Energy Policy Review

Luxembourg 2026

INTERNATIONAL ENERGY AGENCY

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Executive summary

Luxembourg has established ambitious climate and energy objectives, but more targeted policy measures are needed to meet them. Luxembourg's climate and energy goals are aligned with the European Union (EU) targets for a 55% reduction in greenhouse gas (GHG) emissions by 2030 and a 90% reduction by 2040, and it has legally enshrined net zero emissions by 2050. Despite rapid population and economic growth, energy-related emissions have already fallen by 40% since 2005, reflecting the success of early measures. Public support for climate action is also robust, providing a strong foundation for the next phase of the transition. To meet its targets, however, Luxembourg will need to implement more ambitious decarbonisation policies while carefully managing energy security and affordability considerations.

Luxembourg faces unique challenges in its energy transition due to its small surface area and import-dependent economy. Moreover, the combination of its central location in Europe and historically low fuel taxes mean there are sizeable fuel sales to customers from abroad, resulting in high transport-related emissions. Heavy reliance on energy imports – covering all fossil fuels and nearly 80% of electricity demand – increases the vulnerability of the energy system. Addressing these challenges will require long-term, system-wide planning to guide investment across electricity, heating, hydrogen and digitalisation, alongside stronger communication and public engagement to boost uptake in clean energy choices. At the same time, Luxembourg's small size and close integration with (neighbouring) European markets offer significant opportunities for regional co-operation on cross-border electricity and hydrogen infrastructure.

Luxembourg's buildings sector trails other sectors in emissions reductions and would benefit from more targeted regulatory and financial levers to support the low-carbon transition. Despite strong energy performance standards for new construction, nearly 90% of existing homes rely on fossil fuels for heating and renovation rates remain low. The buildings sector accounted for over 20% of national energy-related GHG emissions, while space heating in the residential sector alone accounted for 13% of emissions in 2024. Heat pump deployment is growing but from a small base, supported by subsidies, tax incentives and advisory services. To complement these financial incentives, Luxembourg would benefit from a more strategic approach to space heating, using municipal heat mapping and heat planning to identify where district heating is viable and where electrification through heat pumps is the most cost-effective.

As the largest contributor to both energy demand and emissions, the transport sector must ramp up efforts to lower oil consumption. While Luxembourg was the first country in the world to introduce free public transport and put in place a well-considered plan to promote public transport and active mobility, fuel sales to foreigners and high car ownership levels continue to result in high fuel consumption. Electrification of the vehicle fleet is progressing toward a targeted share of 49% by 2030. In 2025, 12% of registered passenger cars were electrified (8.5% battery electric) and battery electric vehicles (BEVs) accounted for an average of 23% of monthly vehicle registrations. Alongside other existing measures to promote the uptake of alternative fuels and modes of transport, it will be crucial to implement a long-term fiscal strategy to align Luxembourg's fuel prices with its neighbouring countries (Belgium, France and Germany) and to disincentivise the comparatively high rates of vehicle ownership. Strengthened measures to promote the uptake of zero-emission trucks will also be important to decarbonise freight transport emissions.

Luxembourg's electricity sector needs to accommodate growing electrification of end-use sectors. To meet rising demand for electricity, domestic renewable generation is projected to double by 2030, led by solar photovoltaics (PV) and wind, but limited surface area and permitting constraints mean imports will continue to play a dominant role. At the end of 2024 the government launched a public consultation named ESE to simplify and speed-up PV and wind projects, from which it identified and approved 51 concrete measures that are being implemented. The consultation also focused on grid capacity. Additional reforms to the grid connection process to prioritise viable projects would help clear a current backlog of connection requests and support faster connections of shovel-ready renewables projects. In addition, regional interconnections with Germany are being upgraded while the roll-out of smart

meters, digital solutions, flexibility measures and a battery storage strategy will continue to help establish a more resilient system.

Luxembourg should put in place support mechanisms to derisk hydrogen infrastructure development to enable robust trade. Hydrogen will play a limited but strategic role on Luxembourg's pathway to net zero emissions, particularly for hard-to-abate heavy industry applications where direct electrification is less feasible. Meanwhile, hydrogen derivatives such as electro-sustainable aviation fuels will be essential for decarbonising Luxembourg's aviation sector. While the first pilot projects, Luxembourg Hydrogen Valley and EHO-WAVE, are underway, most long-term hydrogen demand will need to be met through imports, given Luxembourg's limited domestic production potential. Therefore, Luxembourg should carefully monitor global hydrogen projects to reassess its assumptions on meeting domestic demand. The 2025 Hydrogen Law provides a framework for planning networks and designating a system operator, but private investors face uncertainty over demand volumes and use rates. Investment guarantees, amortisation accounts or other derisking tools, combined with strong cross-border co-operation with Luxembourg's neighbours Belgium, France and Germany, will be critical to attract capital and position Luxembourg as a consumer and a transit hub in the emerging European hydrogen landscape.

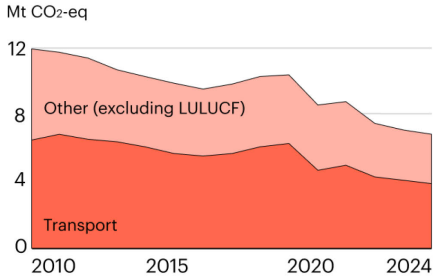
Luxembourg has an important opportunity to expand the use of its digital infrastructure and unlock system flexibility that can empower consumers. The country made commendable progress with the nearly 100% roll-out of smart meters, dynamic pricing and a national energy data platform, but uptake of demand-side response and aggregation remains limited. To maximise benefits, the government should strengthen the regulatory framework for flexibility services, ensure the interoperability of data platforms, and promote active consumer participation through clear communication and tailored incentives. Expanding digital tools for households, small and medium-sized enterprises (SMEs), and municipalities would not only support cost savings and energy efficiency but also reduce grid investment needs by smoothing demand and integrating growing shares of renewables and electric mobility.

Luxembourg's small size, strong institutions and close integration with European markets create unique opportunities to accelerate its clean energy transition. Regional co-operation on electricity, hydrogen and renewable energy allows Luxembourg to leverage scale beyond its borders, while its dense urban structure offers advantages for electrification, digitalisation and district heating. The

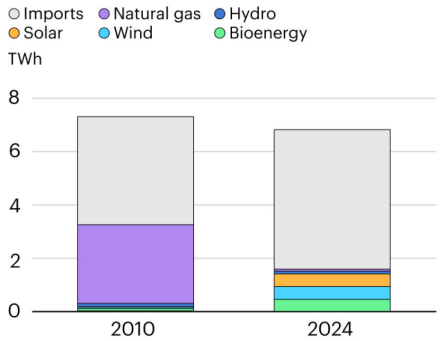
country’s headway on smart meters, digital tools and free public transport shows its capacity to pioneer innovative solutions that can be scaled further. By strengthening system-wide planning, derisking investment in new technologies, and engaging citizens and municipalities, Luxembourg can not only meet its ambitious climate targets but also build a more secure, affordable and consumer-oriented energy system that serves as a model for other small, interconnected economies.

53%

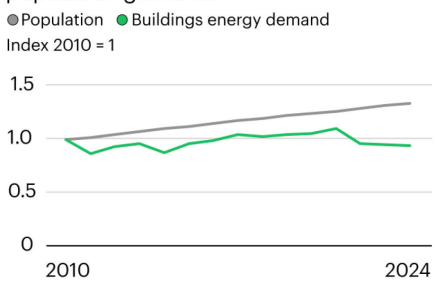
Transport's share in GHG emissions, driven by energy use from non-resident borderers



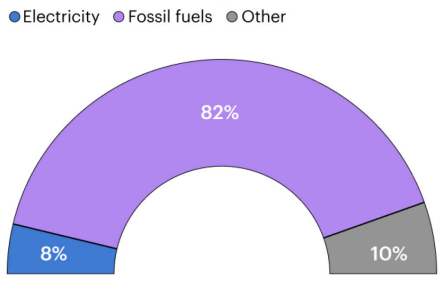
Renewables and **imports** displaced gas-fired generation



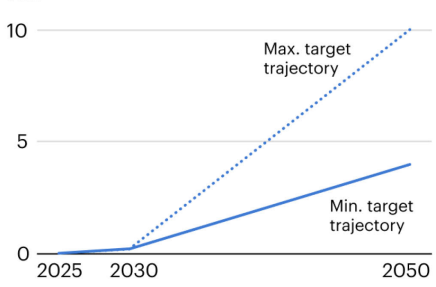
While the evolution in buildings energy demand **diverged** from a rapid population growth...



... residential **space heating** heavily relies on fossil fuels, highlighting the need for **electrification** (2024)



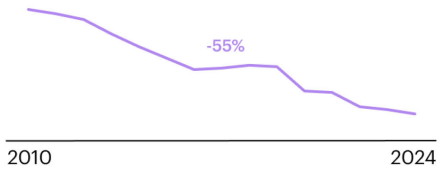
Luxembourg plans to create **hydrogen demand** in transport and industry



99%

of consumers have a **smart meter** (2024)

Carbon intensity halved between 2010 and 2024, despite economic and population growth



See the annexes for the sources for this infographic.

Policy recommendations for Luxembourg

Energy policy landscape

1. Drive long-term system-wide energy planning by strengthening co-ordination and enhancing current planning tools.
2. Step up communication efforts on energy policy measures.
3. Increase efforts to address fuel consumption and emissions in transport and assess ETS2 impact to ensure post-2027 effectiveness.
4. Maintain focus on policy levers to increase the uptake of electric heavy-duty vehicles.
5. Support more grid connection requests through a revised selection process that prioritises project viability.

Hydrogen — Focus area

6. Introduce support mechanisms to derisk hydrogen infrastructure development.

Decarbonisation of space heating — Focus area

7. Adopt a national framework for municipal heat mapping and planning and use it as a guiding strategy for low-carbon heating investments.
8. Introduce minimum energy performance criteria for home upgrades.
9. Consider a progressive application of financial incentives for replacing fossil heating systems to motivate faster replacements.

Digitalisation — Focus area

10. Harness smart meter data to empower consumers and enable active participation in energy markets.

Energy policy landscape

Luxembourg has taken important steps in recent years to lower its energy sector emissions, improve energy efficiency and increase the role of renewable energy. The country has legally enshrined a target to reduce GHG emissions by 55% by 2030 relative to 2005 levels on a pathway to net zero emissions by 2050. To support these targets, its 2024 updated National Energy and Climate Plan (NECP) establishes an implementation approach across a range of policy areas, from promoting energy efficiency to increasing renewable energy and supporting the growth of emerging sectors such as hydrogen.

Nonetheless, Luxembourg continues to face unique challenges. Notably, it has experienced significant population growth, at 35% between 2009 and 2024, which requires strong efficiency measures to offset growing energy demand and associated emissions. Moreover, historically favourable fuel taxes and its central location in Europe turned the country into a hub for fuel sales, resulting in markedly high levels of fuel consumption relative to its neighbouring countries. Luxembourg's energy sector is also characterised by a lack of indigenous energy resources, making it dependent on imports for nearly all its energy needs (100% for oil and gas and around 80% for electricity).

The challenges facing Luxembourg's energy transition require ambitious and targeted policy measures, and the country has positioned itself well to tackle it. In line with its climate and energy targets, Luxembourg has set out long-term plans to wind down its fuel tax advantages and prepare itself for a modern, integrated energy system, including through leadership on digital technologies. Given its location, Luxembourg also benefits from being well-integrated in the European energy system as part of the Central Western Europe electricity market and the Benelux energy co-operation framework. These present opportunities for stronger regional grid integration and

investments in renewable energy and hydrogen assets, boosting energy security and supporting more efficient clean energy transition outcomes.

Climate and energy strategy

Luxembourg's amended Climate Law of 2020 targets net zero emissions by 2050 and aims to reduce GHG emissions by 55% from 2005 levels by 2030, in line with the EU Climate Law. As a member of the European Union, Luxembourg is also covered by the 90% GHG emissions reduction target for 2040, as agreed by the European Union and its member states in December 2025.

Large combustion facilities in the power and industry sectors are part of the EU Emissions Trading System (ETS), whereas sectors like transport, buildings, small energy and manufacturing industries, construction, agriculture, and waste (all non-ETS sectors) are subject to binding national GHG targets under the EU Effort Sharing Regulation (ESR). However, from 2028 onwards, road transport, buildings and additional sectors (mainly small industry) are covered by a new emission trading system, ETS2. For the European Union as a whole, the ETS target is to reduce GHG emissions by 62% from 2005 levels by 2030, the ETS2 is set to bring emissions down by 42% compared to 2005 levels, while the ESR target is to reduce EU-wide emissions by 40% in the same period. Under the ESR, Luxembourg's updated national obligation is to reduce emissions by 50% from 2005 levels by 2030. ESR sectors in Luxembourg account for most of the country's emissions.

The NECP is the key policy document guiding the implementation of Luxembourg's energy and climate change policy through 2030. It reiterates the objective to reduce GHG emissions by 55% from 2005 levels, excluding the EU ETS and land use, land-use change and forestry (LULUCF), and includes targets to reach this: bring the share of renewables in final energy consumption to 37%; improve energy efficiency by 42%; and achieve a 49% share of electric vehicles (EVs). The policy measures laid out in the NECP apply to six sectors: 1) buildings; 2) transport; 3) energy, manufacturing and construction; 4) agriculture and forestry; 5) waste and wastewater treatment; and 6) LULUCF.

The development of the NECP provided considerable opportunities for stakeholder input, including a public inquiry held in 2023. Other platforms for public and expert engagement include the Luxembourg in Transition international consultation on spatial planning, the Citizen's Council on Climate, the Climate Policy Observatory, and the Platform for Climate Action and Energy Transition.

Luxembourg's Klimabonus scheme, established by the Climate Law, offers financial support for energy efficiency and renewable energy investments in housing and mobility. State aid covers areas such as energy efficient home renovations, the replacement of old heating systems, sustainable housing construction, the installation of PV systems, EV and e-bike purchases, and charging stations.

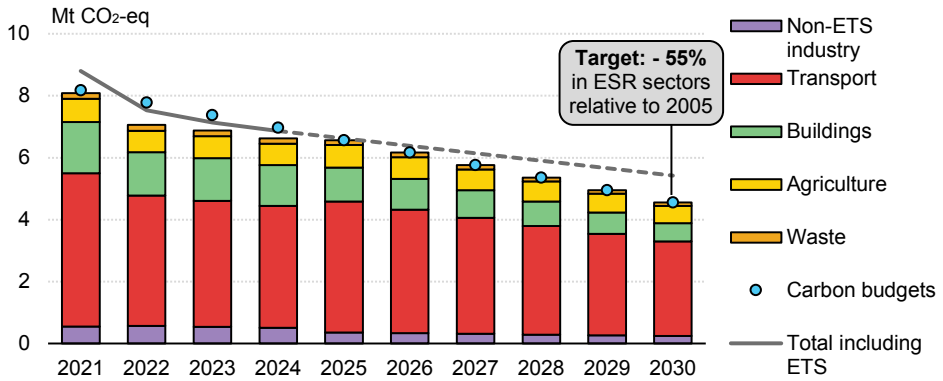
Municipalities in Luxembourg have considerable jurisdiction over areas that overlap with energy and climate change, including adaptation, land use, mobility and waste management. To promote a co-ordinated, nationwide approach to climate change that incentivises local capacity building, in 2012 the government entered into a Climate Pact with municipal governments. Under the Pact, local governments commit to implement climate-related measures in return for financial and technical assistance from the national government. In 2021, the government renewed the Pact under a revised framework (Climate Pact 2.0) that is more focused on quantitative results.

Greenhouse gas emissions trends

Luxembourg has a unique emissions profile shaped by its central location in Europe, favourable fuel prices and reliance on electricity imports. It imports most of its electricity demand from its neighbouring countries, shifting power emissions externally. In contrast, its favourable fuel prices and strategic position have led to disproportionately high fuel consumption in transport due to fuel sales to foreigners, making this sector a dominant source of domestic emissions.

In 2024, Luxembourg's GHG emissions (excluding LULUCF emissions) stood at 7.6 million tonnes carbon dioxide (Mt CO_2), 83% of which came from energy-related emissions, primarily oil in transport. Transport, buildings and industry are the three main emitting sectors, with transport alone accounting for more than half of emissions. However, transport also made the biggest contribution to the 44% decline in economy-wide emissions between 2005-2024. Due to the sustained decrease of energy and emissions intensity across the Luxembourg's economy, its strong demographic and economic development in the same years did not prevent a reduction in absolute emissions.

Economy-wide greenhouse gas emissions (2021-2024) and carbon budgets (2025-2030) in Luxembourg



Notes: ETS = Emissions Trading System; ESR = Effort Sharing Regulation. ESR sectors are shown as bars, with data beyond 2024 indicating Luxembourg's carbon targets under the Climate Law. Total including ETS projections are based on calculations by the European Commission and are not official targets.

Sources: IEA analysis based on Government of Luxembourg (2026), Publication of the final greenhouse gas emissions balance for the year 2024 (Accessed May 2026); European Commission (2025), Overview of key objectives, targets and contributions in the final NECP (accessed in November 2025); EEA (2026), Greenhouse gases – data viewer (accessed May 2026).

To meet its emissions targets, the Climate Law requires that the government establishes emissions budgets for each ten-year period up to 2050 for five sectors: 1) energy and manufacturing; 2) transport; 3) buildings; 4) agriculture and forestry; and 5) waste and wastewater treatment. The first sectoral emissions budget was released in 2022, covering the period through 2030. Monitoring data are released twice a year (provisional and final). Up to 2024, the country met its overall national budget, though compliance varied by sector. The energy, manufacturing and construction sectors have exceeded their emissions budget by about 30% each year since 2021 while the transport and agriculture/forestry sectors have consistently remained within their annual budgets.

Looking ahead, according to the NECP, Luxembourg's current measures are insufficient to meet its climate targets. In the government's scenario without additional measures since January 2022, emissions covered by the Climate Law are projected to be 50% higher in 2030 than the target set for that year. However, measures

enacted since January 2022 have helped narrow the gap and provisional data for 2024 show that the annual target was met.

Taxation and carbon pricing

All energy products in Luxembourg are subject to an excise tax, though lower rates are applied to heating than to motor fuels. Luxembourg's current nominal fuel excise duties are lower than those of its neighbouring countries (though after reimbursements, commercial diesel in Belgium and France are lower). Aware of the disparity, the government's fiscal policy is aimed at addressing social, economic and environmental challenges, including a gradual increase in energy and resource taxes to reflect consumption externalities and favour renewable resources.

Since two-thirds of Luxembourg's GHG emissions come from road transport, reducing fuel sales and exports is critical for its decarbonisation efforts. To do so, the government plans to adjust petroleum product taxes to meet Paris Agreement commitments, particularly through the CO_2 tax in the NECP, and to gradually narrow price gaps with its neighbouring countries.

Fossil fuels have been subject to the CO_2 tax since 2021, with rates of 20 EUR/tonne CO_2 (t CO_2) in 2021, increasing by 5 EUR/t CO_2 annually to reach 45 EUR/t CO_2 in 2026. Luxembourg has not yet decided whether it will continue to apply its CO_2 tax after 2026 or phase it out in light of the new EU ETS2 carbon pricing mechanism (applied to transport and buildings).

Revenue generated by the CO_2 tax is used to equally fund climate and energy transition measures and social compensation mechanisms for low-income households, including tax measures or other actions such as increasing the cost-of-living and energy allowances. Activities covered by the EU ETS are exempt from the tax.

The National Solidarity Fund grants, upon request and under certain conditions, a specific allowance for low-income households. Household income must not exceed a certain threshold to be eligible for the cost-of-living allowance and the energy allowance. The amount of the allowance is dependent on the composition of the applicant's household (living alone or in a community of several people).

Energy support measures (gas and petrol price subsidies), with the exception of measures to stabilise electricity prices, were abolished on 1 January 2025. The

government temporarily justifies these measures due to the high electricity prices since the energy crisis. The government continues to support households by covering half of the forecasted 30% price increase for 2025. This gradual approach ensures that Luxembourg's electricity prices remain comparable to those of its neighbouring countries. Additionally, for successful decarbonisation through electrification, electricity prices must be attractive compared to fossil fuels and non-renewable energy sources.

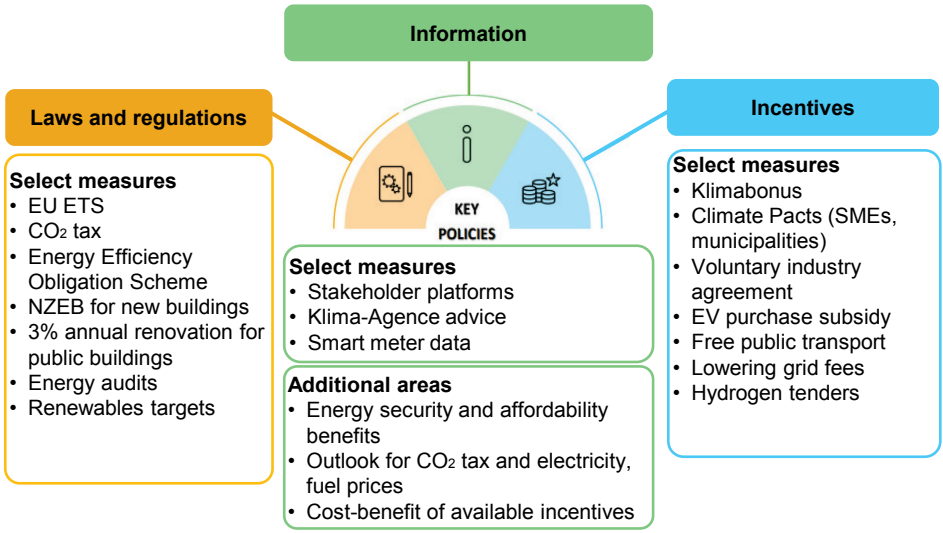
Skills and competencies for the energy transition

Given the energy transition's reliance on technological measures, a skilled workforce is an essential enabling factor for its success. This is currently one of the biggest challenges in achieving climate goals. To ensure alignment between education programmes, course content and energy transition skills, programmes are developed and updated by curriculum teams in partnership with professional chambers, the chamber of employees and sector representatives from training companies. Regular evaluations of the programmes with professional chambers help update needs and strategic objectives. This has led to the introduction of new programmes (e.g. DT Smart Technologies with specialisations in Smart Buildings and Energies, Smart Energy, and Renewable Energies) and additional certifications (e.g. handling refrigeration units containing fluorinated GHG).

Luxembourg's goal in adult education is to expand training offerings in sustainable development to meet the demand for skills and qualified labour in sectors related to the energy transition and to broaden continuous training programmes for anyone wishing to enhance their energy and climate skills. Professional retraining programmes related to the clean energy transition for job seekers and employees at risk of losing their job, in collaboration with the state employment agency ADEM, support reintegration and job retention.

Furthermore, Luxembourg has proposed a national initiative to enhance craftsmen's jobs related to the NECP's objectives. Professional chambers, craftsmen's federations and relevant ministries are collaborating to develop programmes that highlight the strategic importance of craftsmanship and encourage students to pursue craft training in energy and climate transition fields.

Pillars of energy policy in Luxembourg



Note: NZEB = nearly zero energy buildings.
Source: IEA analysis based on the questionnaire sent to Luxembourg for this review.

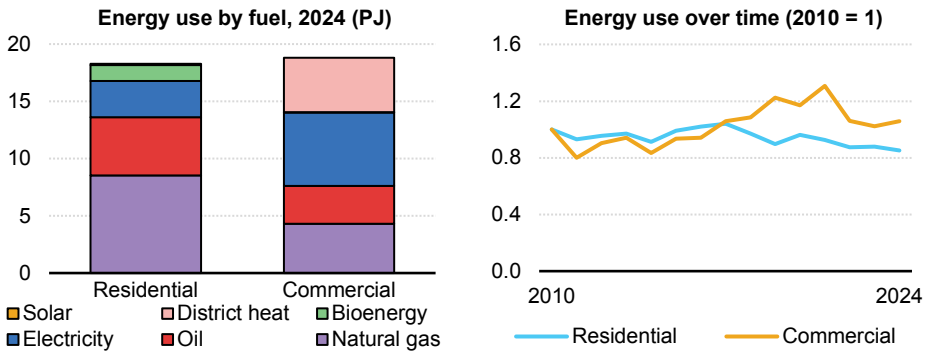
End-use sectors

Buildings

Buildings play an increasingly important role in meeting Luxembourg's national energy and climate goals, as their share in both energy consumption and related emissions continues to grow. In 2024, buildings accounted for approximately 31% of total final energy consumption. The share has gradually increased despite stable absolute energy use, reflecting declines in transport and industry energy use. The building sector energy-related emissions have remained steady, accounting for 21% of the total in 2024. Energy use in residential and commercial buildings was nearly equal, with 18 petajoules (PJ) for residential and 19 PJ for commercial (2024). Nearly 85% of residential units rely on fossil fuels for heating, while electricity represented 8% of residential heating energy use in 2024. Commercial buildings are characterised by extensive use of district heating (25% in 2024) and are overall more electrified (34%).

Luxembourg's strategy focuses on reducing energy demand in buildings, even as population and building floor area expand. Luxembourg applies EU laws and directives to its energy sector, notably requirements under the Energy Efficiency Directive and the Energy Performance of Buildings Directive.

Energy use by fuel (2024) and over time (2010-2024) in residential and commercial buildings in Luxembourg



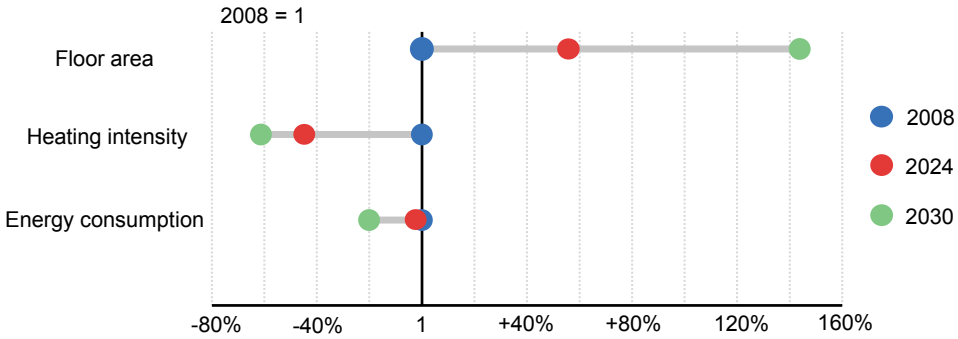
Note: Solar is not visible on the chart's scale and accounts for 0.1 PJ of residential buildings.
Sources: IEA (2025), Energy End-uses and Efficiency Indicators; IEA (2025), Greenhouse Gas Emissions from Energy; IEA (2025), World Energy Balances.

Luxembourg has a sizeable share of older buildings, especially in the residential sector. Renovations thus have an important role to play in lowering energy consumption and emissions from the sector. Luxembourg's renovation rate is, however, relatively low, especially for deep renovations and accelerated action is needed to meet national and EU climate and energy targets. According to the country's Long-Term Renovation Strategy (2020), annual renovation rates for building envelopes were estimated at just 0.4-1%, and by 2020 only 10-14% of the residential stock had undergone energy renovations since 2008. The government is currently working on updating its statistics related to the building stock and renovations to gain a more detailed view of the sector.

Despite a 1.5-fold increase in floor area, energy consumption in buildings in Luxembourg has remained broadly constant over time, suggesting energy savings in

the existing building stock. However, the expansion of the building stock and the increase in total floor area dampen the overall impact of these energy efficiency improvements.

Energy consumption, heating intensity and floor area of residential buildings in Luxembourg (2008, 2024 and projection for 2030)



Note: Heating intensity and consumption are temperature-corrected.
Sources: IEA analysis based on IEA (2026), Energy End-uses and Efficiency Indicators; Government of Luxembourg (2020), Long-term Renovation Strategy (accessed in September 2025).

New buildings

Luxembourg has reviewed its Minimum Energy Performance Standards (MEPS) for new buildings regularly since the implementation of energy performance certificates for residential buildings in 2007 and for commercial buildings in 2010. Since early 2017, all new constructions (since 2021 for commercial buildings) are required to comply with the “nearly zero energy buildings” reference, which aligns closely with the “passive house” insulation standard, using an air/water heat pump as the reference. New buildings must meet at least the performance levels for heating demand (thermal efficiency) and primary energy demand of the reference building to be eligible for a building permit, which means that the nearly zero energy buildings performance level is mandatory for new buildings. These buildings are typically rated as AA in national energy performance certificates.

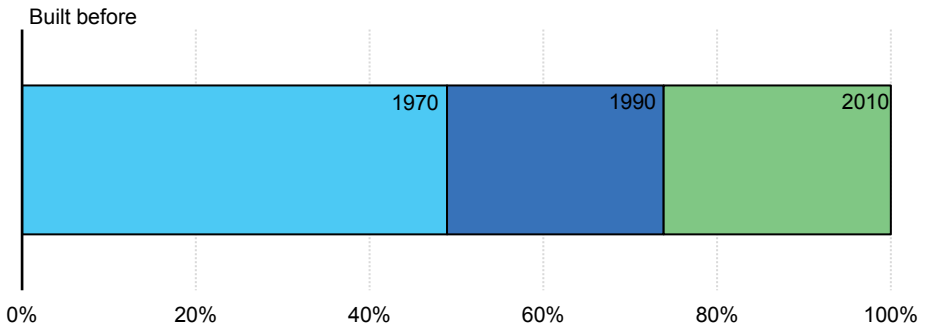
Luxembourg’s building stock and floor area will continue to increase, driven by population and economic growth, resulting in growing energy demand. However,

there are strict requirements for new buildings and a sound legal basis for the construction of highly efficient buildings that use clean energy sources (net zero emissions buildings). The greater challenge for the country's energy transition lies therefore in lowering energy consumption of the existing building stock through renovation.

Existing buildings

In 2020, Luxembourg introduced its Long-Term Renovation Strategy. The European Commission praised Luxembourg for its detailed information on the building stock. The strategy noted that around 65% of the country's residential buildings were built before 1990 and around 40% were built before 1970. Moreover, a 2019 assessment found that a high share of homes recorded low energy performance, with Energy Performance Certificate ratings of F-I; meanwhile, fewer than 10% had ratings of A or B.

Share of residential units by age in Luxembourg until 2010



Source: Government of Luxembourg (2020), Long-term Renovation Strategy (accessed in October 2025).

The strategy includes a national initiative for energy renovation, involving construction sector stakeholders and pilot projects to implement ambitious policies and measures.

Luxembourg is implementing a three-pronged approach to improve the energy efficiency of existing buildings based on the type of building. Public buildings have a leading role, reinforced with the renovation obligations in the EU Energy Efficiency

Directive (which requires a 3% annual renovation rate), alongside state support for public entities. The main support mechanisms for renovations and decarbonisation efforts in public buildings are: general energy transition support for municipalities; the Climate Pact for municipalities that includes technical and financial support; financial support for municipalities under the National Climate and Energy Fund; and the Energy Efficiency Obligation Scheme, which requires electricity and natural gas suppliers to generate energy savings for customers.

The government also plans future obligations for non-residential buildings based on the MEPS under the EU Energy Performance of Buildings Directive. State support for commercial buildings takes the form of: financial support for decarbonisation measures (under revision); financial support for the renovation and decarbonisation of commercial buildings (in development); the Climate Pact for enterprises (focused on SMEs); and the Energy Efficiency Obligation Scheme.

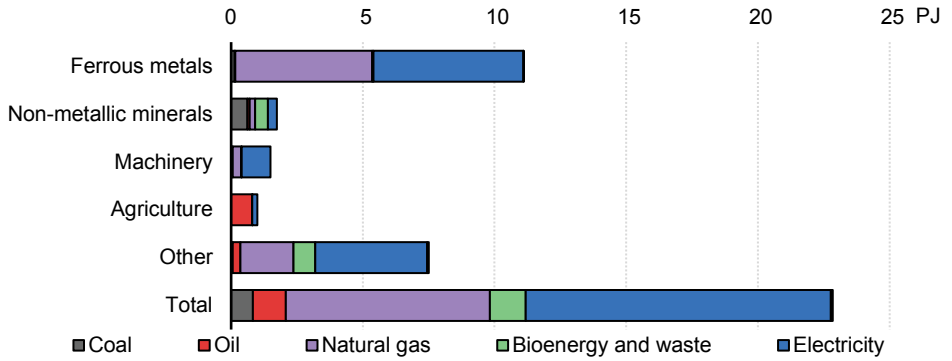
Finally, Luxembourg will not apply mandatory standards for residential buildings, instead focusing on a voluntary approach, supported by information, advice and awareness led by Klima-Agence; financial support under the Klimabonus Wunnen; supplemental support schemes for vulnerable households; a pre-financing mechanism combined with state aid schemes (in development); the Energy Efficiency Obligation Scheme; and a housing renovation pilot project (zesumme renovéieren) that is planned to be scaled up, alongside the establishment of a one-stop shop (OSS) for renovations.

Public perception may pose challenges to scaling up renovation efforts. While residents of single-family homes are more likely to acknowledge the need for renovations than people living in apartments, the majority still report that no improvements are necessary. Among households in buildings constructed prior to 1960, only 58% see a need for renovation. This number drops to 40% for people living in homes built between 1960 and 1990 and further declines to 25% for those living in buildings constructed between 1990 and 2010. Moreover, many of these renovations focus on interior or aesthetic upgrades, meaning the perceived need for energy-related home improvements is even lower. To address this public perception, Luxembourg plans to raise awareness among consumers and craftsmen to help meet its targets.

Industry

Industry is the smallest sector for energy consumption in Luxembourg, covering less than one-fifth of the total in 2024. Industry accounted for a modest share of value added to the economy, at 11.5%, compared to the OECD average of 27%. Metals was the largest exported good in 2024, at almost 20% of total exports, highlighting the importance of this sector for Luxembourg's economy. In fact, iron and steel manufacturing is the largest industrial sub-sector when it comes to energy use, covering 49% in 2024, followed by non-metallic minerals (7.6%) and machinery (6.5%). Steel production takes place entirely in electric arc furnaces, resulting in a high degree of electrification of ferrous metals production (51%). The natural gas used in ferrous metals and fossil fuels used in non-metallic minerals are the main contributors to Luxembourg's industrial emissions. Overall, industry's energy use has been declining, by almost 30% from 2010 to 2024, while emissions declined even faster, by around 41%.

Energy use in industry by fuel and sub-sector in Luxembourg, 2024



Source: IEA (2026), Energy End-uses and Efficiency Indicators.

There has been a voluntary agreement in place since 1996 between the government, Klima-Agence and the industry federation, FEDIL, focused on improving energy efficiency and decarbonisation in the country's industry sector. In 2024, 42 of the country's largest electricity and gas consumers participated in the initiative. Under the first phase that runs through 2026, signatories commit to a 1.5% annual improvement in energy efficiency for a total improvement of 4.5% relative to the 2020-2021

baseline. The second phase to 2030 is foreseen to include decarbonisation targets for companies, in line with the NECP.

A national roadmap for decarbonising the manufacturing sector was established in 2021-2022 and is expected to be updated. The roadmap's main objective is to identify and estimate the decarbonisation potential as quantifiable today per industry sector and decarbonisation lever. It will identify accompanying support needed for industry to decarbonise by 2050 as well as to meet climate, energy efficiency and renewables targets by 2030. The plan identifies the following strategic measures as the most promising:

- introduce a dedicated state aid scheme supporting decarbonisation projects (CAPEX and/or OPEX [capital expenditure and/or operational expenditure])
- create a support scheme for low-emissions hydrogen production pilot projects
- implement an SME climate pact
- extend the scope of FEDIL's voluntary agreement to GHG emissions and renewable energy production (and self-consumption)
- facilitate renewable electricity supply through self-consumption and long-term renewable power purchase agreements
- improve the financial viability of decarbonisation/energy efficiency projects with derisking programmes
- mitigate carbon price volatility with carbon contracts for difference (OPEX)
- promote low-emissions solutions through public procurement
- develop national hydrogen network infrastructure.

In line with the EU Energy Efficiency Directive, large companies in Luxembourg are required to undertake energy audits every four years, which help identify energy efficiency solutions and energy savings opportunities.

Affordability of the energy transition is a top consideration for Luxembourg to ensure the continued competitiveness of its industry sector. In this regard, the government has placed a strong emphasis on keeping electricity prices low. This approach recognises that electricity already accounts for the largest share of industrial energy consumption, and that this share is expected to grow as electrification increasingly continues to drive decarbonisation efforts. As such, the government has implemented a new state aid law based on the EU Temporary Crisis and Transition Framework

(replaced in June 2025 by the Clean Industrial Deal State Aid Framework), which covers funding gaps decarbonisation projects face.

Luxembourg also supports the decarbonisation and energy transition of businesses (with a focus on SMEs) through the Climate Pact for Enterprises (Klimapakt fir Betriber), which provides information on and facilitates the use of various initiatives, programmes, support and financial subsidies, covering a wide variety of subjects and applications.

Carbon capture and storage

To achieve climate neutrality by 2050, carbon capture, utilisation and storage (CCUS) technologies are crucial for decarbonising hard-to-abate manufacturing industries where direct electrification or hydrogen use is not feasible. Luxembourg's 2023-2028 coalition agreement includes plans to assess the potential of CCUS technologies and create a framework to support their deployment in specific industries, such as cement.

The Ministry of the Economy and the Ministry of the Environment, Climate and Biodiversity developed a CCUS and CO_2 removal framework which was adopted by the government in July 2025. It identifies seven measures to support the development of these technologies and sets up an interministerial steering committee to monitor implementation. The government also plans to launch a multi-stakeholder taskforce by the end of 2025 that brings together public and private sector participants in the field. If appropriate, an analysis will be carried out to identify relevant cross-border CO_2 transport infrastructure. The analysis would consider various dimensions including national, regional and European co-operation and co-ordination to transport CO_2 to storage and utilisation sites.

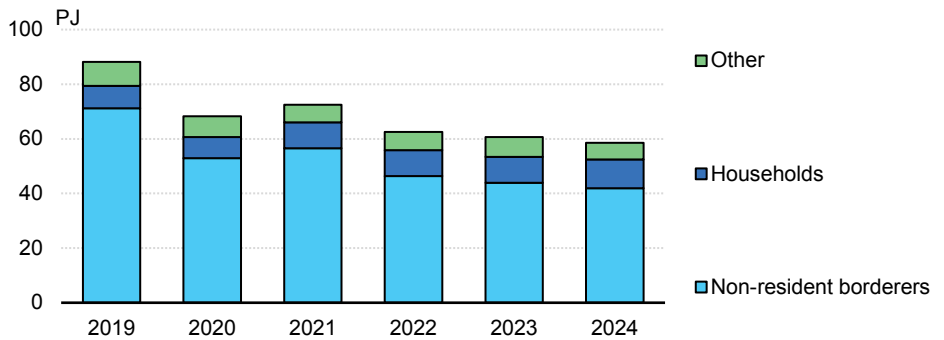
Transport

Transport accounts for a large share of Luxembourg's total energy demand, equivalent to half in 2024. Diesel is the dominant fuel (64% in 2024), followed by gasoline (26%), biofuels (8.4%) and electricity (1.6%). Fuel sales to passengers transiting through Luxembourg are the main driver of energy demand in transport, responsible for more than 72% of all road-related fuel use in 2024. The light-duty vehicle stock in Luxembourg has grown with demographic development, and Luxembourg has one of the highest car ownership rates among IEA and EU member countries, in part driven by low vehicle purchase taxes. There are, on average, three light vehicles for every four residents. Despite the growing stock in light-duty vehicles,

total vehicle kilometres travelled as well as energy demand remain largely unchanged, indicating a shift in car use and mobility patterns. In the National Mobility Plan 2035, Luxembourg anticipates a 40% increase in daily trips by 2035 compared to 2017 levels, while aiming to reduce the share of motorised individual transport.

Luxembourg is actively promoting public transport, encouraging modal shifts for all residents. In 2020, it introduced free public transport for all domestic trips. Buses are the backbone of the public transport system, supported by a network of over 250 routes operating nationwide. Passenger kilometres travelled by bus are around three times higher than those travelled by rail in Luxembourg. Despite the availability of free public transport, light vehicles continue to dominate passenger travel, with approximately five times more total passenger travel volume than public transport.

Road transport energy use by user type in Luxembourg, 2019-2024

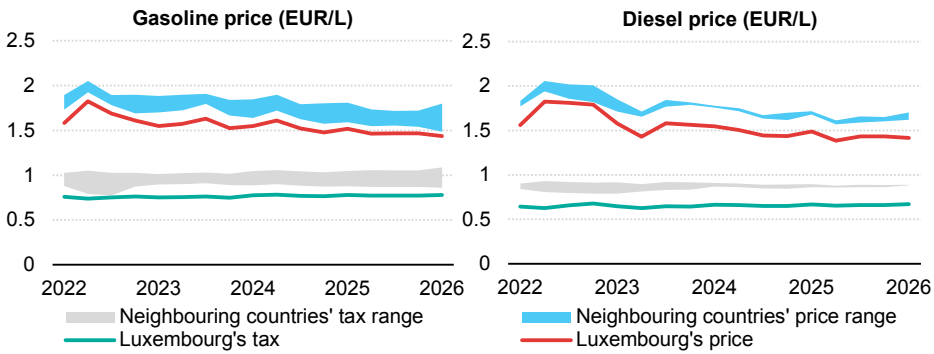


Note: Non-resident borderers include transporters, buses, border workers and tourists.
Source: STATEC (2026), Oil fuels consumption by type of transport (accessed in March 2026).

Based on 2024 government data, the transport sector accounted for 59% of Luxembourg's total GHG emissions in 2024, with emissions decreasing by 1.4% compared to 2023 and 35% compared to 2019, placing them 11% below the 2024 national emissions allocation. However, GHG intensity in the sector remains relatively high and the government has laid out detailed plans to decarbonise its transport sector in the NECP, which outlines 31 measures on transport and mobility, emphasising public transport expansion, the promotion of active mobility and cross-border solutions.

Fuel prices in Luxembourg are attractive for regional freight and residents from neighbouring countries due to Luxembourg's comparatively low fuel taxes. Lower fuel taxes result in lower fuel prices in Luxembourg and are an incentive for many non-resident or border workers to refuel their vehicles in Luxembourg. In the first quarter of 2026, Luxembourg's fuel taxes were 9% lower for gasoline and almost 24% lower for diesel than the minimum tax level of its neighbouring countries.

Gasoline and diesel prices and tax component in Luxembourg and neighbouring countries, 2022-2026



Note: Neighbouring countries include Belgium, France and Germany. In 2026, data is available until Q1.

Source: IEA (2026), Energy Prices.

To meet the Paris Agreement and EU targets, Luxembourg began to gradually close the gaps with its neighbouring countries and intends to continue its efforts. These actions are reflected in a continuous decrease in road-fuel volumes between 2021 and 2025. Government data shows that in 2025 volumes were 36% lower than in 2019.

CO_2 tax

Luxembourg's CO_2 tax on fossil fuels is an important measure to reduce the transport sector's emissions. Laid out in 2020 through the country's previous version of the NECP, the tax has been in place since 2021. It was set at 20 EUR/t CO_2 in 2021 and increased to 45 EUR/t CO_2 in 2026. Revenues from the tax are reinvested in climate and energy transition-related measures as well as to support vulnerable households

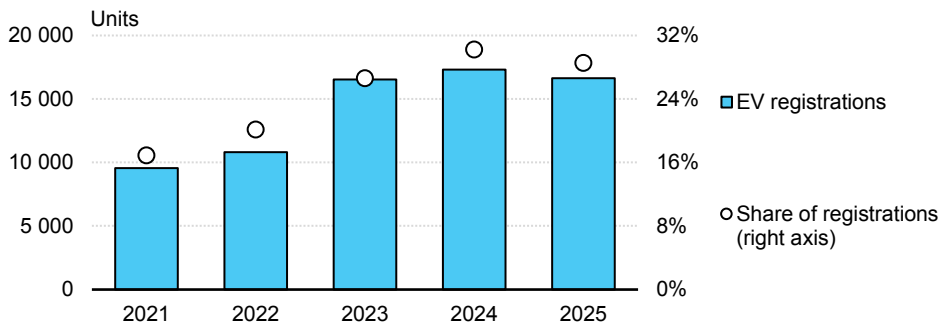
through the energy transition. The CO_2 tax is the government's main tool to reduce the amount of fuel sales to non-residents and the sale of diesel fuel to trucks in transit.

Electric vehicles

Electromobility is a core pillar of Luxembourg's decarbonisation plan for the transport sector, with the goal in its NECP for a 49% share of EVs (including plug-in hybrids) in the total vehicle fleet (cars, trucks, buses, etc.) by the end of 2030. As of 2025, EVs made up 12% of the passenger car fleet (8.5% BEVs) and 9.8% of the total vehicle fleet.

EVs have seen considerable growth in Luxembourg. Between 2020 and 2025, the number of EVs increased sixfold, reaching a stock of around 60 000 (battery electric and hybrid) out of a total stock of more than 600 000 vehicles. Roughly three in ten vehicles registered in Luxembourg in 2025 were electric, up from just one in ten in 2020. Penetration of electric trucks, on the other hand, remains slow, representing less than 1% of the trucks stock at the end of 2025.

Electric vehicle registrations and relative share in Luxembourg, 2021-2025



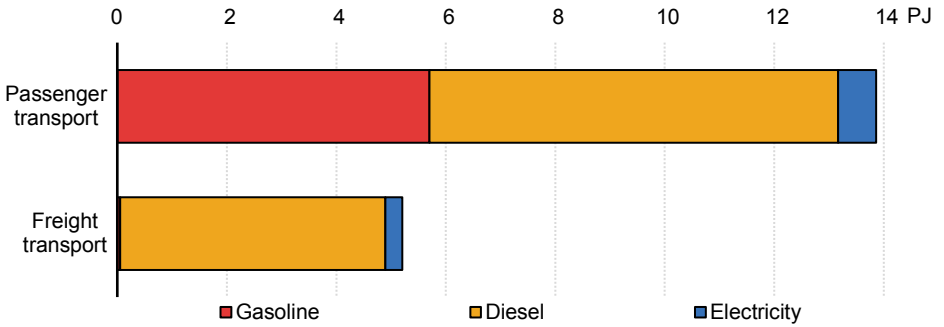
IEA. CC BY 4.0.

Source: STATEC (2026), Number of new road vehicles registrations by type of vehicle and fuel (accessed in January 2026).

The government provides subsidies for zero-emission light-duty vehicles to private individuals and businesses, based on energy efficiency criteria. For battery electric vehicles (BEVs), the maximum grant of EUR 6 000 is usually only awarded to vehicles

with a combined energy consumption (according to the Worldwide Harmonised Light Vehicles Test Procedure) of 16 kilowatt hours (kWh)/100 km or less. BEVs with a consumption between 16 kWh/100 km and 18 kWh/100 km are eligible for a reduced subsidy of EUR 3 000. The energy efficiency criteria for the subsidy are more flexible for households with at least three children.

Transport energy use by type and fuel in Luxembourg, 2024



Note: Liquefied petroleum gas and jet fuel account for less than 0.1% of the total and are not shown.
Source: IEA (2026), Energy End-uses and Efficiency Indicators.

For company cars, benefits in-kind have been calculated based on engine type and CO_2 emissions since 2017. Criteria have progressively been tightened and from 2025, only zero-emission cars benefit from low rates.

The NECP also includes the introduction of a social leasing scheme for EVs, modelled on France's electric leasing scheme, to enable low-income households to gain access to EVs while avoiding high upfront costs. The government is currently undertaking a study on ways to implement such a measure.

For heavy-duty vehicles, the government reimburses up to 40% of the price difference between a zero-emission truck and an internal combustion engine truck. A new law (voted in November 2025) foresees calls for projects that reimburse up to 100% of the price difference as from the beginning of 2026. Moreover, SME's are eligible for direct subsidies of up to 60% of the same price differences.

Luxembourg also offers technical and financial support to municipalities under the Climate Pact for decarbonising transport, including to electrify their fleets.

Fuelling infrastructure

To support the decarbonisation of the transport sector, the government has issued a National Policy Framework (NPF) in line with updated EU regulation (consistent with the "Fit for 55" requirements) on the deployment of alternative fuels infrastructure, including mandatory national targets. The draft NPF outlines the planning and implementation pathways required to ensure the deployment of adequate charging and refuelling infrastructure for alternative fuels (mainly electric charging) across all transport modes. It includes measures to significantly expand the publicly accessible charging network, with a strong focus on fast chargers, especially along Trans-European Transport Network[1] corridors, at urban nodes and in depots.

Luxembourg maintains a national infrastructure of public charging stations as part of the Chargy network, with over 710 alternating current charging points in all municipalities across the country and on "Park&Ride" sites, alongside 90 ultra-fast recharging points, known as SuperChargy stations.

Furthermore, the government introduced public aid schemes in 2022 (partly co-financed by NextGenerationEU) to support investments by businesses in private and publicly accessible charging infrastructure. In 2025, a new law further refined these support measures. Through project calls with competitive bidding, up to 70% of investment of charging infrastructure of companies can be financed. SMEs can moreover directly apply for financing of up to 50% for their charging infrastructure. In parallel, private home charging has been promoted since 2020 through financial incentives and buildings regulations that mandate EV readiness in all new and renovated buildings. As a result, the country has over 3 200 publicly accessible charging points relative to a fleet of over 50 000 vehicles, creating one of the densest charging networks in the European Union.

The EU Directive RED I called for a minimum share of 10% of renewable energy in transport by 2020, which Luxembourg exceeded with 12.7% (including through the application of qualified multipliers). However, additional efforts will be needed to increase the share of renewables to meet the updated EU target of at least 29% of

[1] The Trans-European Transport Network is a planned network of multimodal infrastructure across the European European Union, covering roads, rail, airports and waterways.

renewables in transport (including 5.5% of advanced biofuels and 1% of renewable fuels of non-biological origin) or -14.5% reduction in GHG intensity by 2030 as set out in EU Directive RED III. Luxembourg has established a legal framework that allows renewable electricity used at public EV charging points to count toward the RED III renewable energy in transport target. As a result, the NECP target of a 49% electromobility share is expected to make a substantial contribution to meeting the EU requirements.

Biofuels and hydrogen

Reflecting a technology-neutral approach to alternative fuels, the NPF also includes planning for alternative fuels infrastructure beyond road transport electrification, covering hydrogen refuelling stations and solutions for aviation, rail and inland shipping.

Although the current fleet of hydrogen-powered vehicles is limited, Luxembourg supports the development of hydrogen infrastructure in parallel with battery-electric technologies. Existing incentives support the uptake of hydrogen fuel-cell vehicles in the light-duty segment, with fuel-cell electric passenger cars eligible for purchase subsidies and tax benefits under Luxembourg's electromobility support schemes. In parallel, the government has introduced a dedicated, temporary aid scheme for zero-emission heavy-duty vehicles, explicitly covering hydrogen fuel-cell trucks. In 2023, the first publicly accessible hydrogen refuelling station at the rail-road multimodal hub in Bettembourg was inaugurated, and a new financial aid scheme has been introduced to support both publicly accessible and private hydrogen refuelling infrastructure.

8.4% of the transport sector's current energy use is accounted for by biofuels, reflecting their continued role as a transitional renewable fuel alongside electrification. Since 2020, Luxembourg has thereby limited the integration of biofuels with a high risk of indirect land-use changes to 5%, with plans to further reduce this share in line with the EU Directive RED II (which called for phase-out by 2030).

Policy spotlight: Promotion of public transport and active mobility

In March 2020 Luxembourg became the first country in the world to make all forms of public transport – buses, trains and trams – free of charge across the country. The decision was driven by several policy goals: reducing congestion in one of Europe's most car-dependent countries, lowering GHG emissions, and promoting social equity by ensuring mobility access for all residents and cross-border commuters. By eliminating fares, the government aimed to shift more travellers toward sustainable transport modes, complementing major investments in rail, tram and bus infrastructure under the National Mobility Plan 2035.

Based on comprehensive and detailed studies, the National Mobility Plan 2035 sets out a comprehensive strategy to accommodate a projected 40% increase in daily trips by 2035, driven by steadily expanding population and employment growth. The Plan is designed to accommodate this growth without increasing the total number of private motorised trips through the promotion of public transport and active mobility.

The National Mobility Plan 2035 places a strong emphasis on expanding active transport modes, such as walking and cycling. It supports the development of dedicated cycling infrastructure and the creation of pedestrian-friendly urban environments to make non-motorised travel safer and more appealing. This approach is especially targeted at replacing short-distance car trips.

The Plan also promotes integrated urban planning aligned with mobility goals. It encourages the concentration of housing, jobs and services around public transport hubs to shorten travel distances and increase the use of sustainable transport modes. The co-ordination of land-use and transport planning aims to foster compact, accessible communities that reduce the need for energy-intensive travel.

Luxembourg has also made rapid progress in electrifying its bus fleet. As of December 2025, 26% of all registered buses were battery-electric (708 vehicles), while 71% remained diesel or diesel-hybrid and 3% ran on compressed natural gas. The regional and cross-border network began electrification trials in 2017 and introduced strong electrification requirements in bus tenders in 2020. As a result, in the first half of 2025, nearly 45% of the network's mileage was already covered by battery electric buses. The City of Luxembourg's AVL network has committed to full electrification of all bus lines by the end of 2026. Looking forward, Luxembourg has set a 2030 target for all bus operations to be zero-emission, with other operators also aligning their fleet strategies toward decarbonisation.

Aviation

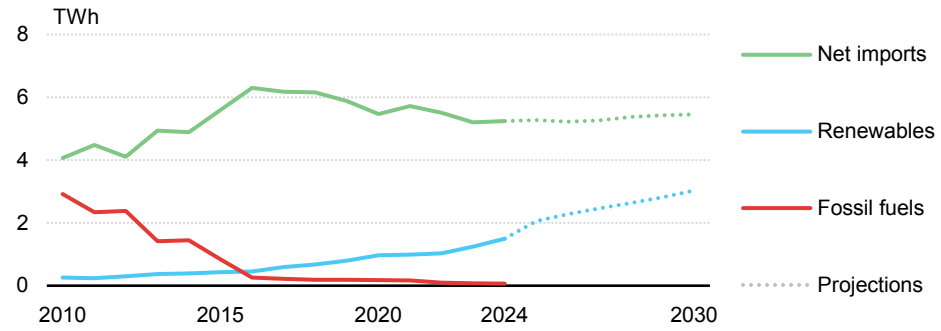
Aviation also plays an important role in Luxembourg's energy demand and is important to its economy. There are few decarbonisation options in the sector as additional energy efficiency gains are limited and electrification technology is in its nascency. As such, the main pathways for decarbonisation in aviation are sustainable aviation fuels and synthetic fuels of non-biological origin produced from renewable hydrogen. Following the publication of the REFuelEU Aviation Regulation, Luxembourg established an interministerial group tasked with implementing the Regulation.

Electricity

Demand and supply

Luxembourg's electricity system has been characterised by an exceptionally high import dependency (around 85% in 2024). Luxembourg sees the use of renewables as a way to meet increased demand and reduce reliance on electricity imports. The NECP estimates that electricity demand in Luxembourg will rise to 7.8 terawatt hours (TWh) by 2030 up from 6.3 TWh in 2024, driven by population growth and further electrification of end-use sectors. While current industrial electrification rates of 49% are higher than the IEA average of 33%, buildings lag behind at just 28%, compared to an IEA average of 45%. Local electricity generation relies heavily on renewable energy (92% in 2024) but covers just 20% of gross consumption. While renewable generation is projected to double between 2024 and 2030, net imports are expected to register minimal growth (+3.9%) according to the NECP's projections.

Electricity supply and 2030 NECP projections in Luxembourg, 2010-2024



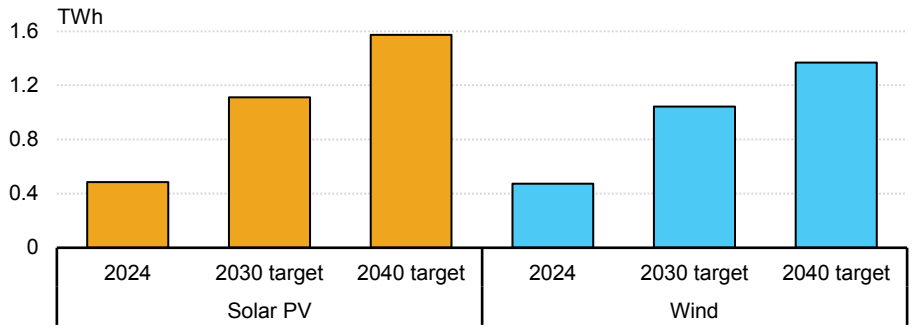
Sources: IEA analysis based on IEA (2026), World Energy Balances; Government of Luxembourg (2024), NECP (accessed in August 2025).

The largest share of Luxembourg's 2.2 gigawatt (GW) installed electricity generation capacity in 2024 was covered by hydropower, which has been constant at 1.3 GW since 2013. Hydro's share in domestic electricity generation capacity has been shrinking annually, due to the more than fourfold growth of solar PV from 2018 and 2024, and concurrent growth in wind capacity (+73% over the same period). Natural gas covered just above 3% of total capacity in 2024. Gas-fired electricity generation shrank considerably from 2010 to 2024 (-98%), displaced by larger volumes of imports and renewables.

Renewables

According to the NECP, Luxembourg aims to increase the share of domestic renewable energy in electricity consumption to 39.1% by 2030 (and 44.3% in 2040) from 21% in 2024 – driven mainly by wind, solar PV and solid biomass. Significant expansions of renewable energy will need to contend with limited space in-country, compounded by occasional local opposition. In 2024, solar and wind contributed to 30% and 29% of domestic generation, respectively. Wind generation is targeted to reach 1 043 gigawatt hours (GWh) by 2030 and 1 368 GWh by 2040, compared to 473 GWh in 2024. Generation from solar PV is projected to increase to 1 112 GWh by 2030 and 1 574 GWh by 2040 from approximately 485 GWh in 2024.

Wind and solar PV generation (2024) and targets (2030, 2040) in Luxembourg



Sources: IEA analysis based on IEA (2026), World Energy Balances; Government of Luxembourg (2024), NECP (accessed in October 2025).

Measures that provide additional support to the scenario include expanding both small and large-scale PV installations, promoting self-consumption, PV readiness for new buildings, tax incentives, and accelerating and facilitating permitting procedures for new installations.

Luxembourg has several investment aid programmes to support renewable electricity production:

- **Small-scale PV installations (≤ 30 kilowatts [kW]):** The Klimabonus scheme offers subsidies for PV systems operated in self-consumption mode and a feed-in tariff for 15 years.
- **Large-scale PV installations:** Since November 2022, tenders have been held to support larger PV systems targeting self-consumption, providing investment aid (without operational aid) to companies. More recently, the government started offering a higher premium for tenders of solar plus batteries. In addition, new tenders are underway to support PV systems on sealed surfaces, including operational aid. A separate, dedicated tender exists for PV installations on agricultural land. This approach creates three complementary benefits to maximise positive outcomes on a single site and project: renewable energy generation, continued agricultural activity and ecological improvements.
- **Other renewable technologies:** Investment aid is available for wind, biogas, solid biomass and post-consumer wood. The law is being amended to align with

EU objectives (Fit for 55, Green Deal, REPowerEU) and encourage corporate participation in the transition to a carbon-neutral economy.

- **Municipal projects:** The Climate and Energy Fund provides investment aid to municipalities for renewable energy initiatives.

Operational support for renewable electricity production is based on the amended Grand Ducal Regulation of 1 August 2014 on Electricity Generation from Renewable Energy Sources. This framework is regularly updated to reflect economic conditions across technologies such as hydro, solid biomass, post-consumer wood, biogas, wind, PV and wastewater/sewage plants.

For large-scale PV and agrivoltaic projects, Luxembourg organises annual tenders based on market premium contracts.

Additional incentives include a tax exemption for income generated from the sale of electricity from PV systems ≤ 30 kW, a reduced value-added tax rate of 3% for PV installations, and exploration of other tools such as long-term renewable electricity supply contracts with risk-reduction instruments or contracts for difference.

To address permitting delays and grid connection issues for renewable projects, Luxembourg launched a national consultation in November 2024 (referred to as the *Einfach-Séier-Erneierbar*, Simple-Fast-Renewable), led by the Ministry of the Economy (Energy Directorate); the Ministry of the Environment, Climate and Biodiversity; and the Ministry of State. The government identified and approved 51 concrete measures. The key reforms include:

- **Streamlined procedures:** Faster approvals, clearer environmental rules, single contact points and more digital processing; removal of most municipal building permit requirements for renewable projects.
- **Better land use:** Expanded agrivoltaics, PV along motorways, reduced safety distances for wind turbines and easier installation of PV in apartment buildings.
- **Public engagement:** Dedicated support for citizens and developers, plus enhanced Geoportal mapping with restrictions and wind data.
- **Improved financial aid:** Pre-financing for small PV grants, stronger municipal/social housing support and better incentives for PV carports.
- **Grid capacity upgrades:** Transparent capacity allocation and measures to enable renewable sharing and storage.

Luxembourg is a frontrunner in European energy co-operation. To address the limited space in-country to develop renewables, Luxembourg participates in the EU Renewable Energy Financing Mechanism, "which builds on joint efforts between countries where renewables development is naturally constrained and countries that have a higher potential to host new generating installations". In 2016, the co-operation took the form of statistical transfers. A new co-operation mechanism has been added in recent years, introduced by Regulation 2018/1999 on the Governance of the Energy Union and Climate Action. This mechanism allows contributing countries to support new renewable energy projects abroad through competitive tenders and share the statistical benefits of generation. In the first call, Luxembourg committed EUR 27.5 million to 7 solar PV projects in Finland with a combined capacity of 283 megawatts (MW). In the second call, Luxembourg will provide EUR 52 million, commissioning 446 MW of capacity via 7 solar PV plants in Finland and 2 onshore wind farms in Estonia.

Market structure

Major players in Luxembourg's electricity sector include the grid operators – the transmission system operator (TSO) Creos Luxembourg S.A., four distribution system operators (DSOs) and the industrial system operator SOTEL – the national regulatory authority (ILR), various electricity suppliers and producers operating within the EU market design, which aims to ensure an efficient and secure supply. The Ministry of the Economy is the competent authority for the sector.

Luxembourg's electricity system is closely integrated with Germany's at the technical and wholesale levels. The two countries share a common bidding zone, resulting in identical wholesale electricity prices. This set-up also entails shared TSO-level services, common reliability standards and joint access rules for wholesale markets. In contrast, retail markets are organised separately, with distinct legal requirements and market communication processes.

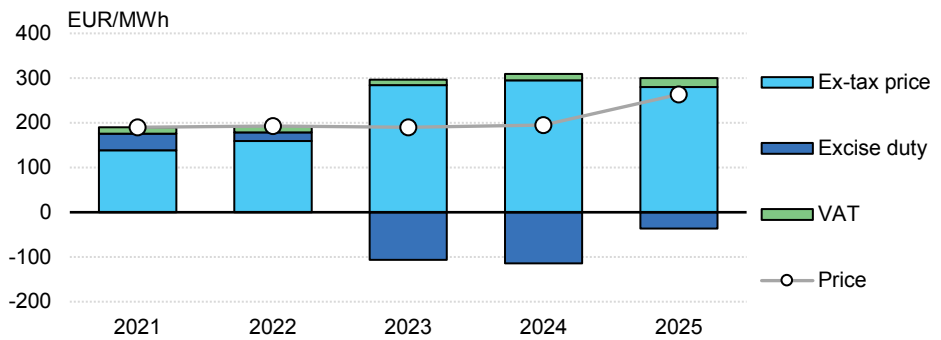
Electricity prices

Electricity pricing in Luxembourg comprises three components: the wholesale energy price, network fees and taxes. The wholesale energy price is determined at the level of the Germany-Luxembourg bidding zone. Network fees historically make up the largest share of the bill (35-45%) and differ by voltage. The regulator ILR sets the grid fee. Taxes and charges, accounting for less than 20% of the bill, include value-added tax, the excise duty and the compensation mechanism. In 2023, to mitigate high

electricity prices, the government introduced a fixed direct price support to all consumers by deducting a negative contribution from the bill. The measure limited the subsidy to customers whose annual consumption was below 25 000 kWh. It helped limit the increase in energy costs observed since 2023. At the beginning of January 2025, a new grid-pricing structure closely tied network fees to both household consumption and the time of use, aiming to spread demand more evenly and reduce grid investment needs. The government also decided in 2025 to absorb network costs into the state budget for three years (2026-2028) to alleviate electricity prices for both households and industry and bolster the economic case for electrification.

Electricity supply in Luxembourg is offered under two models: 1) integrated supply, for which consumers receive a single bill for all components; and 2) non-integrated supply, for which consumers are billed the electricity price only and pay network fees and other charges to the grid operator directly. The second model is only offered to non-residential consumers.

Residential electricity price components in Luxembourg, 2021-2025



Notes: The fixed direct price support appears as a negative component, reducing total price. The ex-tax price is defined as the price component corresponding to all non-tax expenses, including manufacturing costs, distribution, and network charges as well as the profit margins for the companies involved in the manufacturing chain. VAT = value-added tax.

Source: IEA (2026), Energy Prices.

Network development plans

Growing electrification means that peak demand is expected to jump in Luxembourg. Alongside rising renewable generation facilities, the situation foretells sizeable grid expansion needs, translating into high investment costs. Complementary flexibility applications are an important solution to limit grid expansion needs.

Luxembourg's electricity import dependency will remain high, making a robust network essential to its secure supply. As per the electricity law, network development plans (both transmission and distribution) must be based on scenarios that reflect the country's demographic, economic and social trends; national energy policy goals; and EU-wide strategies for meeting general and specific long-term objectives. These plans must also consider the potential of active demand-side participation, energy storage and other alternatives to grid expansion. In addition, they should incorporate consumption forecasts, cross-border electricity trade, and investment plans for EU and regional grids.

The Transmission Grid Network Development Plan is well established, with the latest update published in 2024 (covering the period 2024-2034 with an outlook to 2040). Plans for distribution grids are still in the development phase (with the first draft plans due by the end of 2025). The transmission plan notes the particular importance to Luxembourg of a significant ongoing upgrade of an interconnector with Germany to 380 kV. It also highlights the need for additional interconnection capacity in the medium to long term, driven by rising electricity consumption.

Complementing the NECP and the grid operators' network development plans, the Government Commissioner for Energy's biannual security of supply monitoring report provides an overview of supply quality, existing transmission and distribution grids, and planned future developments.

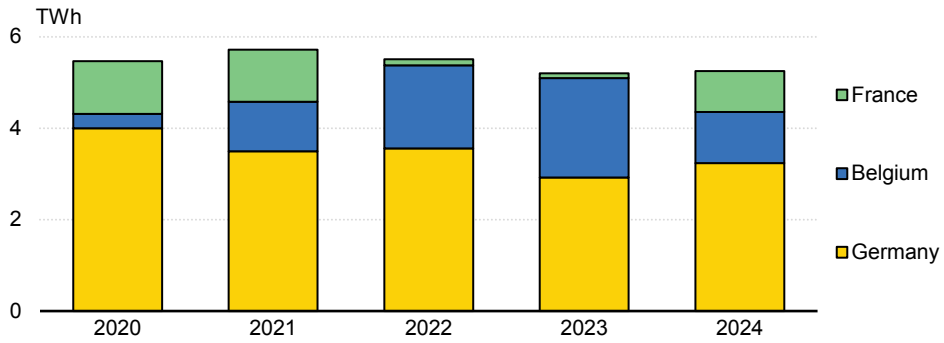
Based on the outcome of the "ESE" consultation process, the TSO/DSO Creos is in the process of updating its grid connection process. This encompasses continued upgrading of existing grid capacities in accordance with the network development plan, working out flexible connection agreements, establishing regularly updated and publicly accessible capacity maps, and streamlining the capacity reservation process to ensure that unused reserved capacities will be freed-up.

Trade and interconnections

In 2024, electricity imports accounted for 85% of Luxembourg's electricity demand, with Germany its primary trading partner. Belgium represented 21% of imports in 2024, down from a peak of 40% in 2023.

Peak electricity imports are expected to increase, and infrastructure upgrades are planned to ensure electricity supply. The TSO anticipates peak import capacity to rise to 1 100 MW by 2030 up from 712 MW in 2022, and up to 1 600 MW by 2040, driven by economic growth and electrification. Around 75% of the interconnection capacity from Germany may already be used in a contingency case today. Interconnection needs will be determined by peak import needs in the future as well, although excess generation is projected to reach about 1 400 MW by 2040. Luxembourg currently has two 220 kilovolt (kV) double lines with Germany, one of which is planned to be upgraded to a 380 kV line, to be operational in 2029. This upgrade will increase transmission capacity with Germany from 980 MW to 1 500 MW. Additionally, there is another 220 kV single interconnection line with Belgium. To support system stability, the TSO plans to install voltage control and reactive power compensation equipment at high-voltage levels.

Luxembourg's net electricity imports by country, 2020-2024



Source: IEA (2026), Electricity Information.

System integration and flexibility

From a legal perspective, the amended Law of 1 August 2007 on the Organisation of the Electricity Market sets out provisions for integrating renewable energy while ensuring that network stability and safety requirements are met. The provisions include simplified procedures for new renewable electricity producers, a framework for self-consumption and the establishment of energy communities.

While the NECP does not set explicit flexibility targets, enhancing system flexibility is the central objective of measures under the "internal energy market" dimension. These measures include a nationwide smart meter roll-out, the development of an energy data platform, a regulatory framework for aggregation, adjustments to network tariffs, a mandate for dynamic pricing and explicit support mechanisms for flexibility.

Since the NECP update, several steps have been taken to reduce barriers and promote flexibility. In the retail market, the requirement for suppliers with more than 15 000 customers to offer dynamic tariffs has entered into force and two suppliers now provide such offers.

On the grid side, a reformed low-voltage tariff structure took effect on 1 January 2025. It incentivises users to avoid consumption peaks by applying an exceedance fee above a set "reference power" threshold, determined by each customer's historical usage and used to calculate the monthly fixed fee. Reviews of the medium-voltage and high-voltage tariff structures have progressed, with grid operators completing the public consultation mid-2025 and preparing proposals to make tariffs more cost-reflective and further incentivise flexibility.

Luxembourg's market for demand-side management has so far seen limited development. This is due to the country's small market size and its strong reliance on the German market for several flexibility-related functions, such as balancing. As a result, Luxembourg has not been a primary focus for aggregators. Although the current law does not prohibit aggregation services, a detailed regulatory framework has not yet been established. However, a significant step forward occurred on 1 January 2025, when access to all balancing market time frames was opened to Luxembourg. Previously, grid users could only participate in the frequency containment reserve time frame. However, pooling within these markets remains restricted to Luxembourg and is not permitted across the Luxembourg and German scheduling areas.

Finally, policy efforts have increasingly focused on storage, particularly batteries. A national battery storage strategy was issued in July 2025 to promote and develop battery storage in Luxembourg. The Strategy defines the role of batteries in the

electricity system, outlines their value stacking opportunities, and proposes measures to remove barriers and encourage battery storage projects. The 20 proposed measures focus on 5 areas: 1) strategic framework; 2) efficient system integration; 3) grid tariff structure; 4) financial support; and 5) improving information, awareness and support.

Fuels

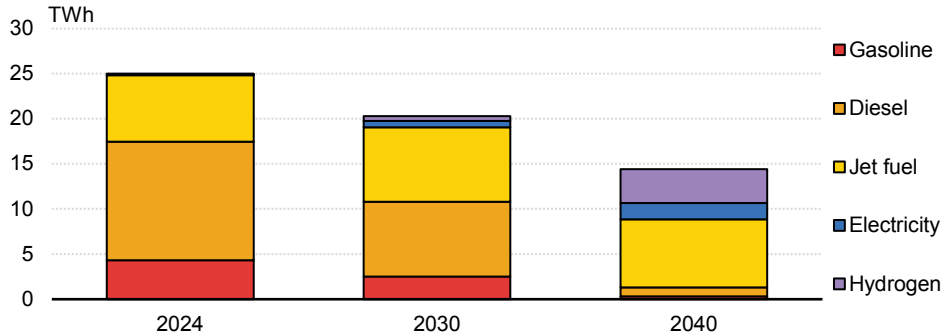
Luxembourg has no domestic production of oil, natural gas or coal, and imports all its fossil fuel needs.

Oil

Oil continues to be the most important fuel in Luxembourg, supplying more than half of the country's total energy demand. Oil demand is highly concentrated in two sectors: transport and international aviation. Road transport accounts for about two-thirds of all oil use, and international aviation represents more than a quarter of total demand. Fuel sales to non-residents are the main driver of oil demand in transport. Fuel sales dropped sharply during the Covid-19 pandemic and have remained significantly below pre-pandemic levels, about 20% lower than they were before 2020.

Luxembourg expects its oil consumption from the transport sector to progressively decline to 2040 based on policy measures from the NECP.

Energy consumption in transport by fuel and projections in Luxembourg (2024, 2030, 2040)



Source: Government of Luxembourg (2024), NECP (Accessed in September 2025).

Luxembourg imports all of its oil consumption in the form of refined products. It does not have domestic oil refining capacity. Oil infrastructure is thus limited to several fuel distribution centres, storage infrastructure and one oil pipeline. One of the main challenges the country is facing during the energy transition is phasing down fossil fuel consumption in parallel with decommissioning storage infrastructure.

Because Luxembourg imports all its oil consumption as finished products, the major players in the oil industry are importers of refined products along with one independent tank farm owner (Tanklux S.A.). Some of these importers are also the main retailers and operate the majority of the approximately 230 fuelling stations.

Luxembourg maintains a maximum price-setting mechanism for oil products through a signed agreement between the state and oil-importing companies. This sets a maximum price for oil products sold to the end-consumer, including gasoline, automotive diesel, heating oil and liquefied petroleum gas. The formula is calculated daily, based on market prices for oil products along with taxes and distribution costs.

Natural gas

While natural gas demand is in decline in Luxembourg, it continues to play a significant role in buildings and industry, representing around one-third of the energy use in each of them in 2024. In 2024, natural gas accounted for 17% of total energy supply, although absolute consumption levels have dropped notably, particularly following the price surge triggered by the Russian Federation's (hereafter, "Russia") invasion of Ukraine. Gas has nearly been phased out for electricity and district heat production following the decommissioning of the country's sole large-scale natural gas power plant in 2016. Within industry, iron and steel are the main consumers of natural gas. Gas consumption in industry fell by more than one-third from 2019 to 2024, led by the non-metallic minerals sub-sector. In 2024 natural gas was mainly sourced from the Netherlands and Norway.

Luxembourg's forecasts to 2040 (based on additional policy measures from the NECP) show natural gas consumption steadily declining, by nearly 30% in 2030 compared to 2024, 50% in 2035 and 75% in 2040.

Natural gas consumption projections by sector in Luxembourg, 2024-2040

GWh	2024	2025	2026	2027	2028	2029	2030	2035	2040
Energy industry	716	626	537	447	358	268	179	0	0
Manufacturing industry	2 239	2 149	2 068	1 989	1 877	1 793	1 674	760	182
Households	2 920	2 650	2 622	2 600	2 552	2 528	2 455	2 031	1 508
Tertiary	970	905	834	776	726	661	594	276	0

Sources: Government of Luxembourg (2024), NECP (accessed in September 2025).

The main players in the gas sector are the grid operators (the TSO, Creos Luxembourg S.A., and the three DSOs: Creos Luxembourg S.A., the city of Dudelange and SUDenergie S.A.), the national regulatory authority (ILR) and the gas suppliers. The Ministry of the Economy is the competent ministry for the gas sector.

The grid operators are all majority publicly owned. The TSO Creos Luxembourg S.A. is legally unbundled from any other gas supply company. A full ownership unbundling of the supply and grid activities is not mandatory in Luxembourg according to a derogation under the EU Directive.

Since 2015, the two gas TSOs, Fluxys Belgium and Creos Luxembourg, together with the regulators, CREG and ILR, have integrated their national markets into one common “BELUX” market zone. With the removal of the two interconnection points (Bras and Pétange) from the commercial offer, grid users no longer have to reserve capacities on the Belgium/Luxembourg border to transmit gas between the two countries. The balancing of gas in the BELUX market zone is co-ordinated by one single, common entity called Balansys S.A.

Gas grid operators have no further plans to expand grids. However, ongoing maintenance costs and security of supply considerations even beyond 2040 mean that grid utilisation costs are expected to increase for the remaining network users.

Considering this gradual reduction in the use of the grids and to reduce the risk of stranded costs being borne by grid operators, the national regulatory authority has adopted a new regulation that allows faster depreciation of grid assets.

Coal

Coal in Luxembourg today is almost solely used by the industrial sector, particularly in processes requiring high heat. It has very limited usage in electricity generation or residential heating. The country imports all its coal needs, mainly from South Africa.

Recommendations

1 Drive long-term system-wide energy planning by strengthening co-ordination and enhancing current planning tools.

Though Luxembourg is a small country, energy strategies appear to be considered by topic and undertaken in a siloed rather than a unified approach. While the NECP provides a broader system-level view to 2030, the government should also consider translating this into a long-term energy strategy to guide the development of various energy sub-sectors in a co-ordinated way. The future energy system will become increasingly interconnected. For example, electricity network development plans (including both transmission and distribution networks) will need visibility on the development and implementation of battery storage and behind-the-meter systems, and aggregation services and corresponding regulatory frameworks. Meanwhile, the development of hydrogen will hinge on industrial decarbonisation plans, electricity availability and the use of the existing gas grid. Therefore, Luxembourg would benefit from an overarching system-wide plan that is underpinned by robust scenario analysis to provide investment guidance on what energy assets are required in which locations and within which time frames. Given Luxembourg's high import dependency, it is important to assess this within the broader context of the country's integration into the European internal energy market. Such system-wide planning would also provide more clarity on the future of the gas grid and could inform measures to prevent depreciation and decommissioning costs falling on other ratepayers or taxpayers (such as a decommissioning fund that is financed by fees levied on current gas users). It could also offer an important opportunity to assess contingency plans (such as CCUS or process heat from biomass) if the hydrogen supply is not available on time

or at a reasonable cost to meet decarbonisation demand from industry. Apart from Luxembourg's NECP, the TSO's network development plans and scenario reports for the electricity system already offer a good foundation in this regard. The increased use of scenario-based assessments throughout the energy system planning would further allow for updates to modelling assumptions and cost comparisons of different pathways to course-correct for new developments and technological breakthroughs. A comprehensive, long-term energy strategy that integrates the different existing planning tools would additionally help communicate government policies and their rationale to the general public more clearly. It would also be of important added value in anticipating and organising cross-border interdependencies. Luxembourg could look to examples in Germany or Sweden, where future energy policy planning is taking a broad, system-wide view.

2 Step up communication efforts on energy policy measures.

Luxembourg has made considerable progress on its energy transition in recent years, underpinned by a stable policymaking environment. The government has a number of policy measures in place across sectors to incentivise energy efficiency and decarbonisation solutions in buildings, transport and industry. However, increased uptake requires effectively motivating behavioural change in consumers and mobilising citizens to take action. While financial incentives certainly help, the government should supplement these with a ramped-up communication. This would not only include clear communication on the policy measures available and ways to use them, but it would also delineate the concrete benefits to consumers. While decarbonisation to address climate change is one important objective, the government should equally emphasise the long-term benefits for energy security (by reducing dependence on fossil fuel imports that are vulnerable to geopolitical disruptions) and affordability that the measures can deliver. The Luxembourgish government has a track record of providing information on political decisions to its citizens through, for example, interviews, press releases and social media, and its Klima-Agence is already doing good work to offer households and small businesses information and advice on energy upgrades, complemented by Klimabonus incentives. The government could build upon these efforts to pursue broader and more system-wide communication to help shift consumer behaviour and increase the uptake of available fiscal measures in support of energy transition goals across sectors. Beyond fiscal measures, increased communication could also support more active consumer participation in electricity markets using Luxembourg's highly

successful roll-out of smart meters. Targeted communication campaigns to promote increased home renovations for different categories of households would also help, as would efforts to dispel false narratives about heat pumps. Likewise, clear communication to households on the benefits of heat pumps, notably cost savings based on efficiency gains even considering a variance between electricity and natural gas prices, might also support increased uptake. Highly visible one-stop shops (OSS) that offer guidance to consumers through a personalised approach can increase the number of people reached, build trust and ultimately strengthen the effectiveness of policies. In many European countries, the role of OSS is growing. The communication and outreach dimension is thereby becoming increasingly important, as seen, for example, in the HORIS initiative taking place in Spain, Italy and Portugal that focuses on consumer-centred digital communication. Luxembourg can learn from these established best practices to set up its own OSS. Energy sector stakeholders also seem to need better information on the available policy support measures and long-term energy policy goals. At present, there appears to be considerable unease on the part of stakeholders and the general public about the longer term outlook for electricity prices. However, considering annually rising CO_2 taxes that will progressively increase the prices of natural gas and oil, the business case for electrification might already be stronger than the average citizen assumes. Clear communication from the government could put these developments into perspective and guide the general public toward the most suitable solutions.

3 Increase efforts to address fuel consumption and emissions in transport and assess ETS2 impact to ensure post-2027 effectiveness.

Luxembourg's transport sector is an outsized contributor to total energy consumption (more than half) and emissions (nearly 60% in 2024). Fuel sales to commuters and freight from neighbouring countries refuelling in Luxembourg is a major driver of energy demand in the transport sector, as is a high reliance on private cars for passenger travel. Though transport has seen more notable emissions reductions compared to other sectors in recent years, sharper drops will be required to meet Luxembourg's climate targets in the future. To address the high rates of vehicle ownership among citizens, the government could consider higher taxes on vehicles. Luxembourg presently has relatively low vehicle taxes compared to its neighbouring European countries. Additional measures could be considered relative to those already implemented to encourage the adoption of alternative modes of transport over high-emission vehicles. These include, among others, a potential revision of

ownership or registration taxes for internal combustion engine vehicles and further lowering benefits for company cars (to encourage alternative modes of transport), complementing the existing purchase subsidies for electric vehicles (EVs). To address the high fuel consumption stemming from fuel exports, the government will need a clearer long-term strategy to align retail fuel prices with those of its neighbouring countries. Its current tool for achieving this is the CO_2 tax, which has reached 45 EUR/t CO_2 in 2026. From 2028, the EU ETS2 is moreover projected to introduce an increase in fuel costs across the EU countries, as all European member states are covered by this new legislation. This has an unavoidable impact on Luxembourg's efforts to close fuel price gaps with neighbouring countries. The future of the CO_2 tax itself is uncertain as the government deliberates on whether or not to replace the tax fully with the ETS2 framework. If it does not preserve an additional CO_2 tax, other tools to tackle fuel price divergences with neighbouring countries will need to be explored, keeping in mind CO_2 reduction goals. While any government decisions in this area will have notable immediate fiscal consequences for the state budget, Luxembourg in any case needs to prepare for a wind down of fuel tax revenues as passenger vehicles (both domestic and in neighbouring countries) shift toward EVs over time.

4 Maintain focus on policy levers to increase the uptake of electric heavy-duty vehicles.

Luxembourg has robust purchase subsidies in place to promote electric light-duty vehicle sales, supporting increased electrification of the passenger vehicle fleet. However, progress on increasing the penetration of electric vehicles in the heavy-duty segment is lagging. The government significantly strengthened its efforts to address this issue. The 2026 implementation of new policies that increase financial incentives to compensate the price difference between electric and internal combustion engine heavy-duty vehicles is expected to have a positive impact. One of the key remaining impediments to the uptake of electric trucks is hesitation to undertake upfront investments in a context where the market is quickly evolving and models could quickly become obsolete. The government could additionally consider offering residual value guarantees for electric trucks, whereby it commits to cover the possible shortfall in an asset's value at the end of its useful life if market conditions fall short of expectations. This would help derisk investments by companies and support increased demand for electric trucks, which would in turn accelerate market growth. The benefit of residual value guarantees over purchase subsidies is that they avoid an immediate budgetary outlay for the government, and if market development is

strong enough, the government may never need to disburse payments. In addition, though the government has made progress on electric charging stations for EVs, electric trucks still seem to lack enough charging infrastructure to complete freight deliveries. The government should continue supporting a wider buildout of public charging points for trucks (in co-ordination with its neighbouring countries), especially along certain heavily trafficked freight corridors. Notably with high-power, heavy-duty vehicle charging, grid upgrades may be required, so the government could facilitate co-ordination among stakeholders (charge point operators and grid operators). This can also apply not only for public/highway chargers but also for truck depots, where financial support to install overnight chargers would be a useful incentive. More broadly, the government should focus decarbonisation efforts in the heavy-duty road segment on electrification rather than hydrogen (given the scarcity of supply and the high prices for hydrogen).

5 Support more grid connection requests through a revised selection process that prioritises project viability.

As in many European countries that are expanding renewable energy generation to support rapid electrification and large loads (such as data centres and electrolysers), Luxembourg faces surging grid connection requests from renewable generation projects, not all of which will be realised. Already, according to the TSO, solar PV connection requests have breached the NECP's 2030 target levels, while wind connection requests are quadruple the capacity projected in the NECP. The situation has forced the TSO to delay connection requests because the grid cannot accommodate them, thwarting much-needed growth in renewables generation. Expansions and reinforcements of the grid are undoubtedly important in this regard. In addition, given the country's limited grid capacity and cross-border interdependence, a traditional first-come, first-served approach to grid connections risks locking in projects that may not materialise while delaying more viable and mature investments. To address this, Luxembourg should build on Creos' ongoing efforts to update its grid connection process, including to move toward a connection process that prioritises projects based on their viability, such as the grid connection reforms recently enacted in the United Kingdom. Assessing grid connections in batches rather than individually, such as in Ireland and Italy, could also speed up connections. In the Netherlands, the regulator allows grid operators to deem certain projects as high priority and fast track their connections. Such changes will require early engagement of the TSO in renewable energy tenders to provide inputs on

project type and location that best suit grid needs and availability. The selection criteria will need to be clearly defined based on specific (and objective) metrics to demonstrate readiness and feasibility, and must be implemented with the utmost transparency to offer maximum clarity to renewable project developers. These efforts would complement those being undertaken by the TSO, which plans to publish a grid capacity map that identifies parts of the grid with extra capacity relative to congested areas.

Focus areas

Hydrogen

Hydrogen will form a key pillar of Luxembourg's path to net zero emissions by 2050, notably in applications in the industry and transport sectors that are harder to decarbonise with electrification. The early years of hydrogen market penetration in Luxembourg will be focused on replacing current volumes of fossil hydrogen with low-emissions hydrogen, followed by longer term expansion of low-emissions hydrogen into end-use applications. Moreover, Luxembourg is keen to retain its role as a critical transit country in Northern Europe by serving as an integral part of a broader European hydrogen network in collaboration with its neighbouring countries.

Hydrogen Strategy

In alignment with its NECP, Luxembourg released its Hydrogen Strategy in 2021, which takes stock of current hydrogen consumption and forecasts future hydrogen demand possibilities based on the goal of climate neutrality by 2050. The report notes that energy efficiency along with electrification remain the priorities for decarbonisation where they are available, while hydrogen use would be limited to areas that are difficult to decarbonise with electrification, such as heavy industry and heavy transport.

The Strategy presents seven measures to help achieve its ambitions, including to support production, import and demand for renewable hydrogen. These are:

1. Contribute to the creation of an EU legal and regulatory framework, including on the certification of renewable hydrogen and support instruments.

2. Co-operate with international partners (the European Union and third countries) on trade, infrastructure and financing.

3. Identify research and innovation opportunities in Luxembourg.

4. Realise flagship projects, aligned with domestic research and innovation strengths and decarbonisation opportunities in industry. These will include pilot projects for domestic renewable hydrogen production, the methanation of CO_2

from biogas, the installation of the first hydrogen refuelling station, connection to an interconnected hydrogen network, and projects under the EU Important Projects of Common European Interest programme.

5. Prioritise actions toward demand creation for renewable hydrogen in key sectors.

6. Develop market instruments that support supply and demand toward the creation of a renewable hydrogen market.

7. Implement a governance structure (Taskforce H_2 Luxembourg) to ensure the implementation of the Hydrogen Strategy.

The implementation of the Strategy is undertaken through regular meetings among involved ministries and with stakeholders. The Strategy is in the process of being updated.

Hydrogen infrastructure

Given the importance of hydrogen infrastructure that needs to be operated and developed by a hydrogen network operator, Luxembourg's 2025 hydrogen law establishes a legal framework for planning, building and operating hydrogen networks. It enables the government to streamline land acquisitions and permitting for pipelines and requires the appointment of at least one hydrogen network operator to oversee technical and environmental compliance (oversight of tariffs and market transparency will fall on the Luxembourg Regulatory Institute). The law calls for a ten-year development plan to guide the hydrogen infrastructure buildout and cross-border interconnections. As of 1 December 2025, Creos Luxembourg Hydrogen S.A. has been designated as the country's hydrogen network operator, marking an important step in kickstarting these activities.

The law aims to position Luxembourg to be able to import the volumes of hydrogen from its neighbouring countries necessary to achieve its climate neutrality target. Toward this end, regular co-operation is ongoing with the European Commission and the H2Global auction mechanism, with the aim of ensuring that hydrogen will be available in the future to fill pipelines. Likewise, Luxembourg is also pursuing bilateral collaboration with Belgium, France and Germany and is active in several multilateral fora, including Benelux, the Pentaleral Energy Forum and the North Seas Energy Cooperation, to identify national needs and cross-border co-operation opportunities

(for example, if Luxembourg could develop an interconnected hydrogen grid that would not only allow imports for national needs but also transit to and from its neighbouring countries). Luxembourg's natural gas TSO is also in ongoing discussions with its counterparts in neighbouring countries to co-ordinate on hydrogen market development.

Demand

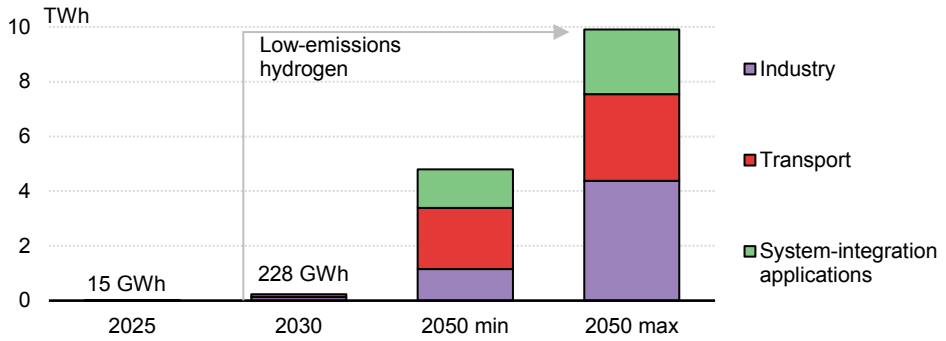
Luxembourg's Hydrogen Strategy notes that current hydrogen consumption is around 450 t of fossil hydrogen. Substituting current (imported) fossil hydrogen consumption with renewable hydrogen is considered to be the first step of the strategy, which could bring CO_2 emissions down with 5 000 t annually. In the longer term, the Strategy expects that renewable hydrogen and its derivatives could reduce GHG emissions by 1-2 million tonnes CO_2-eq per year. As a result, the country could cut up to 20% of its GHG emissions in 2050 from three priority sectors: industry, transport and a future-proof integrated energy system (that supports energy storage and grid flexibility). This would equate to hydrogen demand potential in Luxembourg of 125 000-300 000 t per year by 2050 (or around 4 000-10 000 GWh).

The NECP updates hydrogen demand forecasts, with total demand for 2030 (from road transport and industry) expected to reach 230 GWh by 2030. In aviation, hydrogen demand is projected to reach 104 GWh in 2030 based on the renewable fuels of non-biological origin (RFNBO) target of 1.2% of total fuel consumption.

The key applications for hydrogen (where electrification or biomass are not considered feasible) in Luxembourg's industry sector are in steel and aluminium, glass, cement, and chemicals. In transport, the focus is on long-distance heavy transport and aviation.

An updated 2024 subsidy for zero-emissions vehicles also covers hydrogen fuel cell vehicles (for light-duty vehicles).

Projected hydrogen consumption in Luxembourg, 2025-2050



Source: IEA analysis based on Government of Luxembourg (2021), Luxembourg's Hydrogen Strategy (accessed in October 2025)

Supply

The availability of competitively priced low-emissions hydrogen remains a key challenge for Luxembourg to meet its targets. Given that hydrogen pipelines are not expected before 2030 (and supply in Luxembourg could be challenging even beyond that date), Luxembourg expects that domestic production of renewable hydrogen would need to meet limited domestic demand in the earlier years of market development. Over time, if hydrogen demand were to grow in line with net zero needs, the bulk of demand would need to be met by imports, given that the sizeable volumes of clean electricity needed to support hydrogen demand would be unrealistic in Luxembourg's context.

In October 2024, the Ministry of the Economy launched a EUR 110 million call for projects to support renewable hydrogen production domestically, with a single project receiving up to EUR 30 million. The funding, which can be combined with other EU aid, is meant to cover 45% of the eligible investment costs and operational costs capped at 7 EUR/kg of hydrogen (with 3 EUR/kg as an additional bonus for renewable energy production capacity installed based on a hydrogen project). The goal is to support approximately 12 MW of electrolyser capacity for the production of renewable hydrogen. This pilot call for projects showed that hydrogen production costs in small projects are far from competitive. Nonetheless, the government contends that a certain level of domestic production capacity should be developed to facilitate the

development of expertise needed later to switch industries to hydrogen. Therefore, the government intends to draw on lessons learnt from the concluded pilot call for projects and, together with the EU Clean Industrial Deal State Aid Framework, to introduce a new support scheme for additional domestic production projects.

Also in October 2024, the European Commission approved a new Luxembourgish state aid scheme to further accelerate investments in key sectors for the transition towards a net zero economy, granting investment support for the manufacture of strategic equipment (such as electrolysers) or key components.

Luxembourg's production of hydrogen is closely tied to its plans to expand renewable electricity generation capacity, whereby surplus renewables generation could be used to power electrolysers for hydrogen production. At present, however, Luxembourg's surplus domestic renewables generation is limited, with most electricity consumption being met by imports.

Key projects

Luxembourg Hydrogen Valley is a public-private partnership that aims to establish a hydrogen valley (an area where hydrogen serves multiple end-use applications) in Luxembourg. It is a five-year project that began in 2023 and is funded by the EU Horizon Europe programme. The project aims to set up a 5 MW electrolyser facility in the industrial park of Bascharage to produce 300-400 tonnes of hydrogen annually. First production is targeted for 2026. The project's goal is to deploy low-emissions hydrogen initiatives across the full value chain, from local production to consumption, including storage and distribution for applications in industry and transport. It also plans to connect to other existing and planned infrastructure. Lessons learnt from the project are expected to be applied to similar projects in central and eastern Europe. The project's total budget is estimated at EUR 39 million, with EUR 8 million from the EU Clean Hydrogen Joint Undertaking. A final investment decision on the project was due in early 2025 but is still pending.

ECHO-WAVE is another pilot project for low-emissions hydrogen production. It will combine a 2.5 MW electrolyser with on-site renewables (agrivoltaic solar, a wind turbine and battery storage) to produce around 180 tonnes of RFNBO-compliant hydrogen per year starting in 2027. Supported by the EU Innovation Fund, the project aims to directly couple renewables with hydrogen production to cut roughly 23 500 t CO_2 over a decade and provide a scalable model for industrial decarbonisation and clean mobility in Luxembourg.

Luxembourg considers renewable hydrogen to have strong potential to support transit travel decarbonisation within its borders given its central location along European highway corridors. Toward this end, the first hydrogen fuelling station in Luxembourg was commissioned by TotalEnergies at the end of 2023 in an industrial zone in Bettembourg. The station is part of the H2Benelux initiative, co-funded by the EU Connecting Europe Facility, which has established 8 refuelling stations in the Benelux region (Belgium, Luxembourg and the Netherlands) to supply the 80 hydrogen-fuelled vehicles participating in the trial.

Several cross-border hydrogen infrastructure projects are also planned, including the MosaHYc initiative between the gas distribution network operators Creos in Germany and GRTgaz in France, in co-operation with the energy group Encevo in Luxembourg and the HY4Link project between system operators in Luxembourg (Creos), Belgium (Fluxsys) and France (GRTgaz).

Recommendations

6 Introduce support mechanisms to derisk hydrogen infrastructure development.

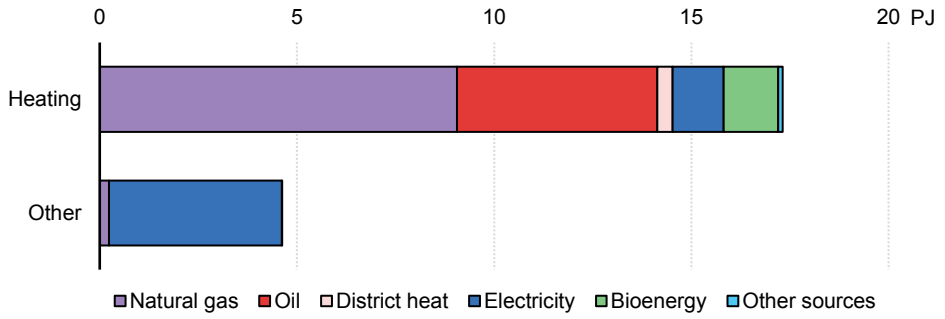
Given recognised limitations for domestic hydrogen production, Luxembourg will need to rely heavily on imported hydrogen to meet demand. In light of the country's smaller market size relative to neighbouring countries, a well-connected network will be imperative to ensure that hydrogen flow into and through Luxembourg to support a well-integrated system from which the country benefits. Therefore, co-ordination with its neighbouring countries will be paramount. Toward this end, the government's 2025 hydrogen law establishes a legal framework for developing hydrogen pipeline networks. However, private investors need a business case for pipeline investments, which is currently lacking, given that grid operators face major uncertainties on where supply or demand will come from and at what volumes. To start, investors will need clarity on how much of the existing natural gas grid would be repurposed for hydrogen (and therefore no longer used for natural gas) relative to how many new hydrogen lines would be required. In December 2025, the government designated a system operator to take up its activities in overseeing and planning network development (as called for in the hydrogen law). Complementing these efforts, the government should also introduce pragmatic measures to partially derisk investments by pipeline developers. One option is investment guarantees that would reduce the financial risks associated with early-stage hydrogen infrastructure projects by protecting investors

from potential losses linked to demand uncertainty, technology performance or regulatory shifts, thereby attracting private capital and lowering financing costs. Luxembourg could draw inspiration from Germany's amortisation account to derisk pipeline investments – which establishes a fund that compensates for high upfront investment costs and low initial revenues – tailoring it to Luxembourg's unique circumstances. Other examples of derisking investments include Denmark's model that combines CAPEX and OPEX subsidies or the Netherlands' model that applies a combination of CAPEX subsidies with a future tariff calculation that accounts for potential low utilisation during the early stages of market development. Denmark has also considered some alternative financing frameworks for the ramp-up period and Austria has unveiled a roadmap for hydrogen corridors to position itself as a European hub for low-emissions hydrogen. Meanwhile, the United Kingdom is combining an initial subsidy with a regulated asset base model under which the subsidy could be financed by a levy.

Decarbonisation of space heating

Accounting for around 20% of Luxembourg's energy-related emissions, buildings are an important sector to decarbonise to meet Luxembourg's climate targets. The vast majority of emissions in buildings comes from space heating, which makes it the focus area for decarbonisation efforts. Currently, almost two-thirds of space heating is fuelled by natural gas and oil, especially in residential buildings. Luxembourg considers the switch to electricity to have dual benefits of improving energy efficiency and lowering emissions. For new buildings, heat pumps are the reference heating system (with some exceptions), thereby ensuring that new fossil systems are no longer installed. However, given the age of Luxembourg's building stock, the most pertinent challenge is to decarbonise space heating in existing buildings, which requires turning over the current stock of fossil heating systems.

Energy consumption in residential buildings for heating and other end-uses in Luxembourg, 2024



Notes: Non-allocated energy use of energy sources in non-residential buildings is included in heating, except for electricity. Other sources includes appliances, cooking and, to a lesser extent, lighting and space cooling.

Source: IEA analysis based on IEA (2025), Energy End-uses and Efficiency Indicators.

The phase-out of fossil fuel-based heating systems is based on a voluntary approach, incentivised by subsidy schemes, with a focus on heat pumps, alongside plans for the development of efficient district heating. The trajectory for this phase-out was laid out in the NECP and will be further developed in the update of the national Long-term Renovation Strategy, which will be replaced by the National Building Renovation Plan currently under development.

Heat pumps

In the context of NECP modelling, the statistical office estimated that approximately 20 000 dwellings in Luxembourg were equipped with electrical heating (including heat pumps) in 2023. It is estimated that 3 750-4 000 units will be added each year.

The decarbonisation of homes using heat pumps is incentivised through subsidy schemes. Notably, the Klimabonus scheme offers subsidies on a national level for the installation of heat pumps, which can be combined with additional subsidies from municipalities as well as from obligated parties under the Energy Efficiency Obligation Scheme. The Klimabonus for housing and renewables covers around 25% of the cost for insulation and ventilation upgrades, 50% of the cost to replace fossil heaters with heat pumps or wood boilers, and 50-62.5% of the cost for solar PV installations. The

government also promotes information dissemination of the subsidies through the Klima-Agence subsidy simulator, which is accessible to all consumers. In addition to the online subsidy simulator, Klima-Agence also offers free advice by phone or in face-to-face appointments.

Following Russia's invasion of Ukraine and its impact on energy prices, Luxembourg saw an increase in demand for advice from Klima-Agence on alternatives to fossil fuel-based stand-alone heating systems, where heat pumps are the preferred alternative (with district heating options being limited to certain areas and its development taking more time; biomass is a constrained resource).

The biggest impediment to heat pump uptake is the cost differential (installation plus operating costs) of heat pumps compared to fossil-based stand-alone boilers (natural gas or fuel oil). The difference in investment costs is partially covered by the various subsidy schemes. With respect to the difference in operational costs due to energy prices, Luxembourg temporarily introduced price subsidies on different energies in 2022 and still maintains (in 2025) a price subsidy on electricity. The government is also supporting a training programme and IT tool by the Chambre des Metiers concerning an evaluation of the heat pump readiness of existing buildings.

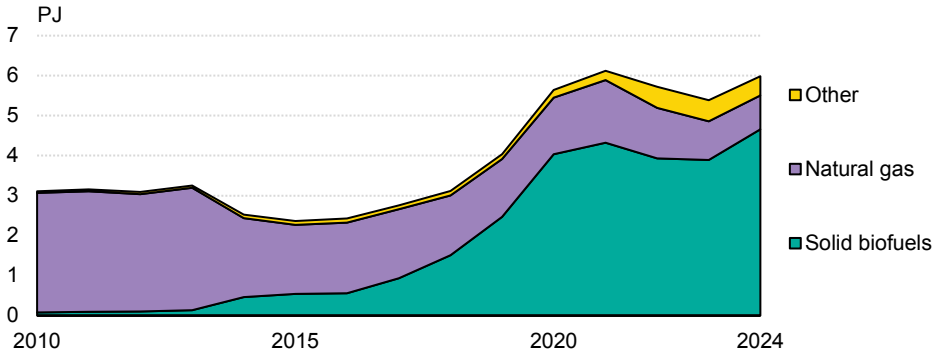
The evolution of fuel oil and natural gas prices compared to electricity prices is crucial for the competitiveness of heat pumps relative to fossil fuel boilers. In this context, the Prime Minister noted the importance of keeping electricity prices in Luxembourg below the European average to maintain social and economic strength. Luxembourg also wants to stabilise electricity prices over the coming years – without reverting to a price cap – to ensure affordable energy prices and encourage the shift to electrification. Toward this end, the government has decided to mobilise EUR 150 million from the public budget to directly finance a portion of grid costs (rather than pass them on to ratepayers) and to cover the costs of a renewables generation support mechanism (an additional EUR 120 million) that is currently financed by all electricity consumers.

District heating

In 2024, Luxembourg's heat production for district heating was around 6 PJ, satisfying 20% of the building sector's heat demand (mainly non-residential). Most of this heat was generated using natural gas or solid biofuels, such as wood pellets, wood chips and wood waste, as well as waste heat from industrial plants and waste incineration. More than 90% of district heating in Luxembourg is produced using efficient

co-generation plants. A trend is developing toward projects using heat pumps (air-to-water or geothermal) and low-temperature networks, although only a few small-scale systems are currently operational.

District heating production by fuel in Luxembourg, 2010-2024



Source: IEA (2026), World Energy Balances.

District heating production has undergone a significant transformation since around 2013. The initial phase of this shift involved replacing natural gas with solid biofuels. This then laid the groundwork for a substantial increase in district heating output, largely driven by solid biofuels. The successful transformation of district heating in Luxembourg led to one of the highest shares of renewables in district heating among IEA member countries, at 75%. As a result, Luxembourg's district heating system today has a relatively low-carbon footprint.

Between 2010 and 2024, district heating demand in buildings doubled, reaching more than 5 PJ. However, non-residential buildings continue to be the main consumer, while residential uptake remains minimal. There are several district heating networks of various sizes in Luxembourg, mainly clustered within the capital city and other larger cities along the French border in the south of the country. The development of district heating networks involved both the densification and expansion of existing networks and the implementation of innovative low-temperature projects in new neighbourhoods.

Luxembourg's NECP foresees policy measures for the further development of efficient, renewables-based district heating networks. Toward this end, Luxembourg is developing a new national regulatory framework to support local heat planning, the decarbonisation of existing district heating networks and the expansion of the district heating market. The new framework will address the following issues:

- setting the legal terms for the construction of networks and establishing the terms and conditions for operators
- defining the tasks of the energy network operator and designating a national regulator (such as for electricity and natural gas)
- analysing specific investment aid for the construction of district heating networks at very low temperatures.

Several subsidy schemes are already in place to assist private and public stakeholders in developing new networks and transforming existing ones. These schemes also support private households in connecting to district heating systems. Improvements to the existing subsidy schemes are currently going through the legislative process. Additionally, efforts are underway to enhance statistical data collection in the district heating sector.

Recommendations

7 Adopt a national framework for municipal heat mapping and planning and use it as a guiding strategy for low-carbon heating investments.

Heating accounts for a high share of Luxembourg's final energy consumption, with most demand still met by fossil fuels. This makes the heating sector a roadblock for achieving net zero targets. District heating can be an attractive solution to use available heat sources (such as waste heat from industries) to efficiently connect large groups of customers and to offer households without other options a heating solution. Under the recast EU Energy Efficiency Directive, Luxembourg is required to undertake comprehensive heat planning and mapping to identify cost-effective decarbonisation pathways, including the expansion of renewable and waste heat use, district heating and cooling networks, and energy efficiency in buildings. The government is currently working on such a framework, but it should prioritise and expedite these efforts to underpin a broader strategy to decarbonise the heating sector. Toward this end, beyond increasing the administrative capacity on heating at

the national level, the government should support local governments (e.g. by defining common planning methodologies and bolstering institutional capacity to undertake assessments) in developing municipal heating plans that lay out how to make their local heating infrastructure climate-neutral over time. These efforts would include identifying where district heating solutions can be developed economically and where gas connections will no longer be available. This will require the establishment of harmonised standards and methodologies for municipalities to collect and report on heat demand (by building type, density, sectoral use) and potential supply sources (renewables, industrial waste heat, data centres, wastewater plants, geothermal). It would likewise support the alignment of standards on equipment such as heat pumps from the national to the municipal level. Luxembourg could look to Germany's example (Heat Planning Act), which goes further than the EU Energy Efficiency Directive and establishes clear targets and timelines for municipalities based on a city's size and population. Notably, given lock-in effects from investments in heating infrastructure, clarity on the optimal mix of energy efficiency, electrification and district heating for each municipality can help steer investments in the right direction. The Klimapakt offers a good basis to undertake this co-operation, supplemented with targeted sharing of knowledge and resources with municipalities to support their efforts on heat planning. As part of this, strong engagement with local citizens and clear communication to households should be emphasised.

8 Introduce minimum energy performance criteria for home upgrades.

Luxembourg takes a voluntary approach to energy performance improvements in the residential sector. However, given the relatively low rates of energy renovations and the pace required to meet its climate targets, the government might need to consider additional measures to motivate more homeowners to renovate. One option that would not impose outsized burdens on households is broadening the criteria that trigger a minimum requirement for energy performance when a household undertakes a renovation. In a similar vein, the replacement of heating systems could be regulated to achieve a minimum level of energy performance for the new system. For instance, replacing an old fossil boiler would need to meet a requirement to upgrade to a minimum energy efficiency level (or GHG/particulate emissions or minimum share of renewables) to ensure that replacements come with significant improvements in energy performance. Not only would this help achieve a baseline level of energy performance improvements over time, but it could also motivate more ambitious voluntary upgrades if complemented with existing information campaigns and

financial incentives. Well-embedded one-stop shops that provide guidance to citizens are driving rising renovation rates in other countries. Luxembourg can build on their lessons learned to spearhead its own infrastructure. Likewise, the government could regulate a minimum rating when an older home is sold or rented to support the upgrading of the existing building stock. For example, France does not allow a home to be rented if its energy class is too low (G-rated), with the minimum rental class level evolving over time.

9 Consider a progressive application of financial incentives for replacing fossil heating systems to motivate faster replacements.

Luxembourg has a high share of fossil heating systems in its building sector, especially in the residential sector. Meeting decarbonisation targets will require turning over this fleet of fossil boilers, and in the case of newer units, before the end of their useful lives. The government could, therefore, consider a progressive system of incentives under the existing Klimabonus scheme whereby earlier replacement of a fossil boiler receives a higher subsidy, progressively declining each year. The government could also include an option to offer higher support mechanisms for switching newer fossil systems, thereby motivating a faster turnaround toward heat pumps (compared to older units that would need to be replaced anyway). Another option could be to offer a time-limited bonus for buildings with the worst energy efficiency ratings. The government should also exclude subsidies for replacing new fossil units after the revised subsidy framework is in place to discourage delays in switching to heat pumps. For example, a new fossil boiler installed after the new subsidy takes effect would not receive a subsidy to switch to a heat pump 15 years later. Moreover, differentiating these subsidies by income level would support more progressive outcomes. Luxembourg could also consider innovative support schemes to lower upfront cost barriers of heat pumps for lower income households and renters. It could, for example, explore Heat-as-a-Service business models, as piloted in the United Kingdom, Denmark and Germany.

Digitalisation

Digitalisation is a key tool for managing an efficient and effective modern energy system. Notably, digital solutions can support flexibility in an increasingly renewables-based power system while at the same time enabling better energy efficiency and emissions reduction outcomes. Digitalisation enables system operation closer to real

time and provides a better understanding of assets across the energy system. It thereby offers a better ability to control energy assets toward optimal grid operation, facilitating the integration of more decentralised generation and energy storage.

Luxembourg has made considerable investments in digitalisation over the past decade, especially on the grid side. This includes a full roll-out of smart metering technology, a national energy data platform, the digitalisation of transformers and a digital twin model of the largest network operator's grid.

Digitalisation has also played an important role in customer interaction with energy suppliers and grid operators. For example, a digital app-based solution for documenting the installation process of PV installations and charging stations has allowed the DSOs to dramatically reduce the number of on-site appointments and thereby manage a fourfold increase in grid connection requests for PV installations.

Smart meters

A legal requirement to equip 95% of electricity metering points and 90% of gas metering points with a smart meter by the end of 2019 and 2020, respectively, entered into force in 2015. The smart meter roll-out was completed in 2020 for electricity and in 2021 for gas meters. Both residential and commercial metering points are equipped with smart meters with a granularity of 15 minutes for electricity meters and hourly for gas meters. All billing is now based on 15-minute/hourly load curves, and smart meter data were a pre-requisite for the new low-voltage tariff structure. By the end of 2024, 99.2% of smart meters had been deployed for electricity and 99.3% for gas, exceeding the legal requirement.

The installation of smart meters has already enabled important changes in the electricity sector, including energy sharing between neighbours and within energy communities since 2023, the introduction of dynamic tariffs by suppliers in late 2024, and grid tariffs based on 15-minute load curves since January 2025.

The government is also planning to introduce a financial support scheme for home energy management systems to further push behind-the-meter digitalisation.

Policy spotlight: Leneda energy data platform

Luxembourg's electricity TSO was mandated by law to develop and deploy a centralised and standardised national energy data platform. As a result, the national energy data platform Leneda was commissioned in 2024 and launched in March 2025. The platform provides all electricity and gas customers with full access to their energy consumption data using information provided by smart meters. Customers can also share their energy data securely in a central place. Leneda likewise allows energy suppliers to tailor services to best meet customers' needs. The platform will further evolve to become a market communication hub and a tool for grid billing. As a result, DSOs are starting to offer advanced functionalities to facilitate energy sharing and data accessibility.

Developed under a legal public service mission and with oversight from the regulator, ILR, Leneda provides a secure hub for data storage and transfer among suppliers, DSOs, aggregators, producers, energy communities and end-users. From 2025, access has been linked to a unique Energy ID, ensuring clear governance of data rights and responsibilities.

For consumers, the platform creates direct and reliable access to their own energy data, enabling them to track and analyse consumption and production as recently as one day back. This visibility supports cost management, promotes more efficient energy use, and allows prosumers to optimise the balance between self-generation and grid demand. By standardising data flows, Leneda also reduces transaction costs, simplifies supplier switching, and streamlines administrative procedures such as moving or registering distributed generation units.

Beyond these immediate benefits, Leneda establishes the infrastructure for broader market innovation. Aggregators and energy communities can leverage the platform to manage collective data, pool resources and participate in flexibility markets. Regulators gain improved oversight and monitoring capacity while consumers benefit indirectly through enhanced competition, transparency and consumer protection.

As such, Leneda strengthens Luxembourg's digital energy infrastructure by making consumer data more accessible, interoperable and secure. It directly empowers consumers while laying the groundwork for a more efficient, flexible and competitive energy system aligned with the country's long-term decarbonisation objectives.

Behind-the-meter energy assets

Due to generous incentives, Luxembourg has seen pronounced growth in behind-the-meter energy assets in recent years, which offer an important opportunity to expand the role of digital applications.

Luxembourg has almost doubled the number of PV installations connected to the grid since 2023, from 13 622 at the end of 2023 to 32 445 by February 2026 This increased the peak capacity by 86%, from 394 MW to 731 MW.

As of December 2025, a total of 42 891 BEVs and 18 362 plug-in hybrid vehicles were registered in Luxembourg, representing 6.9% and 2.9%, respectively, of the national vehicle fleet.

The exact number of installed heat pumps is not available. In the context of NECP modelling, the statistical office estimated that a total of approximately 20 000 dwellings were equipped with electrical heating (including heat pumps) in 2023. It is estimated that 3 750-4 000 units are added annually.

In addition, digitalisation has proven critical for grid operators to manage the mass of PV and charging station connection requests that have emerged in 2024 and 2025. Digital solutions have allowed for a significant reduction in the number of on-site visits.

The government is pushing to incentivise the behind-the-meter flexibility market by offering a top up for vehicle-to-grid ready wallboxes and financial support for home energy management systems to be introduced in October 2026 (a flat subsidy of EUR 500 if at least two behind-the-meter assets are controlled by the home energy management system).

Digital solutions for grid management

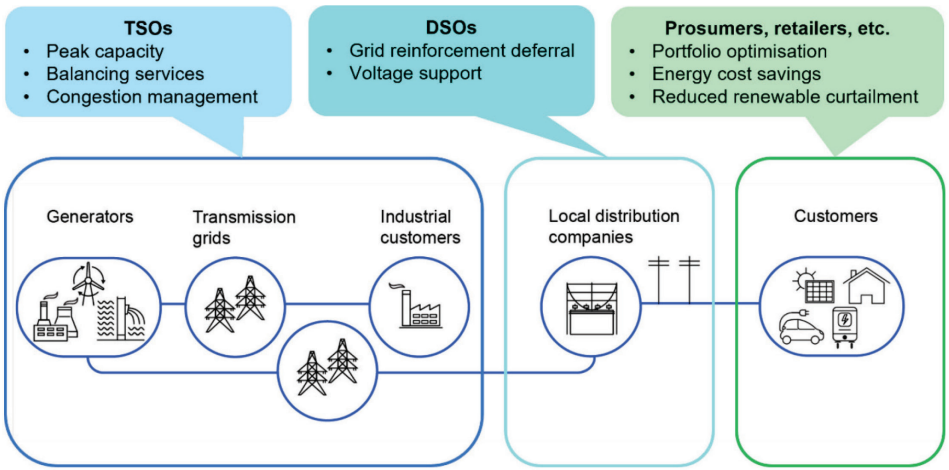
DSOs have invested heavily in digitalisation in the past few years. Beyond the smart meter roll-out, the largest DSO and TSO, Creos, has developed a digital twin of its grids with the objective to improve the understanding of grid flows and grid planning processes and maintenance operations. Creos is also in the process of equipping its grids with smart transformers. On the customer-facing side, Creos is aiming to digitalise most processes related to grid connection using its MyCreos platform.

The four national DSOs also jointly developed an application that allows electricians to document the connection process of behind-the-meter assets (PV and charging

stations). This has dramatically reduced the number of physical interventions made by DSOs in the connection process and improved documentation of the connection process.

Digital investment costs are socialised as part of grid utilisation tariffs. In this regard, digitalisation projects are treated according to the same regulatory principles as other investments.

Multiple grid benefits of digitally enabled distributed energy resources



Source: IEA (2022), Unlocking the Potential of Distributed Energy Resources.

Recommendations

10 Harness smart meter data to empower consumers and enable active participation in energy markets.

Luxembourg has already achieved near-universal smart meter deployment, providing a valuable foundation for both consumer empowerment and system flexibility. However, to date, consumers do not appear to be using their consumption data, leaving an important opportunity to motivate behaviour change or trigger automated

solutions for demand-side response untapped. The government should, therefore, facilitate and motivate the development of services that provide households and businesses clear insights into consumption patterns, allowing them to identify cost-effective energy savings opportunities (e.g. shifting demand to off-peak or low CO_2 periods, improving appliance efficiency, or adjusting heating and cooling schedules). As part of this, the government (through Klima-Agence) could enable the development of digital tools or dashboards – potentially in partnership with utilities – that translate raw data into actionable recommendations, with an emphasis on simplicity and usability. Moreover, the government should consider linking financial incentives for behind-the-meter equipment purchases (such as PV panels, smart appliances, batteries or EV chargers) to participation in demand-response programmes or broader flexibility services. These flexibility services include shifting electricity consumption away from peak periods, providing rapid load reductions or increases when the grid is stressed, enabling real-time optimisation through aggregators and effective use of smart meters, and allowing distributed assets to offer ancillary services such as frequency support or voltage regulation. This approach would ensure that public subsidies deliver consumer savings and measurable system-level benefits, such as reduced peak demand, lower grid reinforcement costs and improved integration of variable renewables. Feedback mechanisms from current smart meters can also inform the next round of digital solutions. For aggregators and service providers, the government could facilitate timely and standardised access to anonymised and consent-based data, enabling energy service companies and aggregators to offer demand-response programmes, bundled energy efficiency services and innovative tariff structures. The government should always ensure the regulatory framework supports third-party data access under strict data-protection safeguards, aligning with EU data-sharing and consumer-consent principles, and address growing cybersecurity concerns. Communication campaigns targeted at consumers to encourage consent on data use would support these efforts. Such measures would also provide system-wide benefits. Empowering consumers and enabling aggregators to leverage smart meter data will enhance flexibility, reduce peak demand and lower system costs, thereby reducing the need for costly grid reinforcements.

Annexes

Acknowledgements

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Abbreviations and acronyms

BEV	battery electric vehicle
CAPEX	capital expenditure
CCUS	carbon capture, utilisation and storage
DSO	distribution system operator
ESR	Effort Sharing Regulation
ETS	Emissions Trading System
EU	European Union
EV	electric vehicle
GHG	greenhouse gas
IEA	International Energy Agency
LULUCF	land use, land-use change and forestry
MEPS	Minimum Energy Performance Standards
NECP	National Energy and Climate Plan
NPF	National Policy Framework
OPEX	operational expenditure
OSS	one-stop shops
PV	photovoltaics
SME	small and medium-sized enterprise
TSO	transmission system operator

Units of measurement

GW	gigawatt
GWh	gigawatt hour
kV	kilovolt
kW	kilowatt
kWh	kilowatt hour
Mt CO_2	million tonnes carbon dioxide
MW	megawatt
PJ	petajoule
t CO_2	tonne carbon dioxide
TWh	terawatt hour

See the IEA glossary for a further explanation of many of the terms used in this report.

Infographic sources

Emissions: IEA analysis based on EEA (2025), EEA greenhouse gases – data viewer.

Growth: IEA (2026), World Energy Balances.

Space heating: IEA (2026), Energy End-uses and Efficiency Indicators.

Smart meters: IEA analysis based on CEER (2025), Annual Reports on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2024 (Luxembourg) (accessed March 2026)

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Carbon intensity: IEA (2026), Greenhouse Gas Emissions from Energy.

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