

Electrification Potential Analysis for Baltics

Past and Future Developments

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Executive Summary

Electrification is rising rapidly on the political agenda across the EU, as over-reliance on imported fuels from third countries has exposed significant strategic vulnerabilities. This is evident in the high cost of energy for regular households, as well as for industrial consumers, which damages the competitiveness of the EU economy. As IEA Executive Director Fatih Birol stated in May 2026, "Europe's sovereignty, competitiveness and security will critically hinge on rapid electrification"¹. Electrification provides a decisive solution for increasing the security, affordability, and sustainability of the EU energy system.

In the Baltic countries, the energy policy has long been driven by security concerns. All three countries desynchronised from the Russia–Belarus BRELL grid in February 2025 and synchronised with Continental Europe, ending a key dependency and underscoring electricity's central role in regional energy security. Despite this progress, fossil fuels continue to dominate final energy consumption across the region. Oil alone accounts for over a third of final energy consumption (FEC) in Latvia, around 45% in Estonia when combined with gas, and more than half in Lithuania. Electricity's share of FEC remains low across all three countries: 11% in Lithuania, 14% in Latvia, and 19% in Estonia, all well below the EU average of 23%. All three countries have nonetheless made significant progress, shifting from near-total fossil fuel reliance toward a more diversified mix in which renewables now account for the majority of electricity production. Nevertheless, challenges remain supply volatility driven by electricity import dependency. Estonia imported more electricity than it produced in 2023, Latvia relies on imports for roughly 60% of its electricity consumption, and Lithuania imported approximately 11,000–13,000 GWh annually between 2015 and 2023 following the phase-out of its nuclear capacity.

To support the data-based development of the energy systems in the Baltic countries, this study provides strategic insights into electrification rates and potential in Estonia, Latvia and Lithuania across the three key energy consumption sectors: buildings, transport and industry. Using three scenarios, two at the sectoral level and one at the sub-sectoral level, this study assesses the electrification potential across the Baltic countries in the coming decades.

By 2040, electrification shares in FEC are expected to reach approximately 45% in buildings, 46% in industry and 27% in transport, as averages across the scenarios and countries. In the building sector, the adoption of heat pumps and advances in energy systems drive electrification. Industrial electrification progresses through efficiency improvements and the gradual conversion of industrial processes. Transport, while showing the lowest absolute share, is projected to see the strongest relative growth, driven by rising EV uptake. Electrification also creates a potential for substantial long-term energy savings. Compared to a fossil fuel baseline, electrification is projected to deliver energy savings of on average approximately 46% in transport, 30% in buildings

¹ Pacheco, M. (2026, May 28). 'Electrification is the answer to save Europe's industry,' IEA tells Euronews. Euronews. <https://www.euronews.com/my-europe/2026/05/28/electrification-is-the-answer-to-save-europes-industry-ia-tells-euronews>

and 18% in industry by 2050. Realising this potential, however, requires electrification to become a real political priority at every level.

Key cross-sectoral measures include establishing legally binding timelines for fossil fuel phase-out and reforming distribution system operator (DSO) regulation to prioritise flexibility as the default tool for grid management. Policy actions are essential to increase the share of electricity consumption in the final energy consumption. Governments in the region should treat these not as long-term ambitions, but as near-term priorities.

1. Introduction

On February 9, 2025, Estonia, Latvia, and Lithuania successfully synchronised their electrical systems with the Continental Europe Synchronous Area. This brought to an end their membership of the called BRELL grid (with Belarus and Russia), effectively enhancing the security of electricity supply and integration into Europe's electricity market. Indeed, electrification more broadly helps to improve energy security and independence², whilst at the same time being one of the most powerful levers for reducing greenhouse gas emissions. The strategic case for electrification is gaining renewed urgency at the EU level.

In April 2026, European Commission President Ursula von der Leyen announced plans for the first-ever EU-wide electrification target, citing Europe's reliance on fossil fuel imports as a critical vulnerability. The surge in oil and gas prices following Iran's blockade of the Persian Gulf entrance has seen European importers pay an additional €22 billion in just 44 days alone, which is underscoring the economic and strategic imperative of accelerating the shift to electricity. Von der Leyen called for an ambitious Electrification Action Plan, with measurable milestones across industry, buildings and transport, to be presented on 19 May 2026. As she noted, Europe's electrification rate has stagnated at around 23% of final energy consumption, well behind China's 30%, underscoring the need for structured policy intervention³. Estonia, Latvia, and Lithuania have already made significant progress in increasing the role of electricity in their economies, supported by growing renewable energy generation and EU climate policy. However, a substantial portion of final energy consumption in industry, buildings and transport remains dominated by fossil fuels, leaving significant untapped potential for clean electrification.

This study uses final energy consumption as its primary metric, the energy delivered to end-users across buildings, transport and industry, rather than primary energy supply. This framing reflects the consumer perspective: it captures how much useful energy people and businesses actually receive from electricity versus fossil fuels in each sector,

² Walter, D., Bond, K., & Butler-Sloss, S. (2025). *The electrification imperative*. EMBER. <https://ember-energy.org/latest-insights/the-electrification-imperative/>

³ Kurmayer, N. J. (2026, April 13). Von der Leyen promises first ever EU electrification target. *Euroactiv*. <https://www.euractiv.com/news/von-der-leyen-promises-first-ever-eu-electrification-target/>

which is the relevant lens for assessing the potential for electrification and guiding policy. It is worth noting that, due to the higher efficiency of electric technologies (e.g. heat pumps and electric vehicles), electrification typically delivers more useful energy per unit of final energy than combustion-based alternatives, making its decarbonisation impact⁴. As continued volatility in energy commodities makes clear, accelerated electrification in Europe and the Baltic States will enhance the region's energy independence and resilience⁵.

Considering this, the study focuses on capturing overall patterns and strategic insights from the historical and future assessment of the electrification rates and potential in three key energy consumption sectors: buildings, transport, and industry. It measures historical electrification rates across these major sectors, drawing on national statistics, IEA Energy Balances and Eurostat data for the period from around 2000/2005 to 2023/2024. The future electrification potential is assessed based on available electrification scenario studies by the IEA, IRENA, Baltic TSOs, Ember and others. The indicative projections for 2040/2050 identify sectors with low electrification uptake but high potential for decarbonization.

The study presents results on sectoral electrification rates, gaps, and future potential, supporting policy planning for the next phase of the Baltic energy transition. Its findings are directly relevant to the goals of the EU's forthcoming Electrification Action Plan and contribute evidence from the Baltic context to the wider European debate on accelerating the clean energy transition³.

2. Historical Energy Trend Assessment

Historically, the Baltic countries relied heavily on traditional energy sources, such as oil shale and natural gas, for electricity production with Soviet-era infrastructure. However, over the last two decades, a significant change has occurred, characterised by major structural shifts and a substantial commitment to renewable energy sources (RES). The following section examines how each Baltic country has pursued its own trajectory in expanding the role of electricity within final energy consumption across key sectors of final energy demand.

2.1. Assessment on Estonia's trend

Figure 1 shows the final energy consumption of Estonia. This indicates electricity's role in Estonia's energy mix has steadily strengthened while fossil energy has decreased. The assessment begins by first looking at Estonia. Estonia's total final energy consumption fluctuated between ~28,000 GWh and ~35,000 GWh, peaking in 2024 at

⁴ Walter, D., Bond, K., Bulter-Sloww, S., Issac, A., & Liebreich, M. (2026, February 17). *Reframing Energy for the Age of Electricity*. Ember. <https://ember-energy.org/latest-insights/reframing-energy-for-the-age-of-electricity/>

⁵ *Estonian, Latvian, and Lithuanian power systems successfully synchronised with Continental Europe*. (2025, February 9). Elering. <https://elering.ee/en/article/estonian-latvian-and-lithuanian-power-systems-successfully-synchronised-continental-europe>

35,487 GWh. Coal and oil shale both declined sharply over the analysed time period. Coal dropped from 743 GWh (2000) to just 16 GWh (2024). Oil shale fell from 701 GWh to zero by 2021. Oil remained dominant but relatively stable, ranging from ~8,500 GWh in 2000 to ~12,828 GWh in 2024. In turn, gas fluctuated, peaking around 3,218 GWh (2003) and then stabilising near 2,000–3,000 GWh. Renewables grew significantly from 4,941 GWh (2000) to 7,149 GWh (2024), showing a steady upward trend. The use of waste as an energy source appeared after 2013 but remained a minor contributor to overall energy consumption; heat remained relatively stable (~5,000–6,700 GWh). Electricity consumption increased from 5,015 GWh in 2000 to 6,620 GWh in 2024, representing a rise of approximately 32%, whereas the proportion of electricity in total energy consumption grew from 18% in 2000 to 19–24% in recent years, peaking at 24% in 2021.

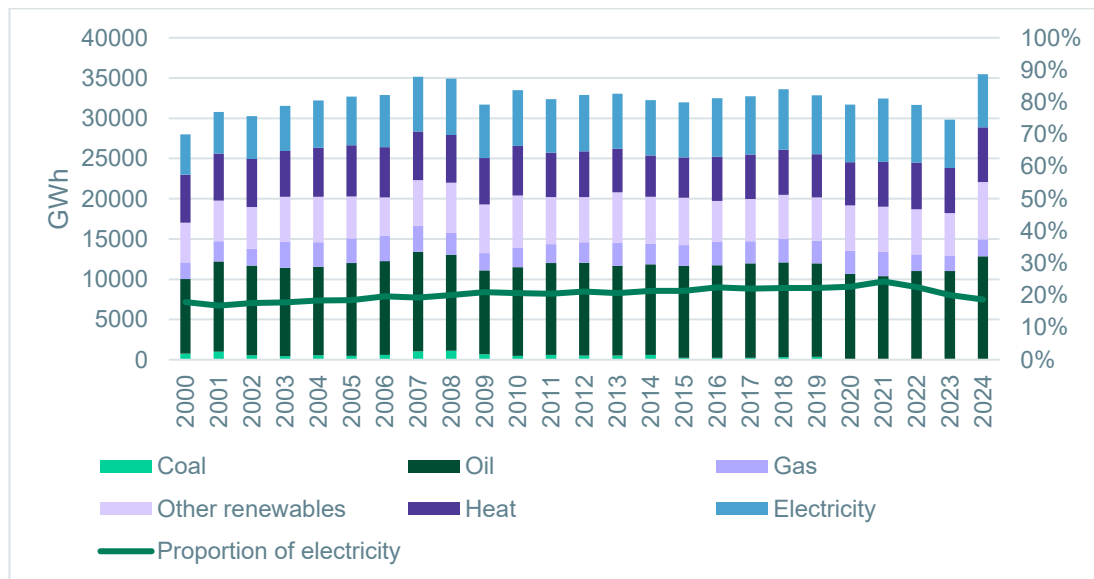


Figure 1 Final Energy Consumption of Estonia⁶

The total electricity production in Estonia varied significantly, peaking at 13,274 GWh in 2013 and then declining sharply to 6,110 GWh in 2024. The major fuel used for producing electricity has been oil shale, which dominated the early years (~7,700–11,400 GWh from 2000 to 2013) but declined after 2018 to a value of 1,507 GWh in 2024. Natural gas and other fossil fuels are minor contributors throughout, never exceeding ~560 GWh. Amongst renewable fuels, such as wood chips and waste, grew from near zero to 1,322 GWh in 2024, whilst wind energy expanded from almost zero in 2000 to 1,164 GWh in 2024. Solar electricity has expanded significantly since 2016 and reached 1,020 GWh in 2024. Hydroelectricity has not been a significant contributor to electricity generation across the analyzed time period. The production of electricity has shifted between fossil and renewable energy sources over the years. Between 2000 and 2010, fossil fuels dominated (~99–100%). From 2015, renewables rose to 16% and then

⁶ National Statistics Estonia

to 29% by 2019. After a rapid transition, the share of renewables nearly doubled from 50% to 60% between 2020 and 2024.

Overall, Estonia's electricity production shifted from near-total reliance on oil shale to a balanced mix with renewables now leading (60%). Wind and solar are the fastest-growing sources, while the decline of oil shale marks a significant structural change. Electricity imports were relatively small compared to Estonia's total electricity production in the early years (e.g., 496 GWh out of 8,510 GWh in 2000), meaning most electricity was produced domestically, mainly from oil shale. However, in recent years imports have grown significantly relative to total production. For example, in 2023, Estonia produced 5,714 GWh but imported 7,660 GWh showing a strong shift toward reliance on imported electricity. Figure 2 Shows the electricity production by fuel in Estonia.

Over the years, the per capita electricity consumption rose steadily from 3.6 MWh/person in 2000 to 5.7 MWh/person in 2018, reflecting economic growth and increased electrification. By 2021, it reached 5.9 MWh/person, which is the highest. After a sharp decline to 4.4 MWh/person in 2023, there was a slight upward trend to 4.8 MWh/person in 2024. Overall, from 2000 to 2024, per capita consumption increased by about 33%. However, recent years have shown volatility, likely linked to the energy transition and efficiency measures, as well as possible effects of the COVID-19 pandemic. Furthermore, despite long-term growth, the last few years have indicated a structural shift –possibly due to reduced domestic electricity production (resulting from the decline of oil shale), higher imports, and energy-saving policies.

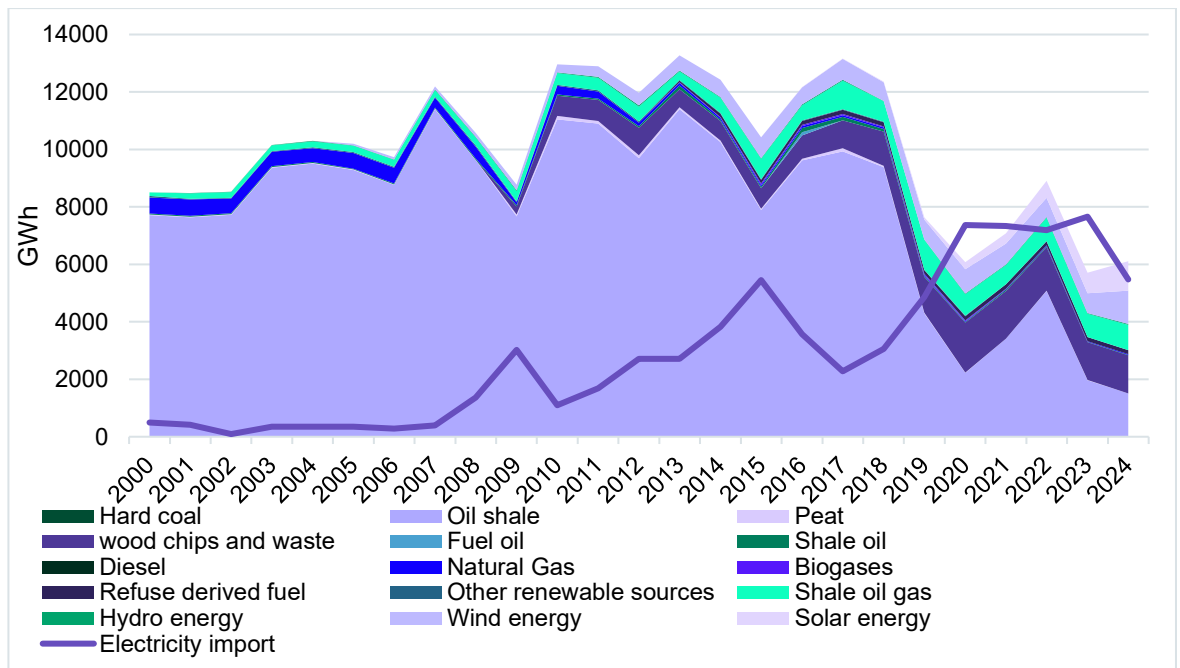
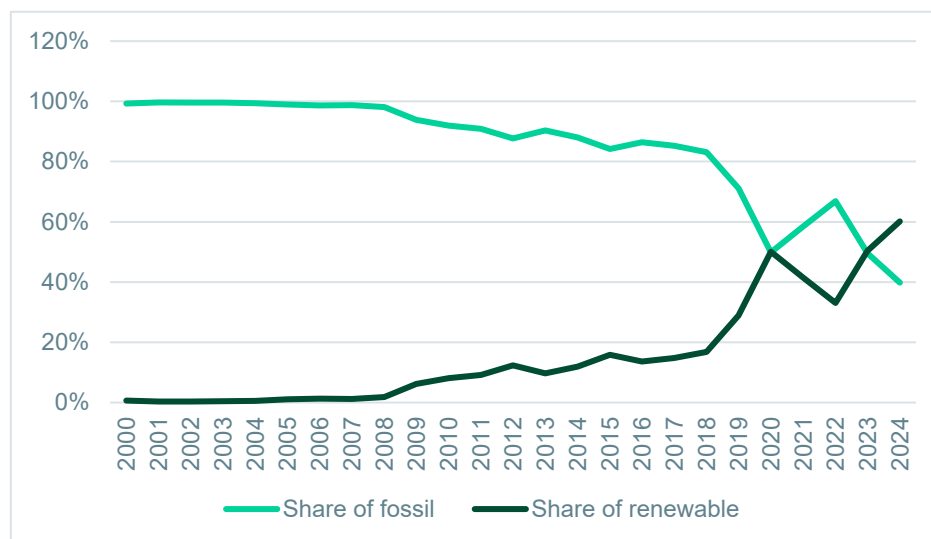


Figure 2 Electricity production by fuel in Estonia⁶Figure 3 Total share of fossil and renewable electricity generation⁶

In terms of seasonal production pattern, winter months (January–March, November–December) generally have higher production, often exceeding 1,000 GWh in peak years. Summer months (June–August) tend to be lower, sometimes dropping below 600–700 GWh. With a long-term trend, production was strong between 2005 and 2013, often exceeding 1,000 GWh/month, peaking at around 1,375 GWh in March 2012. Between 2014 and 2018, production declined slightly with a sharp drop occurring from 2019 onward, with monthly averages falling below 800 GWh by 2020. In 2023, some months reached as low as 324 GWh, with only a partial recovery by 2024. Overall, the decline in electricity production after 2019 aligns with the phase-out of oil shale and the transition toward renewables. The increased variability thereafter suggests reliance on imports and intermittent renewable sources.

Considering the three key sectors of consumption outlined in the introduction, industry started at 6,747 GWh in 2000, peaked around 8,790 GWh in 2007, and then declined steadily to 3,923 GWh in 2023. This indicates a significant reduction in industrial energy demand over time. Transport grew moderately from 7,732 GWh in 2000 to ~9,900 GWh in 2023. Buildings are the largest consumer throughout, rising from 14,133 GWh in 2000 to ~17,179 GWh in 2021, then dropping to 15,085 GWh in 2023.

The share of electricity in total energy consumption by each sector increased significantly in all cases. In the industrial sector, the electrification rate has grown from 27% in 2000 to ~50% in 2022, then slightly decreased to 45% in 2023. Electricity occupies an extremely low share of transport energy demand (around 1% or less) across all years, even declining to 0.3% in 2022–2023, which suggests minimal penetration of electric vehicles or rail electrification. The use of electricity in buildings grew steadily from 20% in 2000 to ~32% in 2021, then dropped to 27% in 2023, indicating an increase but still partial electrification of heating and appliances. Figure shows the final energy consumption of each sector and the share of electricity over the years.

In terms of electricity consumption (GWh by sector), industry rose from 1,829 GWh in 2000 to ~2,646 GWh in 2018, then fell to 1,783 GWh in 2023. Transport energy use was essentially negligible in all years (below 100 GWh/year), peaking at 103 GWh in 2005, then dropping to 32–59 GWh in recent years. Buildings increased from 2,867 GWh in 2000 to ~5,485 GWh in 2021, then declined to 4,013 GWh in 2023.

Overall, the analysis so far indicates that Industrial consumption is driving electrification, at least since 2015, while transport remains almost entirely fossil based. Buildings dominate electricity use, but this is mostly a result of higher overall energy demand. Recent declines in both total FEC and electricity use (post-2021) suggest efficiency improvements and structural changes in energy demand may be occurring.

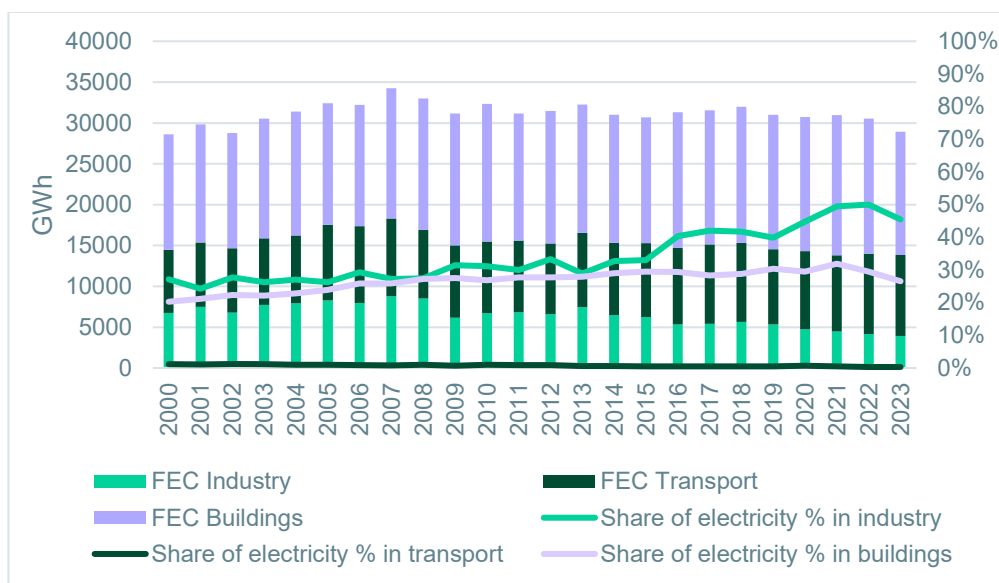


Figure 4 Sectoral electricity consumption in Estonia⁷

Sub-sectoral electricity consumption

Four main sectors of energy consumption are considered for the sub-sectoral breakdown of electricity consumption, households, services, transport and industry. Household electricity consumption in Estonia is primarily broken down into space heating, space cooling, water heating, lighting, and appliances. Overall, Estonia's electricity consumption shows a clear upward trend from 2014 to 2023. Lighting and appliances have the largest share of household electricity demand, rising from about 1,091 GWh in 2014 to 1,357 GWh in 2023, with both have electrification rates of 100 %. In space heating, water heating and cooking, the use of electricity fluctuates year to year, which may reflect weather variability and other factors. However, the use of electricity increased moderately over the considered time period until 2023. Space cooling remained negligible across all years. Overall, the household sector in Estonia indicates steadily rising electrification of household energy services, with appliances and

⁷ IEA Estonia

end-use electricity demand playing an increasingly dominant role in the residential sector.

Service sector electricity consumption data is not available before 2022 in the Eurostat database and the National Statistics. Twenty-two categories are responsible for electricity consumption in the service sector. For convenience, we have categorised them into six different areas. These are wholesale and retail trade, transportation and storage, food and accommodation, technical and professional services, arts, sports, and recreation, and other services, respectively the total final electricity consumption reached 2,908 GWh in 2022 and 1,852 GWh in 2023, indicating reduced activity and efficiency gains. All sub-sectors experienced significant reductions in 2023, with the arts, sports, and recreation sector showing the steepest proportional decline. By 2023, the largest share of electricity was consumed in the technical and professional services sector, followed by other services and wholesale and retail trade.

Transport electricity consumption in Estonia can be decomposed into rail, road, air, and water transportation. Rail transport was the dominant electricity consumer throughout the period, although its consumption gradually decreased from around 30–36 GWh in the early 2000s to the mid-teens by the late 2010s. Electricity use for road transport, which is by far the dominant source of energy consumption overall, also declined markedly after 2005 before recovering after 2020. Electricity use in domestic navigation and aviation is consistently marginal and falls to zero after 2020. After 2021, the demand increases have been driven mainly by rail and road transport, suggesting renewed activity and early impacts of transport electrification in Estonia. However, overall electricity use in transport remains modest compared with other end-use sectors.

The uptake of electric and hybrid vehicles in Estonia

Share of electric and hybrid passenger cars in the total stock of registered passenger cars:

- 2013: Electric 0,1% (708 vehicles), Hybrid 0,2% (1,431 vehicles)
- 2024: Electric 0,9% (8,111 vehicles), Hybrid 6,3% (55,058 vehicles)

Share of electric and hybrid cars among newly registered passenger cars:

- 2013: Electric 0,7% (130 vehicles), Hybrid 1% (195 vehicles)
- 2024: Electric 5,1% (1,323 vehicles), Hybrid 50% (12,983 vehicles)



Figure 5 Registered passenger cars by type of motor energy in Estonia

Source: Eurostat Estonia

Industrial electricity consumption in Estonia can be distributed into 16 sub-sectors. Primarily driven by iron and steel, chemical and petrochemical, non-ferrous metal, non-metallic minerals, transport equipment, machinery, mining and quarrying, food, beverages, tobacco, paper, pulp, and printing, wood and wood products, textiles, and leather, and not elsewhere specified. Over the last two decades, wood products, paper, pulp, and printing, food, beverages, tobacco, and chemical and petrochemical industries have consistently been the largest electricity consumers, typically consuming 300-580 GWh per year each. In contrast, other sectors such as iron and steel, non-ferrous metals, textile and leather consistently account for only 1-10 GWh each per year and remain relatively minor contributors.

2.2. Assessment on Latvia's trend

Latvia's total final energy consumption increased from ~38,300 GWh in 2000 to ~51,000 GWh in 2007, before stabilising for the following years and averaging 47,000 GWh. Oil dominated, increasing from ~13,000 GWh in 2000 to around 19,000 GWh in 2007, and then remaining relatively stable around 16,500-18,000 GWh. Oil shale was used for only a few years, from 2008 to 2012, and stayed at negligible levels. Coal fluctuated, starting

at 716 GWh in 2000 and peaking at around 1,139 GWh in 2011 before declining, accounting for only 124 GWh (2024). Gas grew, peaking at 6,083 GWh in 2007 before fluctuating between ~3,000 and ~5,000 GWh. Renewables ranged from ~9,600 GWh (2000) to ~12,000 GWh (2024), peaking at 12,755 GWh in 2009. Waste grew from 58 GWh in 2008 to 953 GWh in 2024. Heat remained relatively stable (~6,000-7,000 GWh). Electricity increased from 4,477 GWh (2000) to 6,513 GWh (2024), representing a rise of approximately 45%. The proportion of electricity in total energy consumption grew from 12% in 2000 to 14% in 2024. Figure 6 shows the final energy consumption of Latvia. Electricity's role in Latvia's energy mix has increased at the beginning of the 2000s and has remained stable since then. However, fossil energy, specifically oil, remains a significant contributor to Latvia's energy mix.

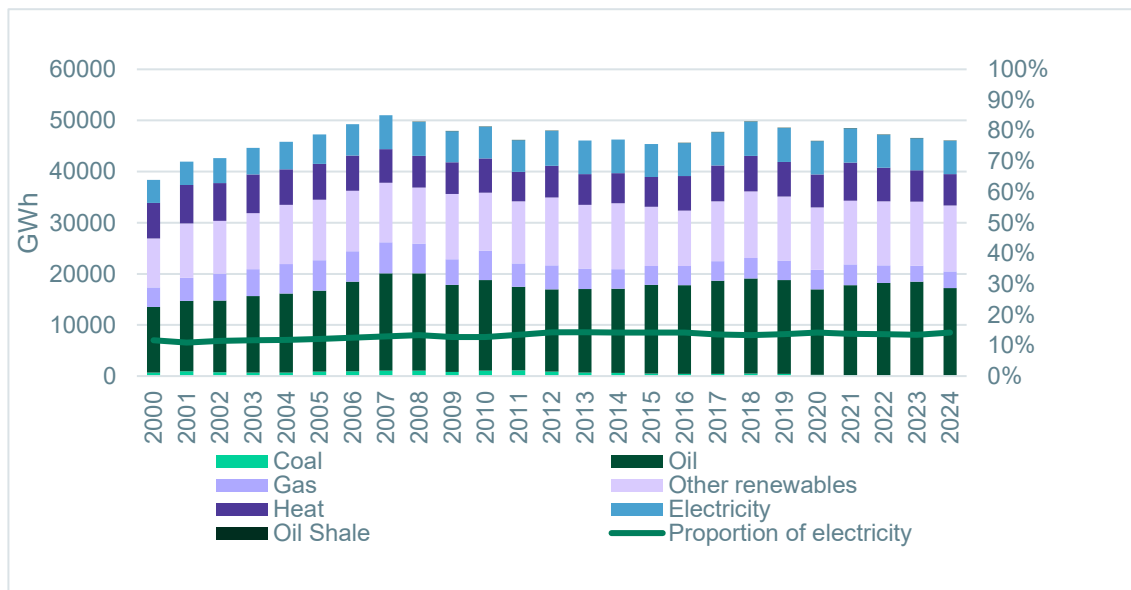


Figure 6 Final Energy Consumption of Latvia⁸

The total electricity production in Latvia fluctuated between ~4,000 GWh in 2000 and ~7,000 GWh in 2024, with a peak at 8,459 GWh in 2017. Hydro energy is the most significant contributor to electricity production in Latvia, remaining stable and averaging ~2,900 GWh over the period. The second major fuel is natural gas, which went overall upward but with substantial year-to-year variability from 2000 (~1,000 GWh) to 2019 (~3,000 GWh), before decreasing to 1,678 GWh in 2024. Oil and coal played a marginal and declining role in electricity generation, never exceeding ~140 GWh and declining to negligible or zero levels in later years. Regarding renewable fuels, wood chips and waste increased from near 0 to 457 GWh in 2024, while biogas, which were at near-zero levels in 2002, peaked at 405 GWh in 2017 before gradually declining to 164 GWh in 2024. Wind energy grew from almost zero in 2000 to 276 GWh in 2024, and solar energy was introduced in 2018, reaching 536 GWh in just six years. In comparison,

⁸ National Statistics Latvia and IEA Latvia

Latvia's electricity imports increased from 2,108 GWh in 2008 to 5,340 GWh in 2014 before stabilising around 4,000-5,300 GWh in the following years.

Due to the importance of hydroelectric energy, the share of renewables in energy production remained high and dominant over the period, increasing slightly from 68% in 2000 to 76% in 2024. However, the country experienced frequent year-to-year fluctuations, reaching a near equilibrium between fossil (49%) and renewable (51%) sources in 2011.

Overall, Latvia's electricity production is dominated by renewables, led by hydropower and supported by growing output from biomass, biogas, solar and wind. However, the exact proportions are subject to fluctuations between years, whilst natural gas has continued to play a significant role over the period. Figure 7 shows the electricity production by fuel and electricity import in Latvia.

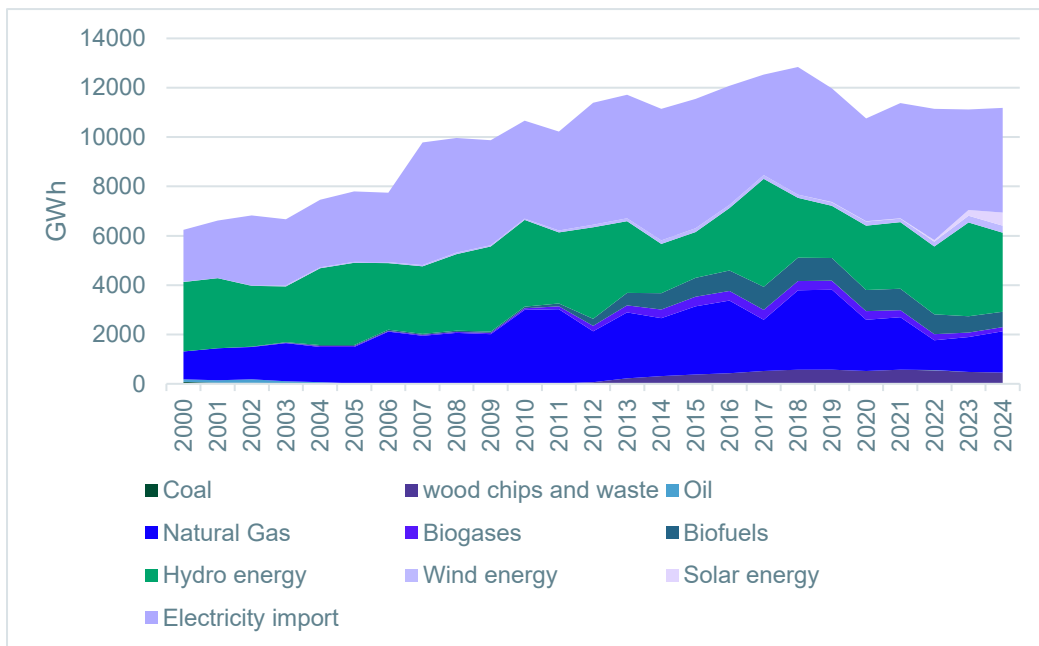


Figure 7 Electricity production by fuel and electricity import in Latvia⁸

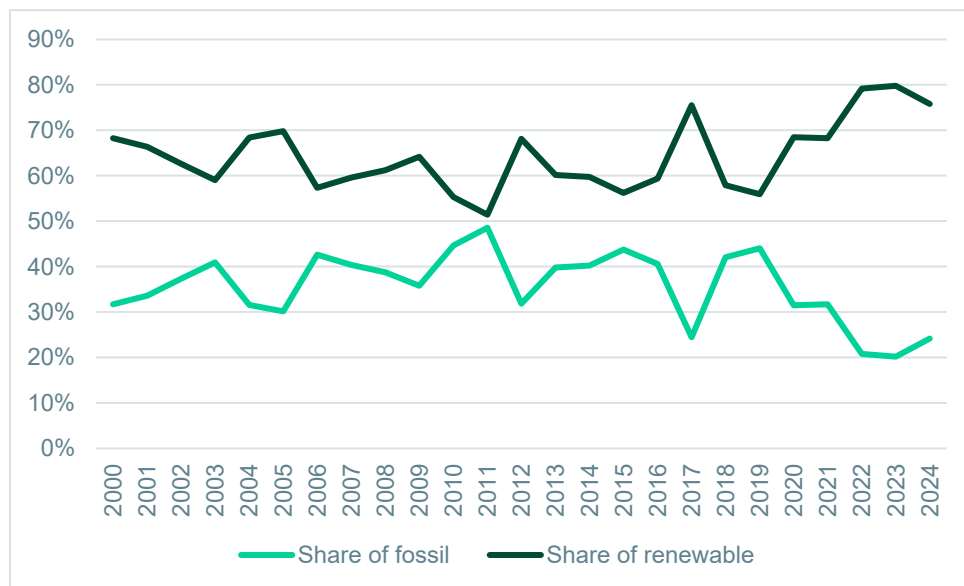


Figure 8 Total share of fossil and renewable electricity generation⁸

Per capita electricity consumption increased by about 81%, from 2.1 MWh/person in 2000 to 3.8 MWh/person in 2024, the highest level on record. Latvia's electricity production is highly seasonal. Overall, winter months (January-March, November-December) tend to have higher production, with peaks above 900 GWh in some years. Early spring, specifically in April, is also a time of regular peak electricity production in Latvia. The production record was set in April 2011, reaching 1,042 GWh. The summer months (June-August) generally have lower production, ranging from approximately 150 GWh to 400 GWh. The electricity production can drop as low as 134 GWh, as in July 2023. The lowest electricity production month is sometimes September as well. The reliance on hydraulic energy, which production peaks during snow melt (March-April) and drops during dry months (July to September) explains these results.

Overall, the monthly electricity production in Latvia is highly volatile, making it challenging to define patterns. There is a trend of growth from 2006 to 2011, followed by a decrease, marked by a maximum output of 566 GWh (January 2014). Production increased again and reached a strong winter production peak of 949 GWh in March 2017, fluctuating between ~300 GWh and 400 GWh in the summer. The monthly production stabilised below these levels in the following years before growing again in 2023 and 2024. The last two years have seen significant gaps between winter production (fluctuating between ~700 GWh and ~950 GWh) and summer production (~150-300 GWh). Overall, the high variability of production patterns suggests a reliance on imports (mainly for natural gas) and intermittent renewable sources, especially hydropower and, more recently, wind and solar energy.

The following analysis focuses on sectoral final energy consumption in Latvia. For this assessment, three major economic sectors are compared: industry, transport and buildings. The industry rose from 6,686 GWh in 2000 to 11,598 GWh in 2024, with a peak of 11,700 GWh the previous year. It shows a significant increase of around 74% for industrial energy demand. Transport started at 8,411 GWh in 2020 and peaked at 15,175 GWh in 2008, showing rapid growth initially. The growth became more volatile from 2009, with demand fluctuating between 12,500 GWh and 15,000 GWh, and reaching 12,970 GWh in 2024. Buildings are the largest consumer throughout, growing first from 20,928 GWh in 2000 to 24,905 GWh in 2007 before decreasing progressively to 19,027 GWh in 2024.

The share of electricity in total energy consumption increased only in the buildings sector. In this sector, the electricity share rose from around 13% in 2000 to 23% in 2023, indicating a growing electrification of heating and appliances, even if it remains a minority. In the transport sector, the share remains extremely low throughout, dropping from around 1.8% in 2000 to 0.9% in 2024, indicating minimal penetration of electric vehicles or rail electrification. The industrial sector also experienced a decrease in its share of electricity, from 21% in 2000 to 15% in 2024, reflecting faster growth in the sector's total energy consumption than in the electrification of processes. Figure 9 illustrates the final energy consumption of each sector and the share of electricity over time in Latvia.

Regarding the final electricity consumption (GWh by Sector), the industry increased from 1,433 GWh in 2000 to 1,816 GWh in 2007, before fluctuating, peaking at 1,993 GWh in 2012 and reaching 1,782 GWh in 2024. Transport's electricity consumption is negligible, ranging from ~100 GWh to ~150 GWh over the period. The building sector has the highest final electricity consumption of the three sectors, increasing from 2,735 GWh in 2000 to 4,412 GWh in 2024. Similar to the industrial sector, it grew until 2008 (4,666 GWh), then decreased slightly and showed year-to-year variability.

Finally, the building sector now leads electrification (over 20%), as electricity use has grown in heating and building services, overtaking the industry where the electricity share declined as total energy demand increased faster than electricity use. Transport remains largely fossil-based, with electricity playing only a marginal role.

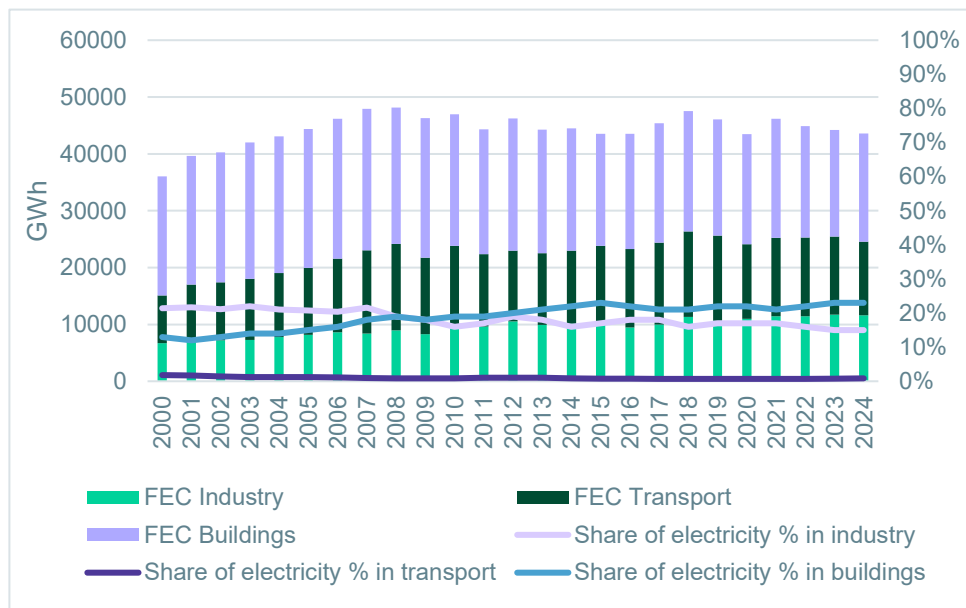


Figure 9 Sectoral electricity consumption in Latvia⁸

Sub-sectoral electricity consumption

Household electricity consumption in Latvia is driven by space heating, water heating and cooking. Overall, Latvia exhibits stable consumption, with only minor variations from one year to the next, from 2014 to 2023. In water heating, the consumption averaged ~340 GWh over the period. Space cooling remained negligible throughout the entire period, while space heating accounted for approximately 70 GWh. The electrification of household energy services is not progressing in the country.

In the service sector, technical and professional services accounted for the largest share of electricity, consuming 1,156 GWh in 2023. In the same year, other services consumed 570 GWh, wholesale and retail trade 398 GWh, and transportation and storage 198 GWh. The food and accommodation, and the arts, sports, and recreation subsectors remained marginal, accounting for 104 GWh and 70 GWh, respectively, in 2023.

The transport sector's electricity consumption decreased from 138 GWh in 2008 to 94 GWh in 2020 before recovering, reaching 122 GWh in 2024. The sector is driven by road transport, for which electricity consumption follows a similar trend to that of the total sector (from 76 GWh in 2008 to 55 GWh in 2024, with a record low in 2015: 26 GWh). Rail transport is the only sub-sector in which electricity consumption increased over the period, from 43 GWh in 2008 to 68 GWh in 2018 and remained stable at this level in the following years. Electricity use in pipeline transport was low, around 10-20 GWh from 2008 to 2017, before falling to negligible levels. Other sub-sectors, such as international air, domestic air, and inland shipping, do not use electricity. Overall, electricity use in the transport sector remains low compared to other end-use sectors.

The uptake of electric and hybrid vehicles in Latvia

Share of electric and hybrid passenger cars in the total stock of registered passenger cars:

- 2013: Electric 0,1% (708 vehicles), Hybrid 0,2% (1,431 vehicles)
- 2024: Electric 0,9% (9,234 vehicles), Hybrid 6,3% (35,258 vehicles)

Share of electric and hybrid cars among newly registered passenger cars:

- 2013: Electric 0,7% (130 vehicles), Hybrid 1% (195 vehicles)
- 2024: Electric 5,1% (1,323 vehicles), Hybrid 50% (12,983 vehicles)

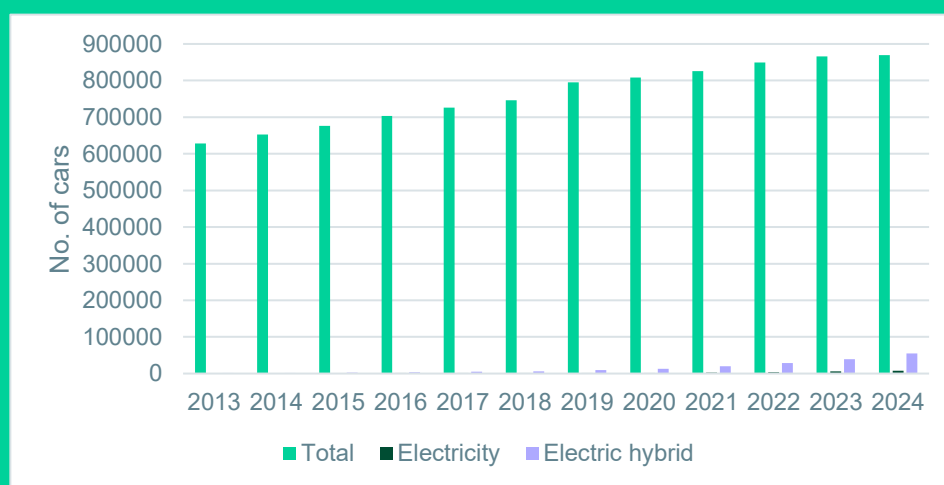


Figure 10 Registered passenger cars by type of motor energy in Estonia

Source: Eurostat Latvia

Industrial electricity consumption in Estonia is primarily driven by wood products, food, beverage and tobacco, non-metallic minerals, metals, machinery, textiles and leather, rubber, plastics and other, chemicals and pharmacy, transport equipment, paper and printing, mining and quarrying and other fabricated metals. The wood products grew from 408 GWh in 2008 to 773 GWh in 2024, peaking at 912 GWh in 2021. Food, beverages, tobacco and non-metallic minerals typically consumed around 200-300 GWh per year each. Metals' consumption fell from 142 GWh in 2008 to 13 GWh in 2024, and machinery's electricity consumption decreased from 136 GWh to 82 GWh over the period. All other sub-sectors remained below 100 GWh per year, including paper and printing and transport and equipment.

2.3. Assessment on Lithuania's trend

Figure 11 shows the final energy consumption of Lithuania. In Lithuania, total final energy consumption increased from 59,585 GWh in 2000 to 82,933 GWh in 2007, suffered a sharp drop in 2009 (likely following the financial crises, but since 2016 has grown steadily to a record of 94,580 GWh in 2024. Within this, electricity's role has remained stable, despite itself increasing from 6189 GWh to 10818 GWh between 2000 and 2024.

The largest component of final energy consumption is oil, which increased from 31,564 GWh in 2000 to 55,547 GWh in 2024, despite intervening volatility. Natural gas use has almost doubled over the same period from 4,223 GWh to between 6,500 to 7000 GWh in recent years, whereas coal has been a minor player in the energy mix across all years. Direct use of renewables have as a whole experienced only minor growth from 7,000 GWh in 2000 to 9,420 GWh in 2024, with direct consumption of heat also remaining broadly stable between 8,900 and 11,000 GWh.

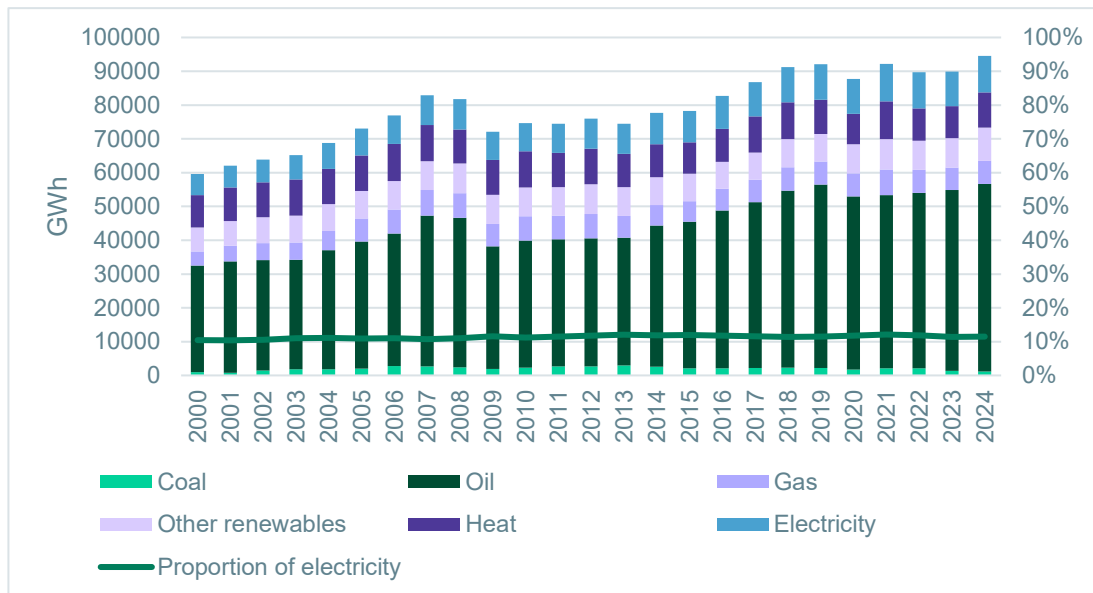


Figure 11 Final Energy Consumption of Lithuania⁹

The total electricity production fluctuated between ~11,000 GWh and ~19,500 GWh between 2000 and 2009, peaking at 19,488 GWh in 2003. From 2010, the total energy consumption was much lower and relatively stable (around 4,000-5,000 GWh) for several years before increasing progressively from 2018 (3,335 GWh) to 2024 (7,997 GWh). Nuclear contributed to the majority of electricity production until 2009, exceeding 15,000 GWh in 2003 and 2004. Its phase-out after 2009 explains the decrease in total electricity production. Oil declined in the long term. Gas remained significant from 2000 to 2015, averaging 2,000 GWh, before falling to 921 GWh in 2024. Coal is a minor fuel, appearing at negligible levels in 2006-2007 and 2014. Other sources started at 91 GWh in 2000, fluctuating around 150-250 GWh from 2002 to 2021, and recovered their initial level by the end of the period.

Considering this, wind is a significant electricity producer in Lithuania, accounting for 3,448 GWh in 2024. Solar appeared later in 2012 and grew significantly to 1,397 GWh by 2024, while waste expanded from almost zero in 2013 to 415 GWh by 2024. Biofuels and waste also increased over the period, reaching 535 GWh and 415 GWh, respectively, in 2024. Hydro experienced growth between 2000 (644 GWh) and 2008 (988 GWh), but this has since stabilized at around 950-1,100 GWh in the following years. In

⁹ National Statistics Lithuania

addition, Lithuania imported electricity. From 2000 to 2009, electricity imports represented around ~4,500-5,500 GWh. After the phase-out of nuclear, electricity imports reached higher levels, around 8,000 GWh from 2010 to 2015 and around 11,000-13,000 GWh from 2015 to 2023.

However, indigenous electricity production has, for the most part, been dominated by renewable and low-carbon sources over the years. From 2000 to 2008, renewables and low-carbon sources, driven by nuclear, accounted on average for ~80% of total electricity production. The phase-out of nuclear power reversed the trend; fossil fuels dominated at 71% in 2010. The transition also led to an increase in electricity imports. However, after the transition, renewable fuels recovered and became the majority again by 2016, reaching 81% by 2024.

Overall, Lithuania's electricity production shifted from a near-total reliance on nuclear energy to a balanced mix with other renewables, mainly wind, solar and hydro, now leading (81%). Wind energy experienced the fastest growth, while the progressive decline of oil and natural gas indicates a structural shift following the phase-out of nuclear energy. Figure 12 shows the electricity production by fuel and electricity import in Lithuania.

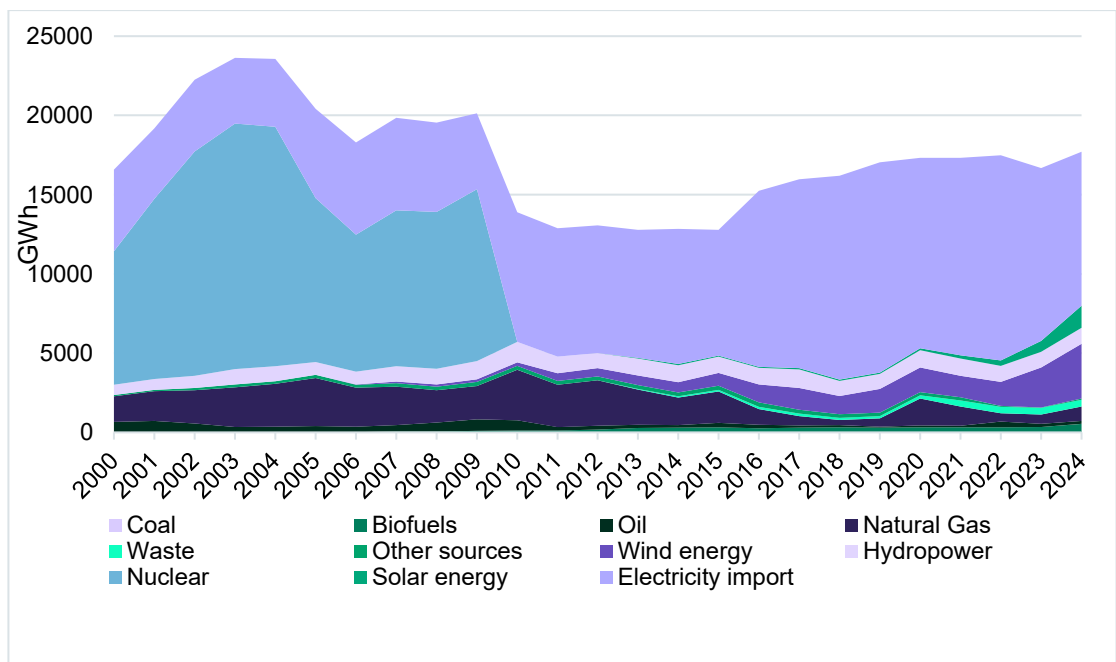


Figure 12 Electricity production by fuel and electricity import in Lithuania¹⁰

¹⁰ IEA Lithuania

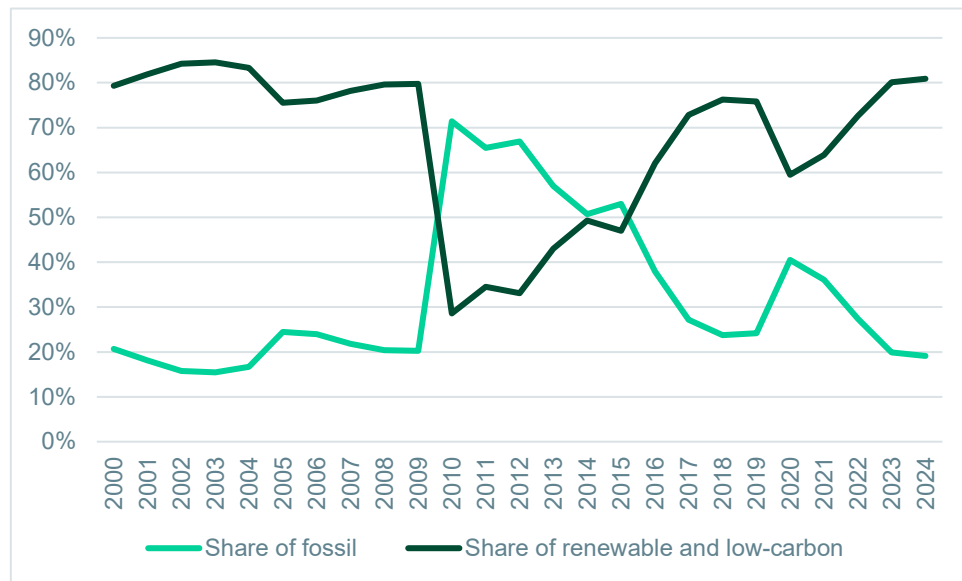


Figure 13 Total share of fossil and renewable electricity generation¹⁰

Over the years, the per capita electricity consumption rose steadily from 2.5 MWh/person in 2000 to 4.4 MWh/person in 2024, representing an increase of approximately 76%. By 2021, it reached its peak of 4.7 MWh per person.

In terms of seasonal production pattern, winter months (January-March, November-December) generally have higher production, reaching around 400-500 GWh per month. The country experienced a historical production peak in December 2024 with nearly 800 GWh. Summer months (June-August) tend to have lower production, sometimes dropping below 250 GWh. Some low records are also observed in April and May, from 2013 to 2015 and then in 2019 and 2020. Overall, monthly electricity production remained relatively stable from 2013 to 2017, decreasing to lower levels in 2018 and 2019, with winter months not exceeding 400 GWh and summer months averaging 250 GWh. In the last two years (2023-2024), production increased to levels above 600 GWh in the winter months.

As data is missing before 2013, we cannot determine how the phase-out of nuclear power affected Lithuania's monthly electricity production. However, the relative volatility and the absence of a clear upward trend can be explained by a growing reliance on renewable energies (solar, waste, wind) and on electricity imports.

Figure 14 shows the final energy consumption of each sector and the share of electricity over the years. Regarding sectoral final energy consumption, industry rose from 8,619 GWh in 2000 to 12,403 GWh in 2021, before stabilising at ~10,500-12,500 GWh in the following years. Transport grew from 12,284 GWh in 2000 to 21,491 GWh in 2008, before stabilizing at lower levels (~18,000 GWh) for a few years. The growth picked up again after 2013, reaching a peak of 26,568 GWh in 2019 before stabilising at ~25,700 GWh over the next five years. This indicates a significant overall increase in transport energy demand over time. Building energy use also increased steadily from 21,284 GWh in 2000 to a peak of 25,530 GWh in 2010, then declined through the mid-2010s before rebounding after 2020 and reaching 26,278 GWh in 2024.

The share of electricity in total energy consumption increased in the industrial and building sectors. In the industrial sector, the rate started at 25% in 2000 and remained stable, with slight year-to-year variations, until 2014, after which it increased to 29% and continued to grow progressively to 31% by 2024. The building sector's rate grew from 17% in 2000 to 26% in 2024, while the transport sector maintained an extremely low share (less than 1%) throughout.

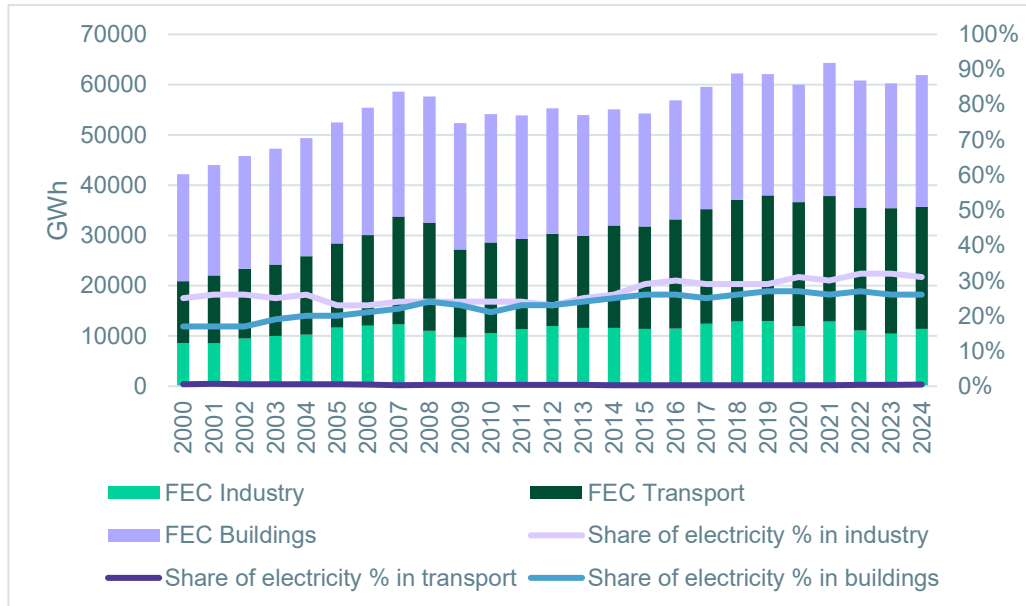


Figure 14 Sectoral electricity consumption in Lithuania⁹

Sub-sectoral electricity consumption

Household sector electricity consumption overall increased from 2017 to 2023. Electricity consumption for space heating increased from 151 GWh in 2017 to 296 GWh in 2023. Water heating showed a similar trend, rising from 148 GWh in 2017 to 246 GWh in 2023. Space cooling remained negligible throughout the entire period.

In the service sector, technical and professional services accounted for the largest share of consumption in 2023 (1,073 GWh). Wholesale and retail trade and other services followed, accounting for 998 GWh and 892 GWh, respectively. Food and accommodation represented 205 GWh in 2023, while the two other subsectors, transportation and storage and arts, sport, and recreation, remained below 150 GWh.

Transport electricity consumption in Lithuania is used in road, pipeline and rail transport. Use of electricity in road transport remained rather stable until 2020 (41 GWh in 2020) before increasing to 67 GWh by 2023. Pipeline transport, itself a function of other energy products, grew from 26 GWh in 2000 to 47 GWh in 2005, then decreased and fluctuated around 20-25 GWh for the remainder of the period. Rail has the lowest electricity consumption among transport modes, accounting for less than 10 GWh from 2000 to 2007 and reaching 13 GWh in 2023. The total electricity consumption in transport increased from 2000 (76 GWh) to 2005 (103 GWh), then fell to lower levels until 2014, when consumption increased again, reaching 105 GWh in 2023.

The uptake of electric and hybrid vehicles in Lithuania

Share of electric and hybrid passenger cars in the total stock of registered passenger cars:

- 2013: Electric 0,0% (2 vehicles), Hybrid 0,1% (1,129 vehicles)
- 2024: Electric 0,9% (15,741 vehicles), Hybrid 5,3% (91,082 vehicles)

Share of electric and hybrid cars among newly registered passenger cars:

- 2013: Electric 0,0% (2 vehicles), Hybrid 0,4% (45 vehicles)
- 2024: Electric 6,7% (1,877 vehicles), Hybrid 53,1% (14,793 vehicles)

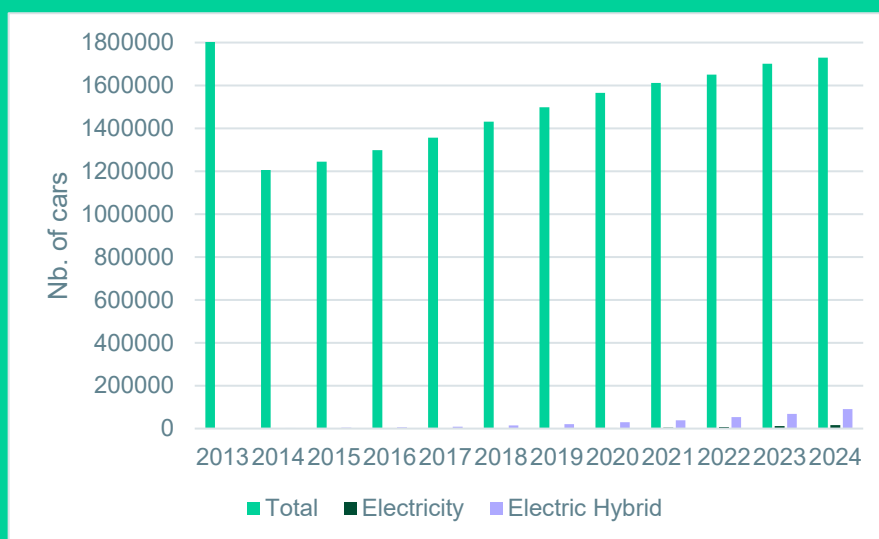


Figure 15 Registered passenger cars by type of motor energy in Lithuania

Source: Eurostat Lithuania

Since 2008, food and tobacco, and chemicals and pharma have been the largest industrial electricity consumers, typically consuming 550-800 GWh per year each. Several other sectors had lower consumption, ranging from around 100 GWh to 350 GWh, including mining and quarrying, metals, and transport equipment.

3.Electrification Potential Assessment

To assess the electrification potential across the Baltic region, three scenarios were analysed. The sectoral electrification rates provided in the original study were used directly as reference values and applied to the corresponding sectors in Estonia, Latvia, and Lithuania. The projections are anchored to the base-year 2024 electrification levels, from which sectoral electrification rates are assumed to increase linearly over time under the scenario assumptions. In 2024, the electrification rates were 27.45% in buildings, 31.30% in industry, and 0.60% in transport in Estonia; 24.94% in buildings, 16.60% in industry, and 1.10% in transport in Latvia; and 27.76% in buildings, 31.10% in industry, and 0.49% in transport in Lithuania.

The electrification of end-use sectors is achieved through the adoption of electricity-based technologies that replace fossil fuel–based systems. The following Table 1 shows the list of electrification technologies.

Table 1 List of Electrification Technologies

Sector	Main Electrification Technologies	Typical Applications
Transport	Battery Electric Vehicles (BEVs), Plug-in Hybrid Electric Vehicles (PHEVs), Electric buses and trucks, Electric trains (catenary rail), Electric ferries/ships, Hybrid-electric aircraft, Charging infrastructure	Electrification of passenger cars, freight transport, railways, maritime transport and emerging aviation electrification
Buildings	Heat pumps (air-source and ground-source), Electric boilers, Electric resistance heaters, Electric air conditioners, Heat pump water heaters, Electric stoves and induction cooking, LED lighting, Electric appliances	Electrification of space heating, cooling, water heating, cooking, lighting and household appliances
Industry	Electric arc furnaces, Induction furnaces, Electric kilns, Electric boilers, Industrial heat pumps, Electric motors and drives, Electric dryers, Electrolysis (hydrogen production), Electric process heating technologies	Electrification of industrial heat, material processing, manufacturing operations and hydrogen production

Three scenarios were developed to assess the potential for electrification in the Baltic region. The scenarios explore different assumptions regarding the pace and extent of electrification across key energy-consuming sectors. For the first two scenarios, electrification was analysed at the sectoral level. Electrification shares (%) reported in the respective studies were used directly as reference values. These shares were applied to each country by first projecting FEC separately for each sector and country and then applying the corresponding electrification rates. The third scenario was developed at the sub-sectoral level, enabling a more detailed representation of

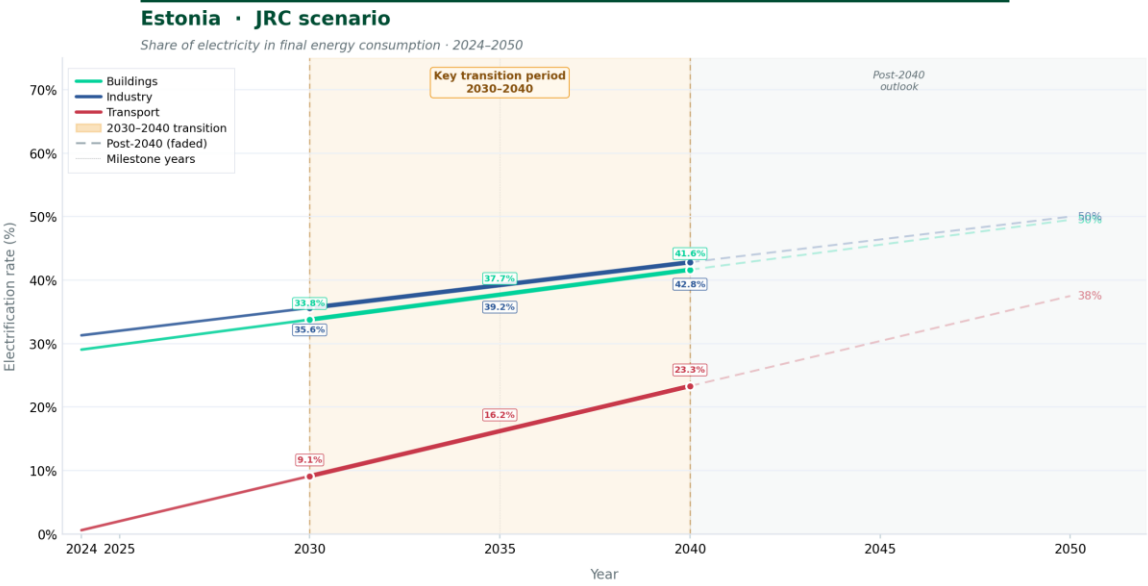
electrification pathways within individual activities and technologies. The three scenarios are described below.

3.1 JRC Scenario

The JRC scenario represents a decarbonisation pathway based on modelling assumptions developed by the Joint Research Centre (JRC) of the European Commission¹¹. It reflects projected developments in energy demand, technology uptake, and emissions reductions consistent with EU climate policy trajectories. Sectoral electrification shares derived from the JRC scenario were applied to projected sectoral energy demand in the Baltic countries. The JRC scenario provides sector-specific ranges for electrification levels across buildings, transport, and industry. The study provides the maximum and minimum electrification percentages for each sector. To adapt the reported values from the JRC study, the average values were calculated and used as a representative target. This resulted in approximate electrification shares of 50% for industry, 49.5% for buildings, and 37.5% for transport. While the scenario assumes a common long-term electrification target for the Baltic countries by 2050, the analysis on this scenario focuses on the intermediate milestones in 2030, 2035 and 2040, which illustrate each country's progress toward these targets.

By 2030, as a result of the progressive adoption of electric heating technologies and advancements in building energy systems, the buildings sector is expected to be electrified to roughly 33–34% in Estonia, 31% in Latvia, and 33% in Lithuania. In the industry sector, electrification reaches around 36% in Estonia, 24% in Latvia, and 35% in Lithuania, showing steady progress, though Latvia remains lower due to its industrial structure. As the adoption of electric vehicles is still in its early stages, the transport industry still shows relatively low electrification levels, ranging from 9–10% in Estonia and Lithuania to roughly 10% in Latvia. By 2035, there will be a greater increase in electrification across all sectors. About 37–38% of buildings in Estonia and Lithuania, and roughly 36% in Latvia, are electrified. The industry sector increases to roughly 31% in Latvia and roughly 39% in Estonia and Lithuania, demonstrating the progressive integration of electric industrial technologies. Due to rising electric car adoption and advancements in charging infrastructure, the transportation sector is experiencing stronger relative growth, reaching roughly 16–17% in all three countries. The Baltic region's electrification levels will further converge by 2040. Electrification rises to about 43% in Estonia and Lithuania and roughly 37% in Latvia, while it reaches roughly 41–42% in the buildings sector. About 23–24% of the transportation sector is electrified, which reflects the ongoing growth of electric mobility.

¹¹Tsiropoulos, I., Nijs, W., Tarvydas, D., & Ruiz, P. (with European Commission). (2020). *Towards net-zero emissions in the EU energy system by 2050: Insights from scenarios in line with the 2030 and 2050 ambitions of the European Green Deal*. Publications Office of the European Union.



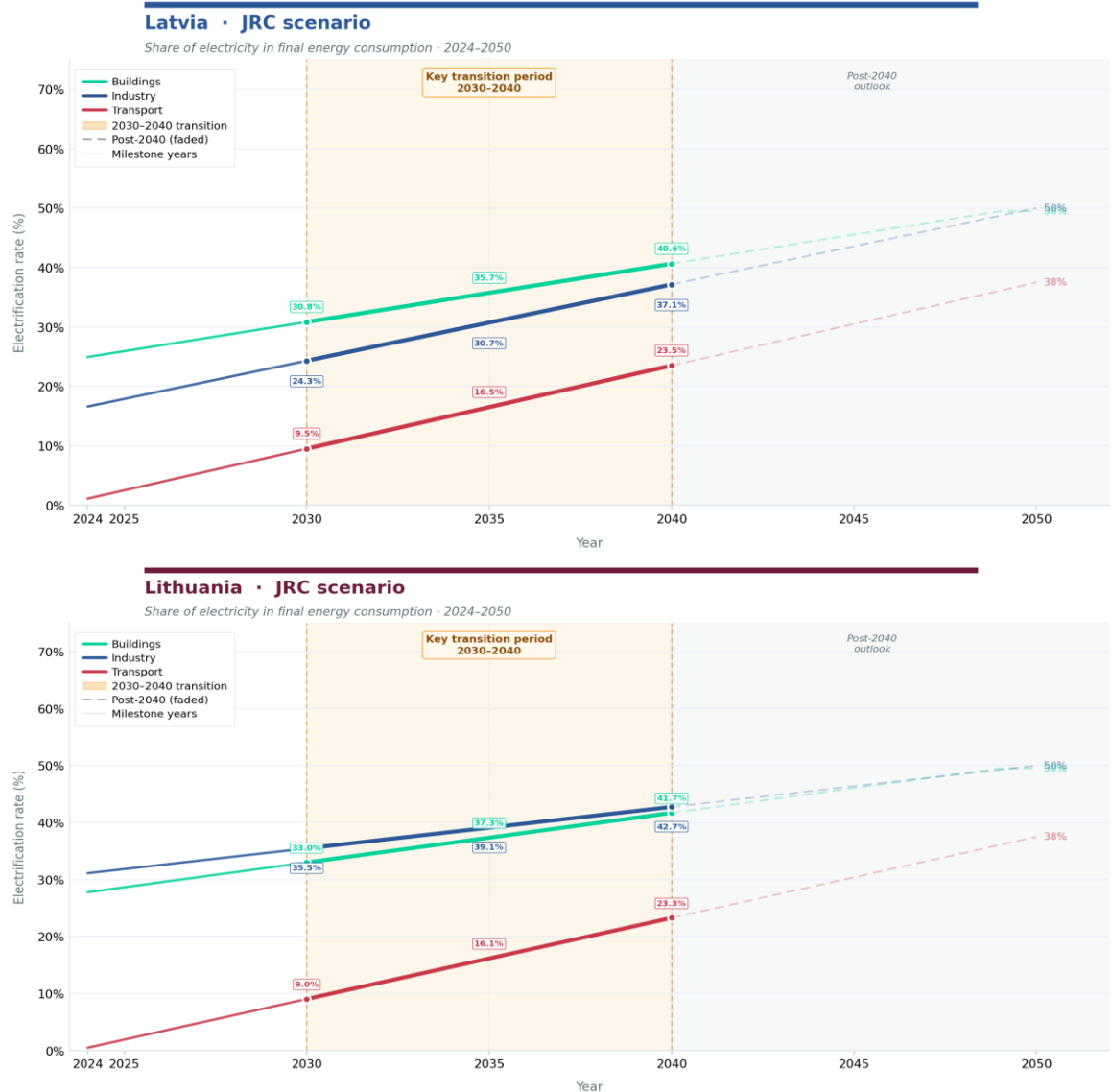


Figure 16 JRC scenario projections

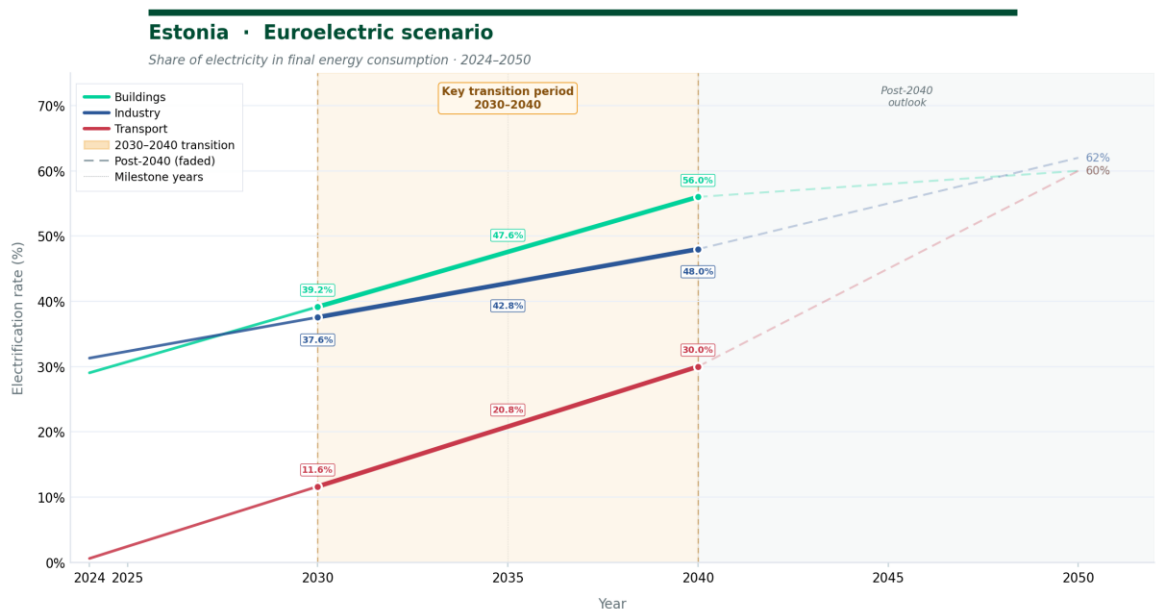
3.2 Eurelectric Electrification Scenario

The Eurelectric Electrification Action Plan (2024) presents a scenario for accelerating the use of electricity across key sectors in Europe to support decarbonization and the transition to a clean energy system¹². In this scenario, the buildings sector is expected to remain the largest consumer of electricity, accounting for 60% of electricity demand in 2030 and reaches 49% by 2050. The electrification rate of the transport sector is

¹² O'Donoghue, C., Olikathodi, A. A., Petcu, I., & Peerhossaini, D. (2024, February). *Europe's 2040 climate target & path to climate neutrality by 2050*. Eurelectric. <https://www.eurelectric.org/wp-content/uploads/2024/06/2040-communication-impact-assessment-eurelectric-analysis.pdf>

expected to reach 8% by 2030 and increase to 22% by 2050, indicating growing adoption of electric vehicles. The industrial sector accounts for 32% of electricity demand in 2030 and declines slightly to 29% by 2050, which reflects efficiency improvements and the gradual electrification of industrial processes. As with the other scenarios, the analysis focuses on the intermediate milestones in 2030, 2035, and 2040 to illustrate the pace of electrification in the Baltic countries.

By 2030, electrification in the buildings sector will increase significantly, reaching approximately 39% in Estonia, 37% in Latvia, and 38% in Lithuania. This reflects the growing electrification of household and commercial energy use, as well as the rapid adoption of electric heating technologies, especially heat pumps. In the industrial sector, electrification rates are approximately 38% in Estonia, 28% in Latvia, and 37% in Lithuania, demonstrating consistent uptake of electric industrial processes. With almost 12% of all vehicles in the three countries being electrified, the transportation sector is expanding more quickly than it did in the beginning. This is mostly due to the growing popularity of electric passenger cars. All sectors will have seen significant increases in electrification by 2035. About half of the buildings sector's final energy consumption is accounted for by electrification, which reaches roughly 48% in Estonia, 46% in Latvia, and 47% in Lithuania. Due to the ongoing electrification of industrial processes, the industry sector is approximately 38% in Latvia and 43% in Estonia and Lithuania. With over 21% electrification across all three nations, the transportation sector is growing rapidly, driven by increased electric vehicle penetration and improved charging infrastructure. The Baltic nations' electrification levels will converge by 2040. In all three countries, the industry sector rises to about 48% electrification, while the buildings sector reaches about 56%. It is anticipated that the transport sector will electrify at about 30%, indicating a significant shift toward electric transportation.



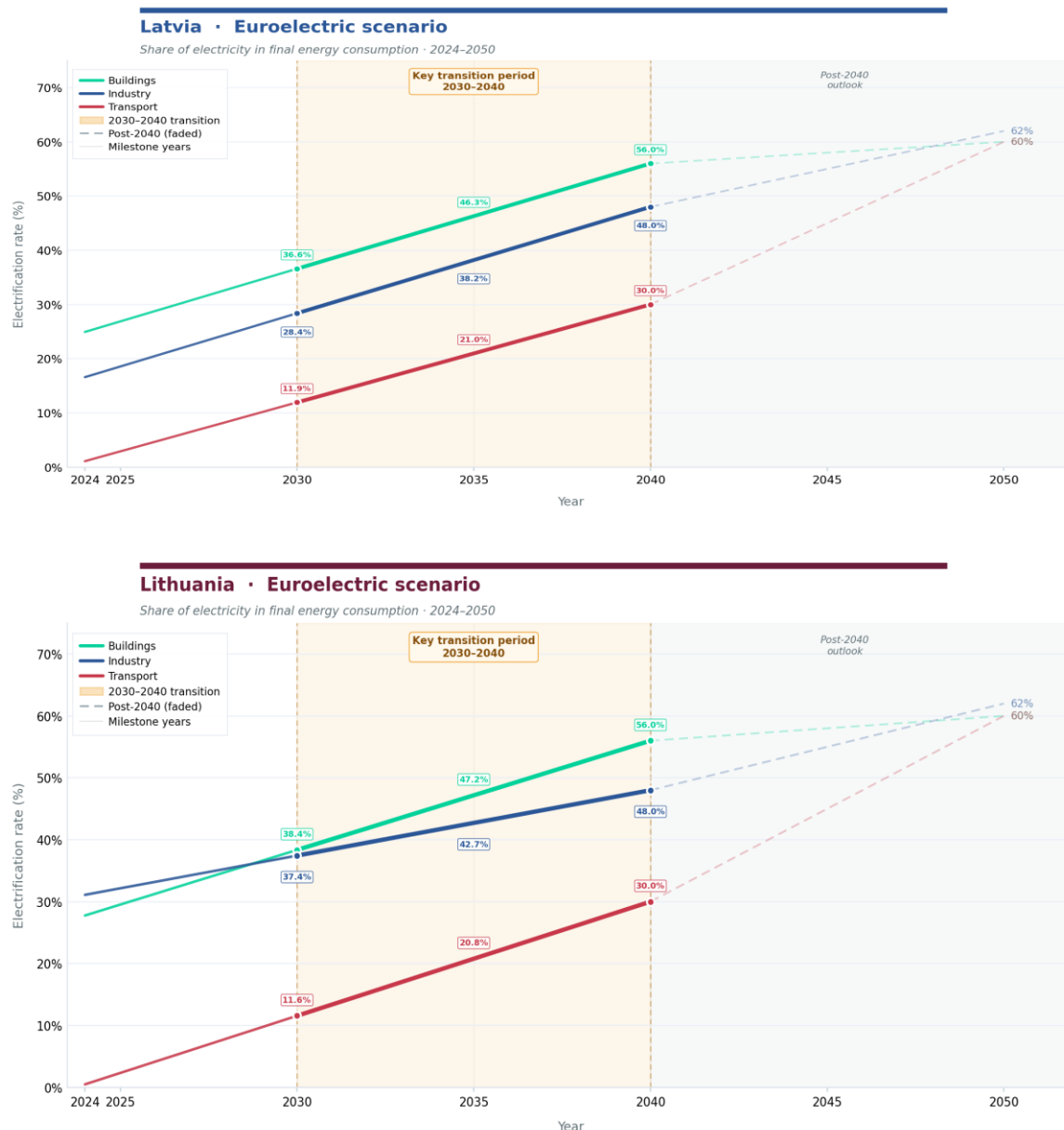


Figure 17 Euroelectric scenario projections

3.3 SEI Expert Scenario

The SEI expert scenario adopts a more detailed approach by starting from final energy consumption at the sub-sectoral level and projections of sectoral final energy consumption until 2050. These projections were determined by assessing the rate of change of per capita energy consumption in industry, transport and buildings and, where a clear recent trend could be observed, applying a constant growth rate until 2050 based on this. For sectors with significant variability, a null hypothesis of constant per capita energy demand until 2050 was used. Total energy demands for each sector were then determined using population projections.

Electrification assumptions are applied based on the expected degree of electrification by 2050. Electrification levels are expressed either through:

- activity indicators (e.g., the share of electric vehicles in transport), or
- direct electrification shares in final energy demand.

Efficiency factors are applied to interconvert between activity indicators and corresponding final electricity consumption. The assumptions used in this scenario are derived from high quality sources, such as the International Renewable Energy Agency (IRENA), or benchmarked against the highest currently observed electrification levels in Nordic countries. The transition towards the assumed 2050 electrification levels follows a logistic growth pathway, characterized by a relatively low steepness parameter (0.3), which represents a gradual uptake of electrification technologies over time. Note however that uptake of technology is not itself modelled, and the rate of transition between current levels and the 2050 target is governed entirely by this parameter. Throughout the scenario period, no structural changes in the overall sectoral distribution of final energy consumption are assumed, meaning that the relative contributions of varying sub-sectors to final energy demand remain unchanged.

In the transport sector, the assessment covers road, rail, domestic aviation, and domestic navigation. Road transport includes passenger vehicles, buses, and freight vehicles transitioning to electric mobility, while rail comprises electrified passenger and freight systems. Aviation and navigation represent domestic air and water transport activities. The buildings sector again consists of space heating, space cooling, water heating, cooking, lighting and electrical appliances. The industrial subsectors are also the same as in the historical analysis. Industrial electrification capture transitions towards can occur through electric process heat, electric furnaces, and advanced manufacturing technologies.

The scenario projections follow a logistic growth trajectory, which reflects the gradual adoption of electrification technologies over time. Nevertheless, the choice of such a function can be justified in the knowledge that variants of logistic growth are used extensively to model diffusion or adoption across a population over time. Whilst the growth described here remains phenomenological rather than mechanistic, doing so mirrors the transitions seen in previous technological adoptions, such as the adoption of the internet, car ownership, or even the adoption of electric technologies such as light-emitting diode (LED) bulbs. We have chosen to model using a symmetric logistic curve, such that the electrification growth rate accelerates after 2035. However, the real rate of adoption and the total cumulative energy savings it affords, will be determined by policy.

Across the Baltic countries, the building sector demonstrates the highest levels of electrification throughout the projection period. This large increase is driven by the large apparent difference in heating sources between the Baltics and Nordics, indicating significant room for potential growth. Such growth would imply the increasing deployment of electric heating technologies, particularly heat pumps. In Estonia, building electrification increases from 29% in 2024 to 69% by 2050. In Latvia, building shows a similar long-term trajectory, rising from 23% to 69% over the same period, while Lithuania reaches the highest level among the three countries, increasing from 24% in

2024 to 72% by 2050. The reason for the similar values is due to similar proportions of building energy demand going towards space heating, which in all three countries have high implied electrification potential in light of the state in the Nordics. We have chosen to model using a symmetric logistic curve, such that the electrification growth rate accelerates after 2035. However, the real rate of adoption and the total cumulative energy savings it affords, will be determined by policy. The industry sector's final value and apparent rate of increase is determined by the relative sub-sectoral contributions to final energy demand and their respective analysed electrification potentials. Considering this, Estonia's industrial electrification rate rises from 31% in 2024 to 55% in 2050. Due to the structure of its industrial sector, Latvia's adoption is gradual, starting at a much lower level of 16% and rising to 39% by 2050. Lithuania's growth from 31% to 57% over the forecast period is comparable to Estonia's. Such transitions would require the gradual substitution of fossil-fuel-based processes with electric alternatives such as electric boilers, electric furnaces, and electrified process heating. The transport sector shows the most dramatic relative increase in electrification, although it starts from very low initial levels. The growth is primarily driven by the rapid adoption of electric passenger vehicles, as private road transport dominates sectoral energy demand. This would be combined with gradual electrification of public transport fleets, and the increasing market share of electric light-duty commercial vehicles. In Estonia, electrification in transport rises from 0.6% in 2024 to 58% by 2050. Latvia grows from 1% to 59% by 2050, while Lithuania's growth trajectory is similar, rising from 0.4% to 59%.

Estonia at sub sectoral level

Electricity demand in buildings grows moderately but steadily from 2024 to 2050. Overall, electrification in buildings is mainly driven by heating electrification. In the transport sector, the most significant growth occurs in road transport electrification. From 2024 to 2050, the road electricity demand increases from 41 to 3,382 GWh. The rail demand grows modestly from 27 GWh to 74 GWh over the same period. This indicates that electric vehicles are the dominant driver of transport electrification, reflecting the rapid adoption of EVs in road transport. Industrial electricity demand grows gradually across most manufacturing activities. The most notable growth occurs in the following sectors between 2024 and 2050: Wood and wood products, which grow from 309 GWh to 404 GWh; and Food, beverages, and tobacco, which grow from 210 GWh to 330 GWh. The pulp, paper and printing grow from 193 GWh to 404 GWh. Some sectors do not see substantial growth such as iron and steel and non-ferrous metals. Where this is the case, it is caused by either a partial or total absence of these sectors from the economy, which is generally seen for metal processing in the Baltic states, or because the level of electrification is already comparable to the current Nordic levels. In the latter case, this would indicate the potential for electrification is somewhat lower, as there is little difference to neighbouring countries in which more advanced technological processes are likely to have been adopted.

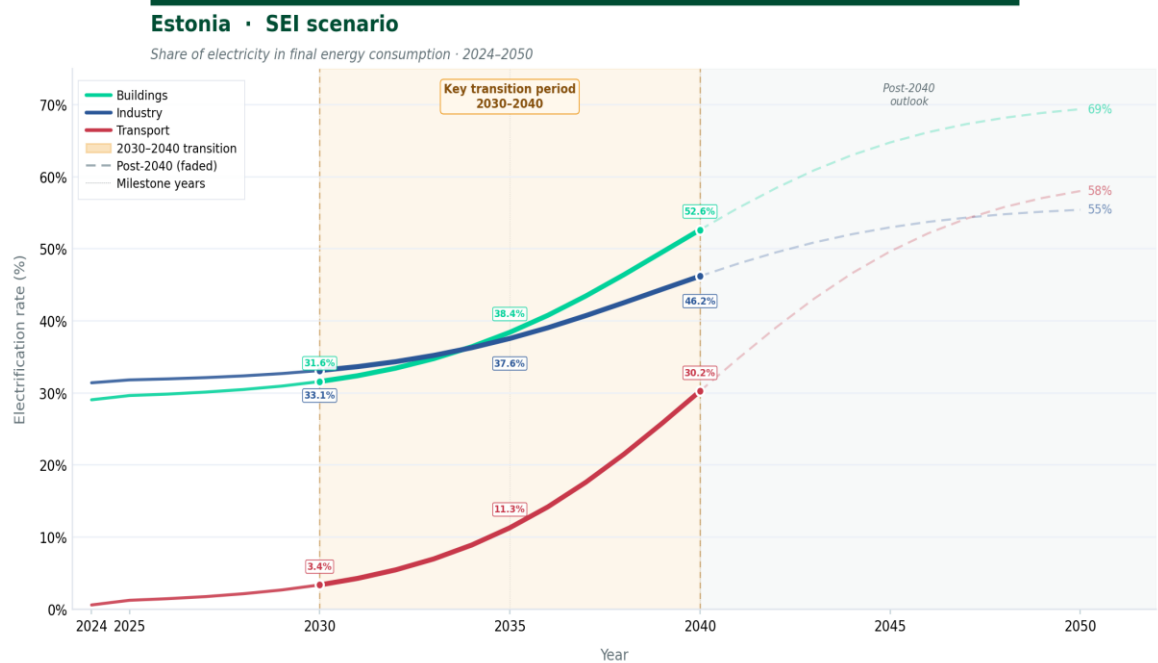


Figure 18 SEI expert scenario projection for Estonia

Latvia at sub sectoral level

Electrification in the buildings sector is primarily driven by space heating electrification, while other building energy uses remain relatively stable or decline slightly in absolute terms between 2024 and 2050. An absolute decline is caused by the projection of overall sectoral energy consumption, which decreases up to 2050. Electricity use in space heating increases significantly from 617 GWh to 2,509 GWh. The water heating gradually decreases from 1,395 GWh to 1,006 GWh, which is again a function of the decreasing total energy consumption alongside a higher starting electrification rate. In turn, cooking increases steadily from 158 GWh to 642 GWh as it is significantly less electrified than the current highest Nordic value. Overall, the buildings sector appears to have strong potential for electrification. Between 2024 and 2050, in the transport sector, as in Estonia, the largest growth is in road transport electrification. Electricity demand for road transport increases from 53 GWh to 4,953 GWh. The rail transport grows more modestly from 84 GWh to 226 GWh. This trend suggests that electric vehicles are the primary driver of transport electrification in Latvia, with road mobility contributing the majority of new electricity demand. Industrial electrification in Latvia is expected to grow steadily but moderately across several manufacturing sectors between 2024 and 2050. The most notable increase occurs in wood and wood products, which increases from 840 GWh to 2,494 GWh. This is predominately because it occupies a large share of industrial final energy consumption, and the level of electrification is low compared to the situation in the Nordics and the other Baltic countries. Other non-metallic mineral products, which increase from 313 GWh to 757 GWh and Food, beverages and tobacco sectors (from 304 GWh to 607 GWh) are also significant energy consumers with relatively high electrification potential. As in Estonia iron and steel is underdeveloped in terms of energy usage and is already highly electrified. Most other sectors have significant electrification potential but occupy smaller proportions of total energy (and therefore electricity) consumption.



Figure 19 SEI expert scenario projection for Latvia

Lithuania at sub sectoral level

Electrification in the buildings sector is growing steadily between 2024 and 2050. Space heating increases substantially from 497 GWh to 5,288 GWh. As with Estonia and Latvia, space heating is both the primary source of energy consumption in buildings and relatively under-electrified compared to the Nordics, which drives this large absolute increase in our model. The water heating increases from 550 GWh to 1,195 GWh. The cooking increased from 388 GWh to 1,548 GWh. The space cooling remains relatively stable over time. Overall, Lithuania shows strong growth in electrified heating and household electricity consumption, contributing significantly to rising electricity demand in the buildings sector. As in the other two countries, the most significant increase occurs in road transport electrification between 2024 and 2050. Electricity demand for road transport increases from 85 GWh to 7,972 GWh. Rail transport grows more gradually from 15 GWh to 81 GWh over the same period. Industrial electrification in Lithuania is showing steady growth across multiple manufacturing sectors, reflecting the country's larger industrial base compared with the other Baltic states. The most notable increase occurs in the chemical industry, from 527 GWh to 1,268 GWh. This is a significant sector of final energy consumption and also has significant electrification potential considering electrification rates in the Nordics. In contrast, despite also being a significant energy consumer, electrification in wood and wood products sector is low in relative terms as the sector already has a similar level of electrification compared to the Nordic countries. Other sectors which are projected to see large absolute increases in electricity consumption are other non-metallic mineral products and food, beverages and tobacco (from 728 GWh to 1,022 GWh). Other sectors, such as machinery manufacturing, pulp and paper, and construction, also show moderate growth over the period.

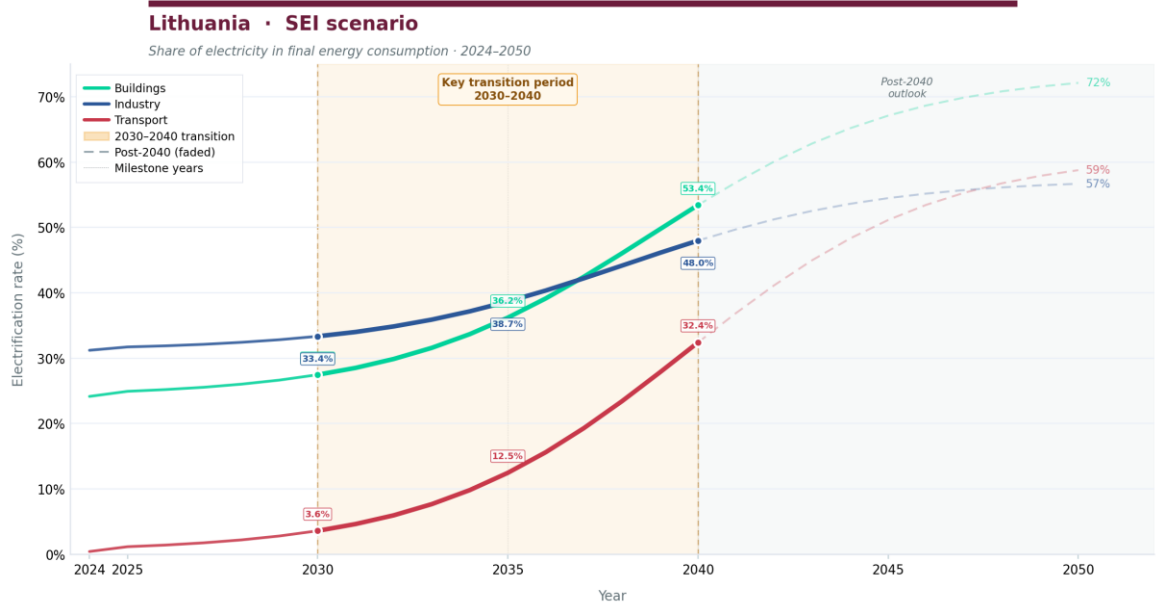


Figure 20 SEI expert scenario projection for Lithuania

Overall, at the regional level, electrification in the Baltic states is largely driven by:

- Rapid electrification of road transport
- Expansion of electric heating technologies in buildings
- Gradual electrification of manufacturing processes in key industrial sectors

Among the three countries, Lithuania shows the largest overall growth in electricity demand, which is driven by its larger population and more diversified industrial base. Overall, the area shows strong potential for a shift toward electric heating and transportation systems, with industrial electrification contributing to the long-term energy transformation in a supporting but continuously expanding way.

Energy savings

The SEI expert scenario estimates the share of the Baltic countries' final energy consumption that can be reduced through electrification and efficiency gains. Energy savings were estimated by comparing current fossil-fuel energy use with the final energy demand after electrification, using sector-specific efficiency gain parameters. Fossil energy demand by country and sector was taken from the JRC-IDEES 2023 country-specific fossil energy splits. For each end-use, fossil fuel consumption was reassigned to one of three electrification categories: diesel for work/motors, low-temperature heat (<200°C), and high-temperature heat (>500°C).

For each category, energy savings were calculated by dividing current fossil energy demand by the corresponding efficiency factor: $J_{\text{diesel}} = 3^{13}$, $J_{\text{lowT}} = 2.5^{14}$, and $J_{\text{highT}} = 1.5^{15}$. These factors represent the improvement in useful energy delivery when switching from fossil-based technologies to electric alternatives. For example, electric motors are assumed to be around three times more efficient than diesel-driven systems, heat pumps provide low-temperature heat with around 2.5 times lower final energy input than fossil boilers, and electric high-temperature processes such as induction or arc systems are assumed to reduce final energy demand by a factor of 1.5 compared with combustion-based systems. A key feature of the analysis is that energy savings will always occupy a lower percentage than the electrification rate. As electricity replaces less efficient combustion processes, they use less energy to achieve the same level of activity. This means that the remaining inefficient fossil share remains more prevalent from an energy basis than it does from an activity one. The result is a levelling off of the energy savings curve as electricity's share increases. This is itself a function of the efficiency gain from electrification, a process that was 10 times as efficient when electrified would save 90 % of the original energy use, whereas a process that was 100 times more efficient would save 99 %.

Table 2 Highlight the energy-savings results across the Baltics by sector. Based on the analysis, in the early years, energy savings remain minimal due to the sigmoid curve used to model the transition. In reality, this could be expected due to limitations on current infrastructure, high technology costs, and slow market acceptance. But as electrification technologies advance and efficiency gains mount, energy savings rise gradually over time. The building sector shows steady increases in energy savings across the Baltics. By 2050, annual savings are expected to reach 29% in Estonia and roughly 31% in Latvia and Lithuania. The absolute savings in Latvia are slightly higher in the early years, but by the end of the projected period, the three countries reach comparable levels. When compared to other sectors, the industry sector exhibits slower growth in energy savings, as well as greater variety between countries. These effects are respectively caused by the lower implied efficiency gain from the electrification of high-temperature process heat, and the more diverse structure of industrial final energy consumption compared to other sectors. Energy savings are expected to reach roughly 19% in Estonia, 20% in Latvia, and 15% in Lithuania by 2050. The greater challenges and capital costs from electrifying high-temperature heat, alongside the extended operating lifetimes of industrial equipment, could cause a slower advancement in electrification. However, over time, consistent improvements result from the gradual replacement of fossil fuel-based processes with electric technology.

¹³ Wego, A. (2024). *Diesel vs. Electric—An energy analysis after three years of driving*. https://fiw.hs-wismar.de/storages/hs-wismar/FIW/Bereich_EUI/AB_AET/Professoren/Wego/Diesel_vs._Electric_-_An_energy_analysis_after_three_years_of_driving.pdf

¹⁴ IEA. (2022). *The Future of Heat Pumps*. IEA. <https://www.iea.org/reports/the-future-of-heat-pumps>

¹⁵ San Lan Technologies Co.,Ltd. (2025, July 14). *Energy-saving Electric Furnace vs Traditional Melting Furnace: Energy Consumption Comparison* [San Lan]. <https://www.san-lan.com/faq/energy-saving-electric-furnace-vs-traditional-melting-furnace-energy-consumption-comparison.html>

In all three Baltic nations, the transport sector exhibits the fastest growth in energy savings. Savings reach roughly 46% in Latvia and Estonia and 47% in Lithuania by 2050. The quick adoption of electric passenger cars, the electrification of public transportation fleets, and the growing market share of electric light-duty commercial vehicles would all be major factors contributing to this robust growth being seen in reality. Overall, the scenario shows that electrification and efficiency gains can drastically lower final energy consumption throughout the Baltic region, with the transportation sector experiencing the biggest relative gains, followed by buildings, while the industrial sector undergoes a more gradual transition.

Table 2 Energy savings of Baltic countries

2050	Buildings	Industry	Transport
Estonia	29%	19%	46%
Latvia	29%	20%	46%
Lithuania	31%	15%	47%

4. Conclusions

Electrification in the Baltic States is primarily driven by three interconnected trends: the rapid electrification of road transport, the expansion of electric heating technologies in buildings, particularly heat pumps, and the gradual electrification of manufacturing processes across key industrial sectors.

This transition brings a range of significant environmental and socio-economic benefits. Electrification, combined with renewable energy and energy efficiency, represents one of the most cost-effective pathways to meeting climate targets^{16,17}. It also strengthens both energy and supply security, as countries become less dependent on imported fossil fuels, which are subject to price volatility and high costs. In 2023 alone, the EU's energy import bill rose to 427 billion euros¹⁸. The shift toward renewable electricity is now widely recognised as the most affordable energy source. In addition, the phase out of fossil fuels directly improves air quality and public health¹⁹. Finally, the transition is a driver of quality job creation, generating green and skilled employment across multiple sectors. Targeted national measures can help to sustain these benefits and ensure that current trends translate into lasting change. The following section examines the financial,

¹⁶ IEA (2023), *Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach*, IEA, Paris.

¹⁷ IRENA (2019), *Global energy transformation: A roadmap to 2050* (2019 edition), International Renewable Energy Agency, Abu Dhabi.

¹⁸ European Commission (2025). *Report on Energy Prices and Costs in Europe*, European Commission, Brussels.

¹⁹ United Nations. (n.d.). *Taking action for the health of people and the planet*. United Nations. Retrieved April 2, 2026, from <https://www.un.org/en/climatechange/science/climate-issues/health>

political, and technical measures that can be implemented in the Baltic States to accelerate electrification.

5. Recommendations

This analysis focused on modelling the electrification potential for the three Baltic countries and does not assess the viability of the policy measures needed for this change. Considering this, we have mapped a non-exhaustive list of recommendations which could be relevant to the Baltic countries in supporting electrification. These recommendations are based on institutional reports and on best practices from relevant European countries. We will first introduce cross-sectoral recommendations before presenting sectoral recommendations.

Cross-sectoral recommendations

Increased electrification drives broader system change beyond individual sectors. It places additional pressure on grids and requires stronger and more flexible infrastructure, as well as clear policy direction.

- **Set legally binding timelines for fossil fuel phase-out and align price signals accordingly.** Giving a clear, legally binding timeline for phasing out fossil fuels is an essential foundation²⁰. It provides investors, grid operators, and policymakers with a common reference point. This also means updating energy excise duties and ending remaining fossil fuel subsidies²⁰. The IEA identifies fossil-fuel subsidy reform and CO₂-based excise duties as priorities for all three countries^{20,21,22}. Latvia has taken a first step with a CO₂ excise reform in 2025^{23,24}.
- **Reform DSO regulations to make flexibility the first option for grid management.** The Baltic states could adopt technology-neutral, TOTEX-based regulation that rewards DSOs equally for flexibility services and

²⁰ IEA. (2023). *Estonia 2023. Energy Policy Review*.
<https://iea.blob.core.windows.net/assets/20720ecf-d61f-4376-abd4-738896d32d34/Estonia2023.pdf>

²¹ IEA. (2025). *Lithuania 2025. Energy Policy Review*.
<https://iea.blob.core.windows.net/assets/0f37fbcd-856d-4fde-8f2b-4db10d9bfd2a/Lithuania2025.pdf>

²² IEA. (2024). *Latvia 2024. Energy Policy Review*.
<https://iea.blob.core.windows.net/assets/40d40536-4044-459e-9891-d586f1977bfd/Latvia2024.docx.pdf>

²³ Ministry of Finance. Republic of Latvia. (2024). *Changes in taxation and finances from 2025*.
<https://www.fm.gov.lv/en/changes-taxation-and-finances-2025>

²⁴ ERR. (2026). *Estonian government cancels planned May energy excise hikes*. ERR.
<https://news.err.ee/1609965305/estonian-government-cancels-planned-may-energy-excise-hikes>

conventional grid investment²⁵. DSOs could be required to assess and procure demand response, storage and other non-wire alternatives before reinforcing the grid, and to lead local flexibility procurement in congested areas²⁶. More broadly, DSOs could be active drivers of the transition. By removing grid bottlenecks and anticipating demand growth, they can directly deliver cheaper electricity²⁶.

- **Shift smart-meter digitalisation to active flexibility markets and tariffs.** The Baltic States have advanced smart-meter rollouts, but demand-side flexibility has not followed – a gap the IEA explicitly flags for Lithuania²¹¹. Nordic evidence shows that the next steps are to introduce dynamic or capacity-based network tariffs, open data access, lower market-entry thresholds, and rules that allow value stacking across DSO and TSO services²⁵⁵. This would help convert digital infrastructure into real consumer and industrial flexibility.
- **Increase long-duration storage capacity.** While short-term battery storage is being addressed, gaps remain in long-term storage. For instance, Lithuania's National Energy Independence Strategy implicitly relies on green hydrogen production for long-duration storage but given slower-than-expected hydrogen market development, a dedicated long-duration storage strategy that does not depend solely on hydrogen offtake remains missing²⁷.

Sectoral recommendations

Transport

As shown in the report, the electrification of the transport sector will be driven by rail and road transport. This means accelerating the electrification of passenger cars including private, corporate and public ones as well as railways, and expanding electrified public transport.

- **Promote EV vehicles through fiscal policy.** Several fiscal policies could accelerate the adoption of EVs in the Baltics. One relevant measure is a value-added tax (VAT) exemption. For instance, Norway introduced a VAT (25%) exemption for BEVs below NOK 500 000 (44 000 €) in 2023²⁸. Baltic countries could also target corporate cars, drawing inspiration from Belgium, where 100% of the purchase value of a company BEV is deducted from corporate taxable income²⁸²⁸. Such policies would help accelerate the

²⁵ Nordic Energy Research. (2025). *Demand side flexibility in the Nordics. Lessons learned from 10 case studies*. <https://pub.norden.org/nordicenergyresearch2025-03/index.html>

²⁶ DSO Entity. (2026). *Report on Distributed Flexibility Practices*. <https://eudsoentity.eu/wp-content/uploads/2026/02/Report-on-Distributed-Flexibility-Practices-Markets-for-Local-Services-2.pdf>

²⁷ Ministry of Energy of the Republic of Lithuania. (2024). *National Energy Independence Strategy*. https://enmin.lrv.lt/public/canonical/1740735085/5963/NENS%202024-2.12_EN.pdf

²⁸ IEA. (2025). *Global EV Policy Explorer*. IEA. <https://www.iea.org/data-and-statistics/data-tools/global-ev-policy-explorer>

electrification of the car stock, beyond the registration tax exemptions already in place.

- **Extend zero-emission public transport beyond the capitals.** The Baltic states have made strong progress on zero-emission city bus procurement. The priority now is the overhaul and expansion of rural and intercity public transport networks to restore connectivity and reduce car dependency^{20,21,22}. It means accelerating diesel fleet replacement outside big cities, eliminating remaining mixed procurement contracts, and extending zero-emission requirements to intercity coaches and government fleets. This also creates an opportunity to distribute electricity demand, which justifies grid reinforcement in underserved areas and strengthens overall grid resilience.
- **Accelerate the expansion of EV charging infrastructure.** The charging density outside capital and major cities remains a barrier. Expanding the infrastructure alongside highways and in rural areas will ease EV uptake.

Building and heating

In the building and heating sector, greater electrification means greater use of both individual and large-scale heat pumps, for households and district heating networks. Accelerated renovation, higher building energy performance standards and efficiency gains must accompany this shift.

- **Increasing the electrification of district heating.** There is a need to transition away from fossil fuels and biomass²⁹ district heating by tapping into the potential of large heat pumps, short- and long-term heat storage, and biogas³⁰. To accelerate this shift, governments could redirect existing subsidy schemes away from fossil fuels and biomass toward heat pump installation and network modernisation. For instance, Lithuania plans to integrate residual waste heat and power-to-heat solutions. But district heating companies need to be supported to make the necessary investments in the network and substations²¹¹.
- **Subsidise smart heat pump adoption and tighten building energy standards.** Smart heat pump subsidy programmes need to be scaled up and better targeted at lower-income households, especially in areas without district heating access²⁰⁰. This must go hand in hand with tightening minimum energy performance standards and expanding renovation grant programmes, with support increasing proportionally to energy savings achieved and priority given to the least efficient homes. Such investment is the most cost-effective way to tackle energy poverty as it reduces household exposure to price

²⁹ While biomass district heating helps reduce emissions in the short term, it cannot be the preferred solution for the longer term. Indeed, biomass brings significant challenges related to carbon, air quality and biodiversity.

³⁰ Henley, M., Kuld, J., Pedaja, M., & Sillak, S. (2022). *Getting gas out of district heating in the Baltics* (p. 9). CEE Bankwatch Network. https://bankwatch.org/wp-content/uploads/2022/10/2022-10-12_Getting-gas-out-of-district-heating-in-the-Baltics.pdf

volatility and avoids the need for costly blanket price support measures during energy crises²²².

- **Make tariff regulation more supportive of long-term investment in the district heating sector.** Regulation overly focuses on short-term price minimisation, which restrains operators from investing in network modernisation, heat storage, and other important changes. The IEA stresses this problem explicitly for Lithuania, where regulation drives competition but not investment. This situation has been further compounded since 2011 when substations were transferred to building owners, fragmenting ownership and limiting incentives for whole-network optimisation²¹¹.

Industry

Industrial electrification goes together with improving process efficiency and modernising production systems. It also requires the development and piloting of new technologies for hard-to-abate industrial processes that cannot easily be electrified with existing solutions.

- **Anchor sectoral low-carbon roadmaps in climate laws.** The Baltic countries could develop sectoral decarbonisation roadmaps with industry stakeholders to establish binding milestones for the main actions needed in each sector, especially on regulation, information measures and incentives²⁰⁰. This process is currently being integrated into the elaboration of the climate law in Estonia³¹. A climate law that sets legally binding targets for carbon neutrality and intermediate emissions reductions could give Baltic states a stable framework for electrification, increase investment certainty, and better align industrial decarbonisation with renewable and grid planning.
- **Reduce electricity taxes to a minimum**, as recommended by the European Commission's Action Plan for Affordable Energy³². For instance, taxes and levies on mid-sized industrial electricity consumption are, on average, three times those on fossil gas consumption in Lithuania and twice as high in Latvia and Estonia³³. Such taxes hinder industrial electrification.
- **Scale up resource efficiency grant programmes.** The Baltic countries have programmes to support industrial energy and resource efficiency, largely

³¹ Kliimaministeerium. (2025). *Kliimakindla majanduse seadus*. Kliimaministeerium. <https://kliimaministeerium.ee/eesti-kliimaseadus#teekaartide-esialgne>

³² European Commission. (2025). *COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Action Plan for Affordable Energy Unlocking the true value of our Energy Union to secure affordable, efficient and clean energy for all Europeans*. EUR-Lex. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52025DC0079&qid=1741780110418>

³³ Rosslowe, C. (2025). *Shockproof: How electrification can strengthen EU energy security*. Ember. <https://ember-energy.org/latest-insights/shockproof-how-electrification-can-strengthen-eu-energy-security/policy-recommendation/>

funded by EU instruments like the Recovery and Resilience Facility^{34,35}. These programmes could be expanded and given a long-term funding base, including using EU ETS revenues, to support investments.

- **Create conditions that support the piloting and testing of innovative electrification solutions.** Governments could encourage companies to test and scale up new decarbonisation options. This could include support to further develop green hydrogen to decarbonise hard-to-abate sectors. The Baltic countries could benefit from the emerging competitive advantage of Finland and Sweden in low-carbon hydrogen production. The Baltic countries can also look at system-level approaches, such as industrial symbiosis, which can reduce energy use, share resources, and lower emissions across industrial sites³⁶.

³⁴ KIK. (n.d.). *Ressursi- ja energiatõhusus ning ohutu materjaliringlus ettevõtetele*. KIK Environmental Investment Centre. Retrieved https://kik.ee/et/toetatavad-tegevused/ressursi-ja-energiatõhusus-ning-ohutu-materjaliringlus-ettevotetele?utm_source=chatgpt.com

³⁵ Ministry of the Economy and Innovation of the Republic of Lithuania. (2024). *€55 million investment to improve energy efficiency in industrial enterprises*. LRV.LT. <https://eimin.lrv.lt/en/structure-and-contacts/news-1/55-million-investment-to-improve-energy-efficiency-in-industrial-enterprises/>

³⁶ SYMBI project. (2026). *SYMBI. Industrial Symbiosis for Regional Sustainable Growth and a Resource Efficient Circular Economy*. Interreg Europe. <https://www.interregeurope.eu/symbi>

Appendix

In this study, we have projected the final energy consumption (FEC) for the transport, buildings, and industry sectors by applying a similar method across three countries. The projection is based on two elements: population projections and sectoral per-capita energy consumption.

First, historical per-capita energy consumption was calculated for each sector by dividing historical sectoral FEC by population. Future sectoral FEC was then estimated by multiplying the projected population by the projected per-capita consumption.

In general, two approaches were used for projecting per-capita consumption:

- If historical per-capita consumption showed a strong decline over time, it was assumed that the 2023 per-capita level remains constant in future years.
- Otherwise, per-capita consumption was projected using the average historical growth rate based on the last 5 or 10 years, depending on the trend.

The same approach was applied consistently across all three sectors and all three Baltic countries. The only difference between cases was whether per-capita consumption was kept constant at the 2023 level or projected using the recent historical growth trend.

The rationale for the assumption was used to keep the projections realistic and consistent across sectors and countries. In cases where per-capita energy consumption has already been declining strongly in the historical period, continuing the same downward trend far into the future could lead to unrealistically low consumption levels. Therefore, keeping per-capita consumption constant at the 2023 level provides a conservative assumption and avoids overestimating future efficiency improvements or structural changes. Where no strong decline is observed, using the average growth rate from the last 5 or 10 years allows the projection to reflect recent historical trends while smoothing short-term fluctuations. Combining this with population projections ensures that future FEC is driven by both demographic developments and past sectoral energy-use patterns. The following figure shows the total FEC of sectors.

Using the scenario-specific projection rates for each country, the implied electrification rate can be estimated by analysing the projected final energy consumption (FEC) across sectors.

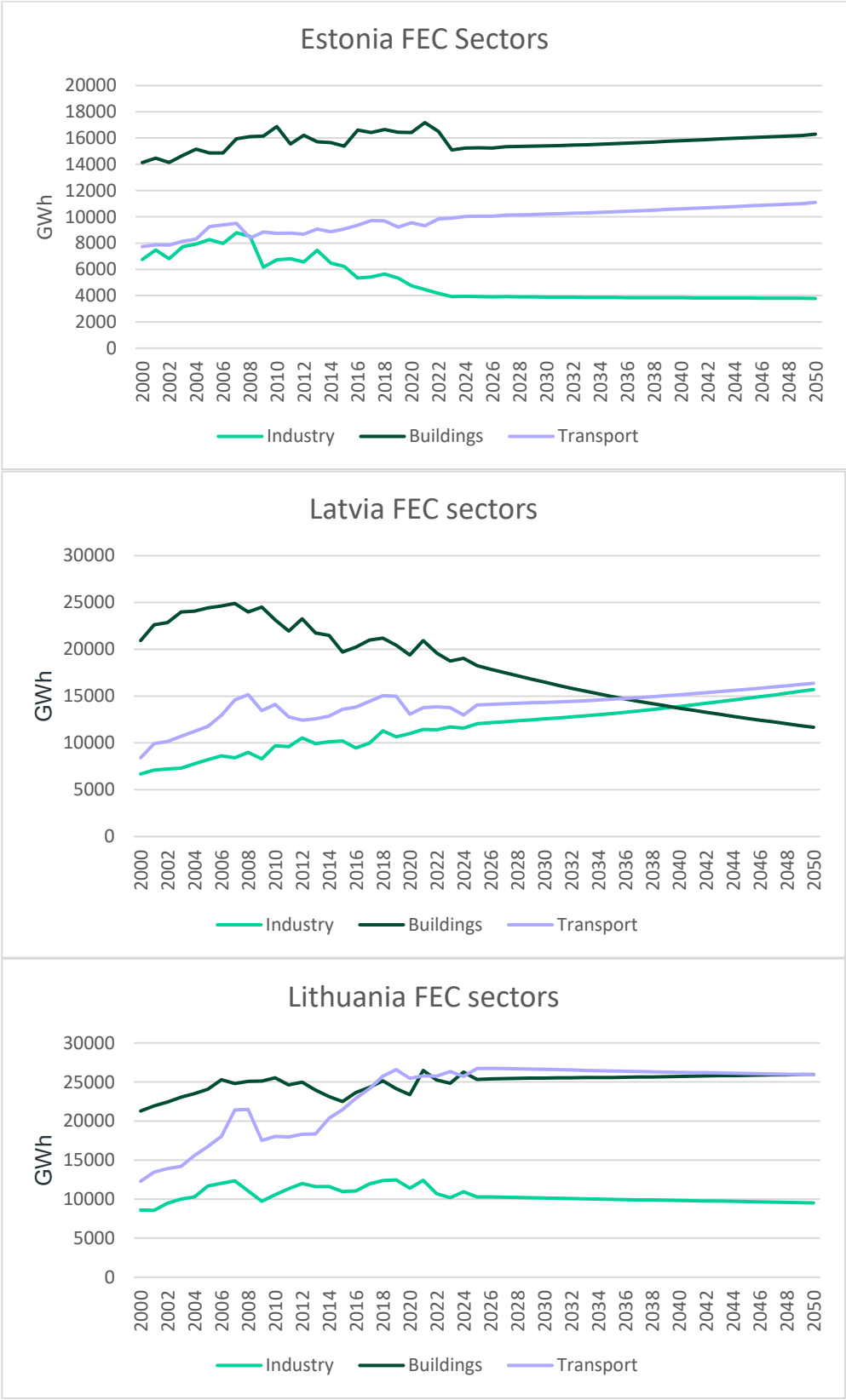


Figure 21 Final Energy consumption projections