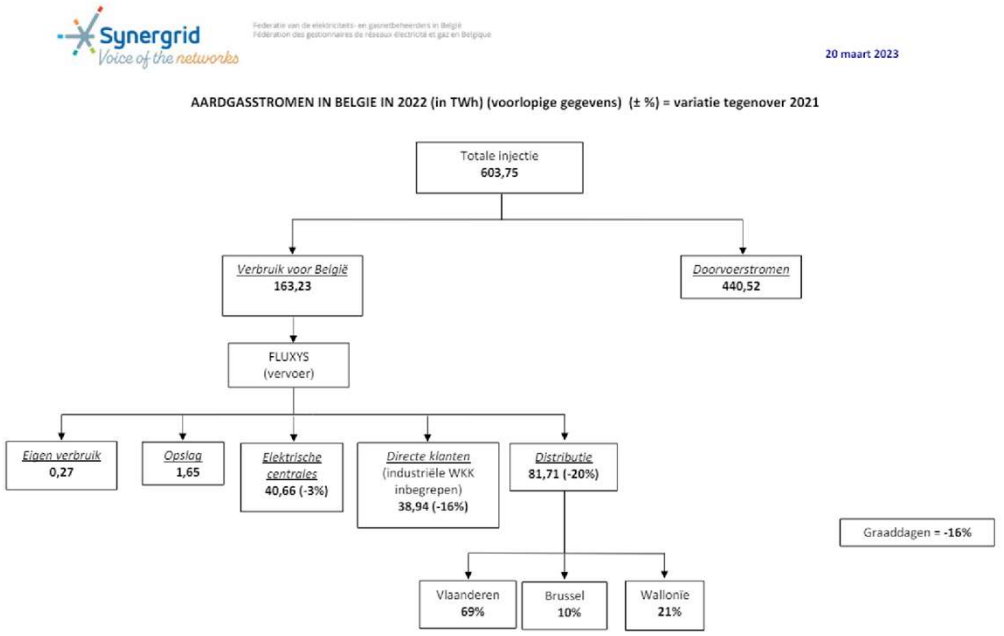
Regulation – Gas transport networks

- **TSO Fluxys – regulated by CREG**
- Revenue cap regime – regulatory period for tariff methodology is 4 years.[1]
- A sharing mechanism of 50% is applied on controllable OPEX (in the words of the NRA: “An incentive mechanism is installed to reduce controllable OPEX whereby any year-on-year reduction is shared 50/50 among the future tariffs and the TSO”).
- Cost base calculation = Belgium uses the building block approach used by the vast majority of the NRAs (23 out of 27), that is, they separately assess all cost components including operating expenditure and capital expenditure
- CREG defines 12 performance projects for 2024-2027 for Fluxys for financial bonus, incl. CH4/CO2 reduction, and energy efficiency and renewable energy for own consumption.[2]
- Methods and approaches to assessing and setting allowances: Business case analysis: the NRA performs a cost-benefit analysis for any investment above €10m. However, investments are typically allowed if tariffs do not need to be raised to accommodate them. Specialised consultants hired to estimate the reasonable costs for investments with many technical requirements.
- **Targeted depreciation percentages** are applied, so that all natural gas transmission assets are **phased out by 2050** (effectively end 2049, per the tariff methodology in effect since 1/1/2020) iand the residual asset value will be zero in 2050. Natural gas pipelines which may be repurposed are not subject to this accelerated depreciation scheme. Within this framework the natural gas TSO should manage the risk of stranded assets, considering that the risk premium in the cost of equity calculation already considers the unforeseeable risk of asset stranding. If stranded costs arise in this framework, they should not be borne by the natural gas network users.[3]

Sources: [1]ECA (2018); [2]CREG (2022); [3]DNV (2022); [4]Fluxys (2023a)

Belgium as gas transit hub

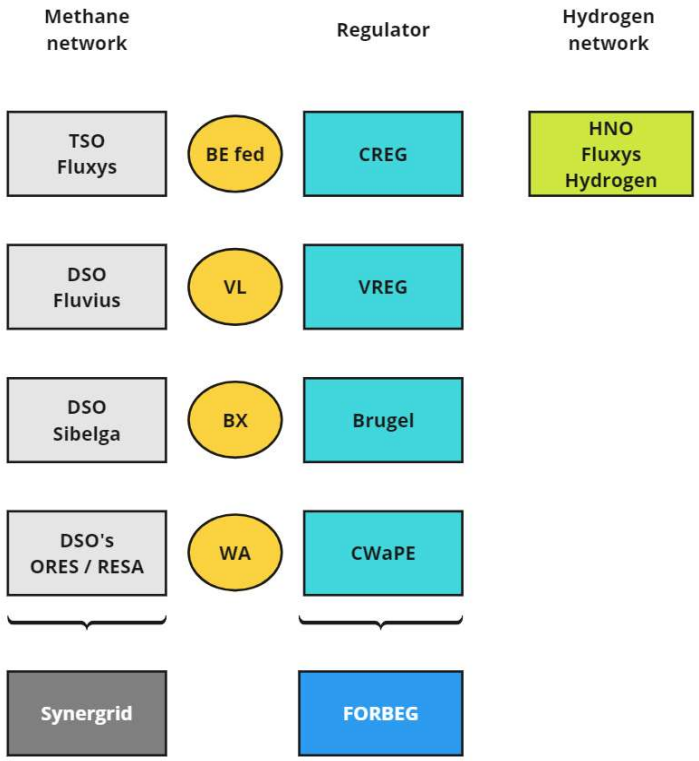
- The Belgian gas transmission infrastructure, with the LNG terminal in Zeebrugge and pipeline interconnections to neighboring countries and Norway, makes Belgium an important gas transit hub.[1]
  - Gas transit and associated congestion income is a major source of revenue for Fluxys.
  - In gas crisis year 2022 Belgium exported 2.7 times more gas than it used in Belgium. Export was mainly to Germany.[2]
- Fluxys and Russian LNG transshipment
  - The LNG terminal in Zeebrugge acts as one of the main European transshipment terminals for Russian LNG (Yamal LNG). The Belgian federal government long resisted calls to force Fluxys to break its long-term contract with Yamal LNG, for fear of having to pay contract breach fines.
  - Collective European action was finally achieved in the 14th package of restrictive measures against Russia (June 2024), which includes a ban on Russian LNG transshipment.[3]



Sources: [1]Fluxys (2024); [2]Synergrid (2024); [3]European Commission (2024)

Gas network operators and regulators

- The gas transmission network is regulated at the federal state level.
- The gas distribution networks are regulated at the regional level, each region having its own energy regulator.
  - CREG acts as National Regulatory Authority in European fora, but has no hierarchy over the regional regulators
- The gas (and electricity) system operators are grouped in Synergrid.
- The energy regulators have an informal collaboration platform called FORBEG.

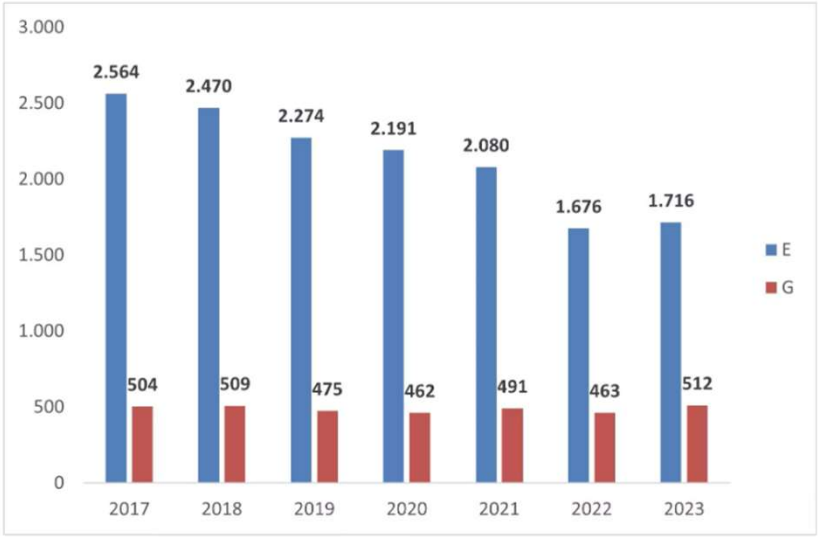


Source: [1]RAP

Regulation – Gas distribution networks

- DSO Fluvius in Flanders – regulated by VREG[1]
- Revenue cap regime, in which VREG sets a maximum allowed income. In 2023 for the first time in 5 years the allowed income increased, mostly due to inflation.
- Investment plan 2023-2033 foresees no expansion. Budget halves to €88M/y for secure operation and pilots for green gas (biomethane, green H_2).
- Financial incentives for innovation for energy transition.
- Fluvius approach to gas distribution grid: “keep it running”. Economics of biomethane “very uncertain”. Most of the gas distribution network is “H_2 ready”.
- Analogous approach for
  - Brussels region DSO Sibelga – regulated by BRUGEL
  - Walloon region DSO's ORES, RESA – regulated by CWAPE

Max. allowed income for Fluvius for electricity (E) and gas (G) (M€)[1]



Source: [1]VREG (2024a)

Fossil heating phase-down per region

	Flanders[1]	Brussels[2]	Wallonia[3]
2021	Ban on **gas** connections for large building projects		
2022	Ban on **oil** heating for new buildings, retrofits, replacement in existing buildings with gas availability. Cost for new **gas** connection in new buildings no longer capped (increase from €250 to €1200).		
2023	Increased min. share of RES in EPB, plus obligation to install low-temperature heating. No **gas** connection allowed anymore in new buildings or small developments.	End of fossil subsidies	
2025	No **gas** connections in any newbuild. All new connections cost no longer capped.	No more new heating **oil** systems. No **gas** or heating **oil** in new build or deep renovations.	No more **oil/coal** heating in new buildings
2026			No replacement of heating system with **oil/coal** in existing buildings
2030		No more fossil heating in renovated buildings, no more heating **oil** in public buildings	
2040		No more heating **oil** in any building	
2050			No more fossil **gas** heating

Sources: [1]Vlaanderen (2024); [2]Maron Trachte (2024); [3]Gouvernement Wallon (2023)

Deep dive into energy price ratios for heat pumps

- Federal regulator CREG analysed in a detailed May 2024 report the return on investment for heat pumps in Belgium, as a factor of the electricity to fossil energy cost ratio. CREG takes into account real energy prices, existing subsidies, different building types, and distinguish between protected (vulnerable) households and non-protected households. CREG also made this analysis for wood pellet heating.[1]
- The results show clearly that the price ratio is far too high to make heat pumps profitable investments.
- Protected customers can apply for the regulated social tariff for gas and electricity. Heat pumps are for them still unprofitable compared to fossil gas, but in most cases profitable for renters compared to heating oil (which doesn't have a social tariff).
- The profitability of heat pumps differs greatly between the 3 regions, due to differences in investment subsidies, grid costs, fiscal treatment and commercial actions of gas/electricity suppliers. The monthly offtake capacity peak tariff in Flanders has a positive impact on the profitability of heat pumps. In Wallonia the price ratio is the worst of the 3 regions for heat pumps and the best for wood pellet heating.

Heat pump	Needed max. price ratio	Average observed price ratio
Electricity/gas	1,7-2,1	4,1-6
Electricity/heating oil	2,4-2,6	3,6-4,7
Electricity/propane	1,7-2,1	4,5-6,3

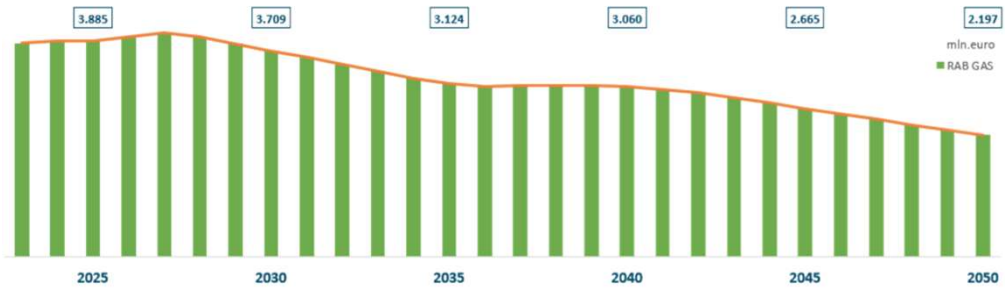
- In June 2024 CREG followed up with a series of recommendations to improve the profitability of sustainable heating technologies.[2]
  - Priority for building insulation
  - Continue lower VAT of 6% for heat pumps
  - Time of Use distribution network tariffs
  - Shift excise duties from electricity to fossil fuels
  - Focus heat pump subsidies on well-insulated buildings

Sources: [1]Commissie voor de Regulering van Elektriciteit en Gas (CREG) (2024a); [2]CREG (2024b)

Flemish gas distribution investment depreciation

- Fluvius is owned by the Flemish cities and towns. Currently they have €3.8 billion in gas grid investments still on the books. Fluvius is planning only investments to “keep it running”. Operational safety, no new lines.[2] Pipelines are amortised over 50 years.
- If investments in the gas grid are not amortised at an accelerated rate, €2.2 billion worth of unusable gas grids will still have to be written off in the event of a gas exit in 2050. (Flemish Energy minister Demir, in response to question of Flemish Parliamentarian Staf Aerts, Green party, Nov 2023)[1]
- Fluvius and the energy administration VEKA are analysing the options for a planned phase out and associated accelerated depreciation. Options may include:
  - Amortise earlier on existing gas consumers
  - Cover cost from government budget
  - Introduce levy on electricity consumers (!)
- Regulator VREG plans a public consultation on the issue.
- As far as we could find, the debate on the phase out and associated depreciation has not started yet in the Brussels and Walloon regions

Evolution of the book value of the Fluvius gas distribution network (M€)[1]

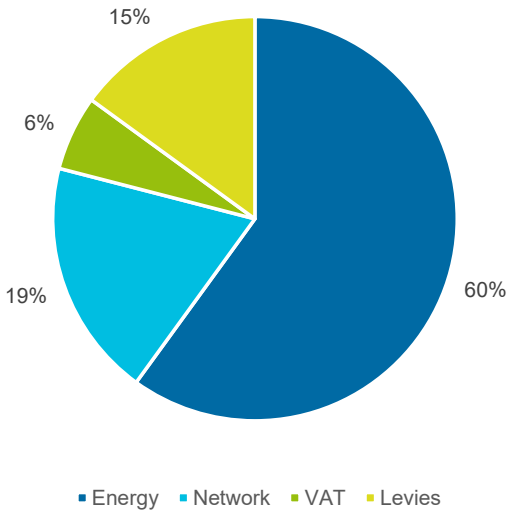


Sources: [1]Vlaams Parlement (2023); [2]De Tijd (2023)

Gas grid charges – retail customers

- In 2024 network charges account for 19% of the total gas price for retail customers.[1]
- Belgian households and professional consumers have the lowest gas bills of the neigboring countries. The share of levies and network costs in the consumer bill are lower than in most other neighboring countries. (CREG Boordtabel)[1]
- Due to decreasing demand and decreasing customers, including potential gas grid decommissioning, future grid charges may increase substantially. A decision is needed on who will pay for these costs, and when.

Belgian average natural gas price components, residential market, June 2024[1]



Source: [1]CREG (2024c)

Regulation – Heat planning

- In Belgium, heat planning is a competence of the regional governments. The approach is different in the 3 regions.
- Flemish region: The 2025 Heat Plan contains 26 measures to move towards sustainable heating and greening of energy carriers. The Heat Plan focuses on actions relating to financial support and the optimisation of the effectiveness of the support, various actions to encourage sustainable heating, the minimum share of renewable energy, heating networks, local heat plans, research actions, communication and subsequent monitoring of the plan.[1, 2]
  - Main source of renewable heat for households is biomass. This is expected to reduce by half by 2030, but will remain the biggest
  - Heat pumps are expected to triple between 2020 – 2030
- Walloon region:
  - No dedicated heat plan. Specific plan for district heating. Renewable heating part of Walloon region climate and energy plan.
  - Focus on biomass (pellets) and biomethane, as well as coal-bed methane. Significant growth (500%) projected for heat pumps, but they remain 3rd ranking renewable energy heating technology
- Brussels region[4]:
  - No dedicated heat plan. Extensive set of measures to tackle greenhouse gas emissions and energy use by buildings as part of the Brussels Air Climate and Energy Plan for 2030.
  - Focus on energy renovation, increasing energy performance of buildings. Planned phase-out of oil heating and gas in new buildings. Heat pumps and the use of biogas for heating are expected to double between 2020 and 2030. Solid renewable fuels (wood) is to be reduced.
  - Link with spatial planning is being investigated, to establish zonal plans for district heating using renewable sources.

Sources: [1]Vlaamse Regering (2021); [2]Concilliation Committee (2023): [3]Gouvernement Wallon (2023) ; [4]Leefmilieu Brussel (2023)

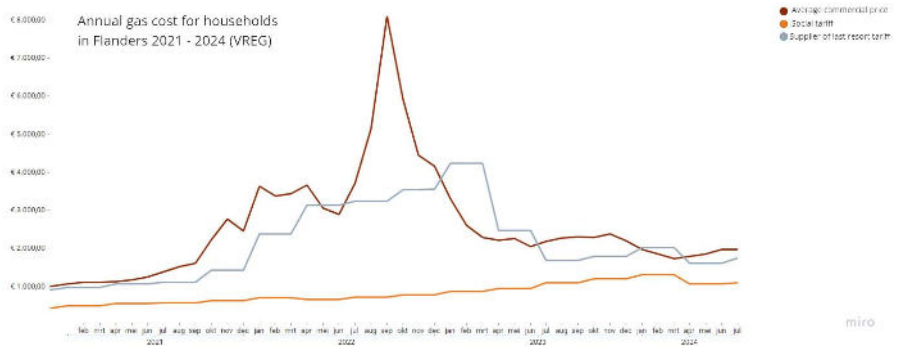
Disconnection from the gas network

- For customers wishing to disconnect from the gas grid, a customer[1]
  - Should end their gas supply contract with their energy supplier
  - Request the gas DSO to de-activate the gas supply to the house and seal the meter (cost €100 incl VAT in Flanders, free in Brussels)
  - Physically removing the gas meter is optional (cost €800 in Flanders)
- Having a digital gas meter installed is free.

Source: [1]Fluvius (2024)

Financial support for vulnerable gas consumers

- Regulated social tariff for gas (and electricity, and heat from district heating) for eligible vulnerable households (expanded during energy crisis)
  - CREG calculates the social tariff every quarter, taking the lowest commercial rate and network tariff of the previous month, and applying a cap on the possible increase.[1]
  - The social tariff was significantly lower than commercial rates during the energy crisis.[2]
  - The cost of the social tariff is socialised across all consumers.
- Gas and Electricity Fund: support of people in energy poverty, through local social services (OCMW)
- Downpayment plans
- General energy poverty strategies differ between regions. No quantified energy poverty reduction targets. Common elements include.[3]
- Advancing energy performance of public social housing
- Higher financial support for protected consumers for energy efficiency investments
- Specific advisory services to support and guide people in energy poverty towards energy savings

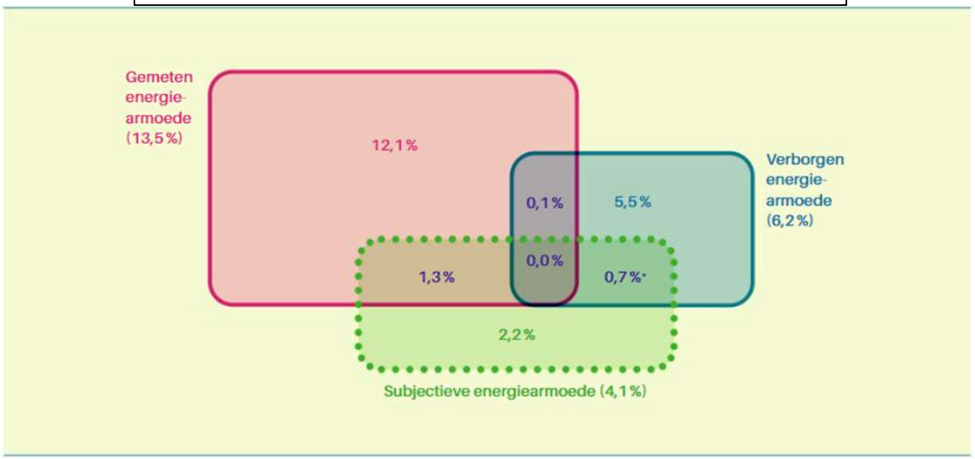


Sources: [1]CREG (2018); [2]VREG (2024b); [3]VEKA (2024b)

Addressing vulnerable energy consumers and broader social justice concerns

- The Koning Boudewijn Stichting publishes an annual energy poverty barometer for Belgium.[1] They measure 3 types of energy poverty, that partially overlap.
  - Measured energy poverty: households spend too much of their disposable income on energy bills after deducting housing costs.
  - Hidden energy poverty: this is characterised by an abnormally low energy bill, which betrays a possible situation of deprivation.
  - Perceived energy poverty: this is the subjective assessment of households who say they cannot afford to heat their homes properly.
- Taken together, in (crisis year) 2022 a total 22% of households in Belgium experienced energy poverty.

Overlap between types of energy poverty[1]

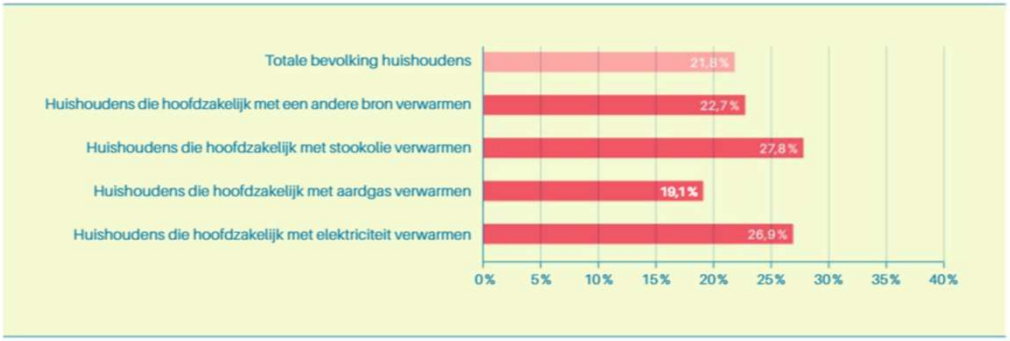


Source: [1]KBS (2024)

Addressing vulnerable energy consumers and broader social justice concerns

- Support measures during the energy crisis of 2022 were crucial to protect vulnerable families against the financial impact of the crisis. Underlying are big differences depending on profile of families.
  - Specific support during crisis: Heating premium, Basic energy package, Lower VAT, Additional energy voucher for social tariff customers, freeze of rental price indexation for worst energy performing dwellings.
  - These measures were often untargeted, leading to inefficiencies.
- Energy poverty is much higher in Brussels and Walloon regions than in Flemish region.
- Energy poverty is lowest in households heating with gas, compared to electricity, heating oil.
  - Electricity is relatively more expensive than gas, due to taxation.
  - Furthermore, a social tariff is established for electricity and gas (and district heating), not for heating oil. Households on heating oil (or coal, or wood) are less protected against price shocks.

Energy poverty and sources of heating[1]



Source: [1]KBS (2024)

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Belgian hydrogen strategy

- On 29 October 2021, the Federal Government approved its first hydrogen strategy, updated on 12 October 2022. The Federal Hydrogen Strategy aims to use hydrogen and renewable molecules to make certain applications climate-neutral **when electrification is not economically viable or technically realistic**. This concerns mainly **industry and freight transport, aviation and maritime transport**.
- The strategy consists of four pillars:
  - Position Belgium as a hub for the import and transit of renewable molecules in Europe.
  - Strengthen Belgian leadership in hydrogen technologies.
  - Creating a strong hydrogen market.
  - Invest in cooperation for successful implementation.
- The Belgian hydrogen strategy is to eventually only use **"green"** renewable energy-based hydrogen. In a transition period "blue" fossil with carbon capture hydrogen can be used, depending on cost developments. By 2050 at the latest all hydrogen should be green.
- Views of the federal government on the role of H_2 and who should regulate it, are not necessarily aligned with those of the regional governments. This is an ongoing dispute.

Source: [1]FOD Econ (2022)

Belgian hydrogen law

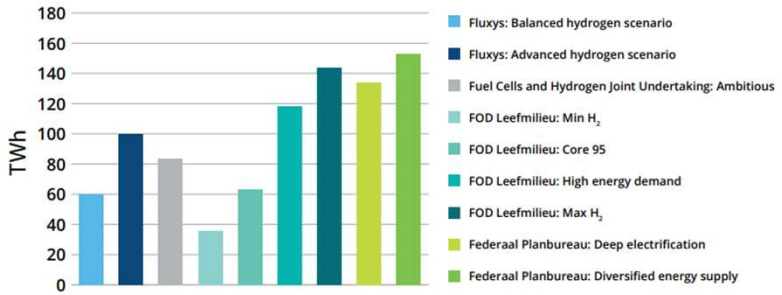
- The law of 11 July 2023 on the transport of hydrogen by pipeline was published in the Belgian Official Gazette on 25 July 2023. This "hydrogen law" organises the designation of the hydrogen transport network operator who becomes responsible for planning, developing and managing the hydrogen transport network in Belgium. It was at the time a first-of-its-kind legislation in Europe.
- The hydrogen law
  - guarantees non-discriminatory access to the hydrogen transport network for all interested parties;
  - defines, among other things, the rules and procedures for preparing the network development plan and for setting regulated network tariffs;
  - designates electricity and fossil gas regulator CREG as the hydrogen transport regulator.
- The strategy nor the law define quantified targets for H_2 or derivatives in Belgium
  - By 2026 a capacity of 150 MW of **electrolysers** should be installed in Belgium (included in the Belgian Restauration and Recovery plan)
  - By 2026 the Belgian government aims for 100 to 160 km of **hydrogen pipelines**, and by 2028 a connection with the German hydrogen network.
  - The plan mentions very significant volumes of **hydrogen import**: 20 TWh in 2030 and 200 to 350 TWh in 2050, in large part for transit to other countries.

Source: [1]FOD Econ (2023a)

Belgian hydrogen

- An extensive stakeholder process preceded the law, among others informed by a report commissioned from Deloitte on the role of clean gas in a climate-neutral Belgium.[1]
  - End use for H_2 predominantly in industry, road transport, aviation, shipping, power generation. Use for heating called “uncertain”.
  - Electrolysis for green H_2 and production of blue H_2 in Belgium depend on cost evolution of electrolysers and electricity grid, and cost of CCS and fossil gas respectively.
  - Major role for import of H_2
- Memoranda of Understanding for hydrogen import signed by BE government or other institutions to date:
  - Chile[4]
  - Namibia[3]
  - Oman[2]
  - United Kingdom[5]
  - Tasmania[6]

Projections for H_2 demand in Belgium in 2050 from a range of studies



Sources: [1]Deloitte (2021); [2]IEA (2022a); [3]IEA (2022b); [4]Port of Antwerp Bruges (2021); [5]Hydrogen Central (2022); [6]Tasmanian Government (2022)

Hydrogen backbone

Air Liquide network (red is hydrogen)

- Belgium has one of the most extensive and well-connected private (grey) hydrogen networks in the world, owned and operated by Air Liquide.
- In Belgium, this network consists of more than 600 km of underground pipelines, mainly concentrated around the industrial clusters in the ports.

Source: [1]Deloitte (2021)

Hydrogen Network Operator

- Fluxys Hydrogen – a spinoff of fossil gas TSO Fluxys Belgium – was designated by the Belgian federal government on 26 april 2024 to be the Belgian Hydrogen Network Operator.[2]
  - In order to meet conditions to be designated HNO, Fluxys had to end participations in H_2 projects (Hyoffwind, Power to Methanol Antwerp)[1]
  - Legally separate entitity from mother holding Fluxys Belgium NV

Sources: [1]Fluxys Hydrogen (2023); [2]FOD Kanselarij (2024)

Hydrogen for heating

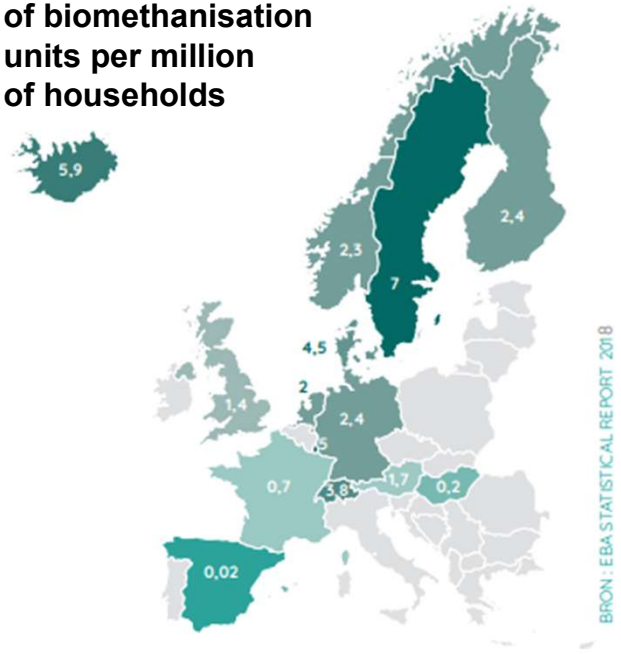
- Flanders:
  - DSO Fluvius recognises no future for hydrogen heating, wants to focus on industry connected to the distribution grid. Until recently Fluvius was still advocating for a „keep all options open“ approach.
- Brussels: commitment to phase out fossil fuels[1]
  - Phase out of heating oil in climate and energy plan
    - 2025 no new buildings heating with fossil fuels, and no new oil heating
    - 2030 no fossil heating in deep energy renovated buildings
    - 2035 no oil heating older than 15y
    - 2040 ban on oil heating
  - Gas DSO Sibelga notes gas network needs to be greened with biomethane, syngas and H_2
    - invests in research in „living lab“ to investigate role of alternative gasses in buildings: MØDÜLL[2]
- Wallonia
  - DSO ORES sees an important role for hydrogen in the energy transition. But thinks its application will be more straightforward in industrial applications than in residences. Note that the gas distribution network in Wallonia is less expansive than Flanders. That contributes to the focus on wood pellets and district heating, rather than hydrogen.

Sources: [1]Leefmilieu Brussel (2023); [2]Sibelga (2023)

Biogas in the gas network - development

- **Biogas** contributed about 0.1 Mtoe (1.2 TWh) to a final energy consumption of 33 Mtoe in 2022 in Belgium (= 0,3%). This has been stable since 2013, after a period of rapid growth starting in 2005.[1] Biogas is mostly used in cogeneration units.
  - Biogas production in Belgium is predominantly a case of small-scale digesters at farms or wastewater treatment facilities, where the biogas is used locally to generate heat and/or power.
- Fluvius has a goal of achieving a 10% share of **biomethane** in the gas distribution network. Biomethane could also be used in the transport sector as bio-CNG or –LNG, or as feedstock for the chemical industry.
  - The gas sector itself estimates the potential for biomethane to be 15 TWh/y (=9% of total gas consumption, or 18% of gas at distribution level).[2]
  - In contrast: today biomethane production in Belgium is very small compared to other EU countries. Currently 3 biomethane injection projects are active in Flanders with Fluvius. They represent about 0,014 TWh/y. There's no immediate reason (such as dedicated large scale support programs) to expect a significant and sudden increase.
- The Flemish Socio-economic Council sees the expected continued decrease of fossil gas use and the limited potential to use the gas grid for alternative gasses, as a sign the Flemish government should create clarity around the future (phase-down) of the gas grid.[3]

Number of biomethanisation units per million of households



Sources: [1]Eurostat (2024); [2]Gas.be (2019); [3]SERV (2023)

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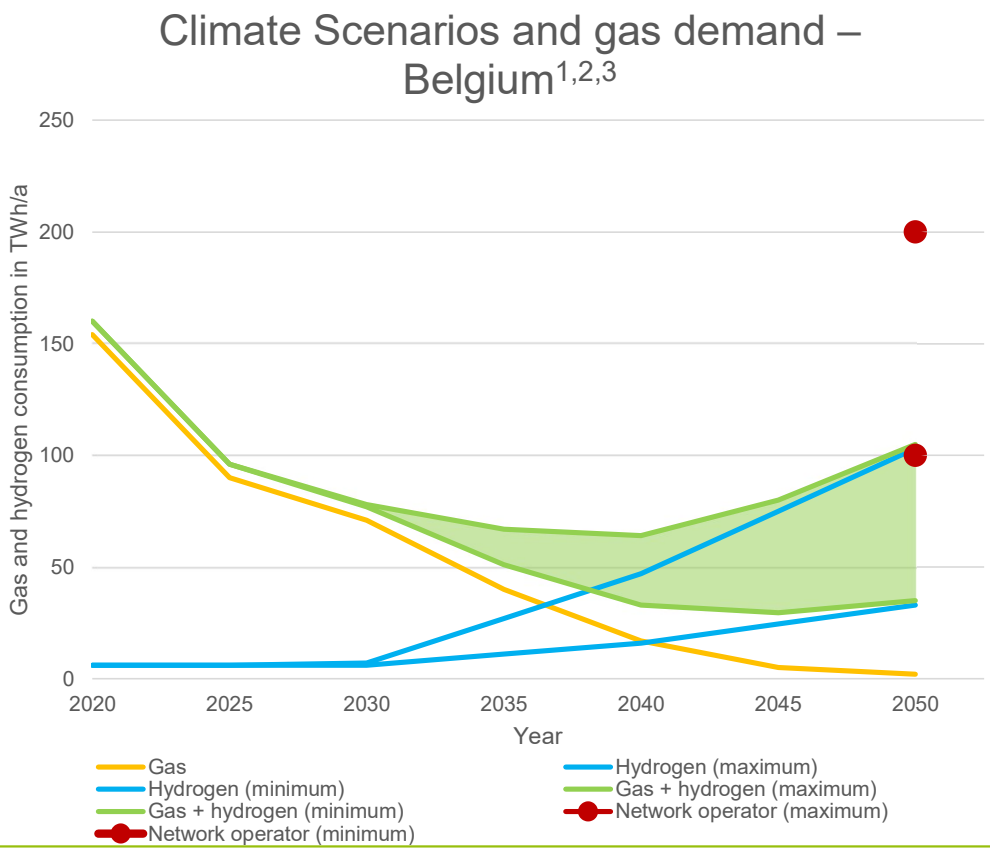
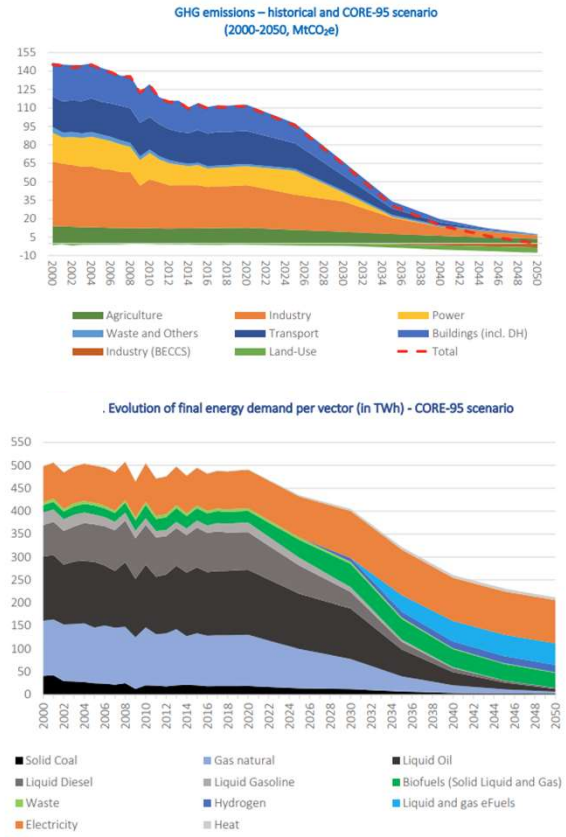
Climate scenario's versus gas demand for Belgium

- In Belgium fossil gas demand goes down to close to zero in the Belgian climate scenario developed by the federal Environment directorate-general.[1]
- The demand for hydrogen is projected by Energyville (energy research center) to stay at the current level until 2030, to then grow rapidly, with significant variation in the climate scenarios.[2]
  - Demand for H_2 in 2050 reaches between 33 and 103 TWh in 2050.
  - Demand for hydrogen in 2050 at the higher bound is only about 20% lower than fossil gas demand in 2020.
- Projected demand for molecules by the gas TSO Fluxys starts at the higher bound of the Energyville range, with their higher bound at 200 TWh (this includes other molecules beside H_2).[3]
  - Note that the Belgian hydrogen strategy mentions imports of 350 TWh H_2 of which about half would be for domestic use, aligning the strategy closer with the Fluxys projections than the Energyville scenarios.



Sources: [1]DG Leefmilieu (2021); [2]Energyville (2023); [3]Fluxys (2023)

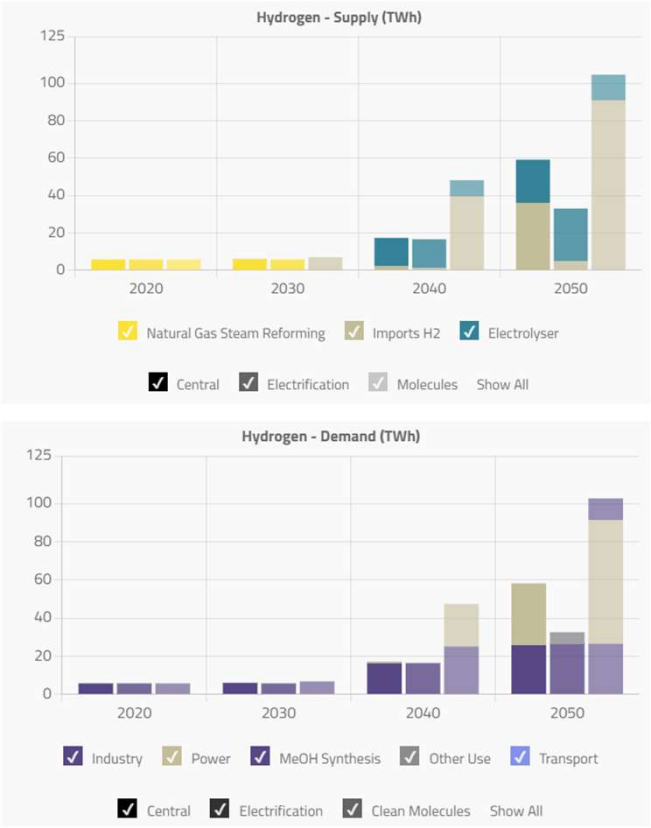
Climate neutral Belgium – Federal Climate Service scenario's



- Scenario study by the Federal Climate Service (2021) for a climate-neutral Belgium by 2050
  - In 2050, fossil fuels are almost completely phased-out. Remaining fossil fuels in 2050 (around 7% of total final energy demand) are used in industrial processes and as feedstocks, and are combined with Carbon Capture and Utilisation or Storage (CCUS)
  - In all scenarios, energy demand decreases significantly and fossil fuels are gradually phased out through electrification and the use of carbon neutral fuels. The decrease in final energy demand amounts to as much as 57% in 2050 w.r.t. the reference scenario.
  - Electrification of the demand sectors, combined with a power production system based entirely or almost entirely on renewable energy sources, is the main avenue to gradually phase out the use of fossil fuels.
  - Since electrification is not possible for all energy end-uses, it needs to be complemented with the deployment of climate-neutral fuels.
    - Biomass will be used to some extent but its potential, although significant, remains limited and is strongly linked to land use choices.
    - Hydrogen and e-fuels will be required to close the gap, especially for use as industrial feedstocks.
  - Fossil fuels are completely phased out in the buildings sector and electricity becomes the most important energy vector, representing more than 80% of the final energy demand. Biomass and H_2/e-fuels complement the energy mix, mainly where electrification is too difficult or costly to implement

Source: [1]DG Leefmilieu (2021)

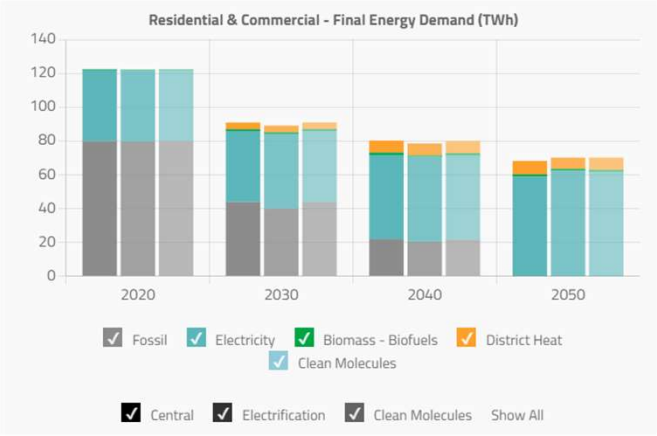
Climate neutral Belgium – Energyville on hydrogen



- Scenario study by Energyville for a climate-neutral Belgium by 2050 (2023).
  - Until 2030 hydrogen production in Belgium is dedicated for ammonia production through an existing Steam Methane Reforming process, from 2030 with Carbon Capture and Storage, so called blue hydrogen.
  - Production of green hydrogen in Belgium starts growing after 2035 in the 3 scenarios. Electrolyzer capacity provides flexibility during periods of high renewable electricity production and lower electricity prices.
  - In a scenario prioritising electrification, no investments in hydrogen peak turbines take place. In a scenario with a higher emphasis on clean molecules, hydrogen use in power increases drastically towards 2050 to power hydrogen peaking turbines.
  - Hydrogen use in the industry takes place in all scenarios. Clean molecules are used for high-temperature processes in the chemical industry, glass and bricks, steel finishing and smaller amounts in the lime and cement sector. In focused Clean Molecules scenario, on top of these uses, hydrogen is also used for methanol synthesis as feedstock for a methanol to aromatics/olefins process.

Source: [1]Energyville (2023)

Climate neutral Belgium – Energyville on residential/commercial sector

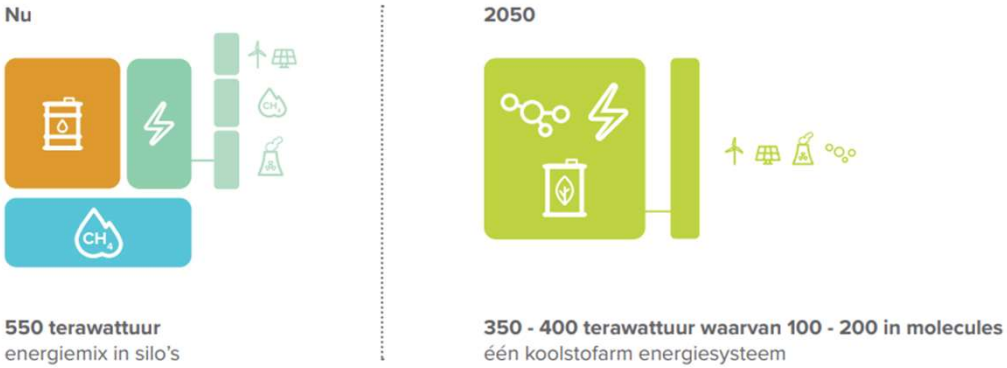


- Scenario study by Energyville for a climate-neutral Belgium by 2050 (2023).
- The impact of the different scenarios on the decarbonisation choices made is negligible in the residential and commercial sector.
- Energy efficiency measures and a fast electrification of the final energy use lead to fast CO2 emissions reductions and a fully decarbonised sector by 2050.
- In all scenarios, the key to decarbonise these sectors is renovation, increased insulation and heat pumps, with a special role reserved for district heating fed by waste heat, deep geothermal energy or centralized heat pumps in suitable regions/districts with a dense buildings patrimony and high heat demand. Although the use of clean molecules was modelled too, this was not selected as a cost effective solution by the model.
  - A cost-effective trajectory towards a net-zero 2050, shows rapid investments in building insulation and a complete phaseout of fuel oil by 2030. Electric heat pumps and - to a smaller extent - district heating and biomass replaces the fuel oil boilers. Natural gas use decreases with more than 20% by 2030.
  - By 2050 there is a complete shift from natural gas to electric heat pumps and a limited amount of district heating.
  - Final energy demand in these sectors decreases from 122 TWh today to 70 TWh by 2050, which is a 43% efficiency improvement.

Source: [1]Energyville (2023)

Gas scenarios from system operators

- Fluxys projects 100-200 TWh of demand for molecules in 2050, in all sectors, including transport and buildings.[1]
  - The lower margin is in line with Energyville H_2 projected use
  - Federal climate service as well as Energyville see no significant role for H_2 in buildings or transport.
- Fluvius intends to repurpose part of its gas distribution network for H_2 supply to industry, as part of its vision for a DSO for 2050. Recognises difficulty of H_2 for residential.[2]
  - The focus on industry is in line with the scenario results of Energyville and Federal climate service.
  - Question is how many industrial plants connected to the gas distribution network would not be able to electrify (Energyville quotes these clean molecules users: “chemical industry, glass and bricks, steel finishing, lime and cement sector, methanol synthesis”)



Sources: [1]Fluxys (2024a); [2]Fluvius (2020)

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Public information and transparency

- The federal Directorate-General for Energy prepares a "**prospective study of natural gas**" (PSG) as regulated by the Law of 12 April 1965 on the transportation of gaseous products by pipelines (art. 15/13) (Gas Law)[1]
  - The PSG analyses supply of and demand for natural gas in the long and medium term. It informs the indicative investment plans of the TSO Fluxys.
  - The PSG is prepared in cooperation with the Federal Planning Bureau. The regulator CREG is consulted. The Central Business Council (socio-economic stakeholders) can advise.
  - The PSG extends over at least 10 years. It is updated every 4 years. The current version is looking out to 2030-2035, and was finalised in 2020. The PSGs are available on the website of DG Energy. A new version should be presented in 2024.
- Integrated cross-sectoral strategy and planning is lacking in Belgium.
- The gas TSO and DSOs annually present rolling 10-year investment plans. They consult the public via their website, and summarize the (non-confidential) input in a consultation report. The respective regulator approves the plan.
  - An example is the latest consultation by Flemish DSO Fluvius for their investment plan 2024-2033.
- The regulators consult on and establish the tariff methodologies for the recovery of network related costs:
  - Transmission network tariff: CREG for the TSO Fluxys,
  - Distribution network tariff: VREG for DSO Fluvius, Brugel for DSO Sibelga, and CWaPE for DSO's ORES, RESA.

Source: [1]FOD Economie (2021)

Opportunities for stakeholder involvement

- Since the PSG is considered a plan or program with significant impact on the environment, a proper Environmental Impact Assessment is required, including a public consultation.
  - Such an assessment and consultation was skipped for the 2 last PSG's, since the PSG was deemed merely descriptive.
  - It is not clear if the DG Energy is planning a public consultation for an environmental impact assessment of the forthcoming PSG in 2024. Otherwise opportunities for stakeholder involvement will be limited to the representatives of trade unions and employers in the CRB.
- Tariff methodologies: the first upcoming opportunity for stakeholder involvement is with CWaPE for the gas distribution tariff methodology in the Walloon region. CWaPE is preparing a consultation for the tariff methodology 2025-2029. CREG just consulted on and approved the tariff methodology for 2024-2027, Brugel has just consulted on the tariff methodology 2025-2029, VREG has just consulted on the tariff methodology 2025-2028.[1]
- Input for stakeholder involvement:
  - Shorten depreciation periods for past and future infrastructure investments to avoid stranded assets and spread decommissioning costs evenly over a shorter period, ensuring full payback by the time the network is decommissioned. This can be inspired by the targeted depreciation rates writing off the transmission grid by 2050.
  - Adjust electricity to gas price ratio by rebalancing taxes and levies, to create a level playing field for alternatives to gas heating. Such a shift needs to incorporate a strategy and measures to enable vulnerable households to join in the transition.
  - Specifically, in the Walloon region, develop clarity on the phase out of new gas connections in new buildings in the near to mid-term. This clarity was already achieved in the other regions (no more gas connections from 2025).

Source: [1]VREG (2024a)

List of sources

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Contacts

Sibylle Braungardt, Marc Stobbe

Öko-Institut e.V. – Institute for Applied Ecology
Postfach 17 71
D-79017 Freiburg
Germany

Mails:
s.braungardt@oeko.de
m.stobbe@oeko.de

Jan Rosenow

Regulatory Assistance Project (RAP)
Anna-Louisa-Karsch-Straße 2
D – 10178 Berlin
Germany

Mail:
jrosenow@raponline.org