

Montel Clean Power Progress Index 2026

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Foreword



Tobias Federico
Chief Analyst, Montel

It is with great pleasure that Montel introduces the first edition of our Clean Power Progress Index, assessing how European countries are decarbonising their power generation sectors. Aimed at providing energy market professionals with a range of insights, this report uses the wealth of energy market expertise in Montel to provide an independent view of how the European power sector is progressing towards carbon neutrality.

This is achieved by tracking four key metrics: power sector carbon emissions, deployment of renewables, fuel mix changes and the expected outlook to 2030, all of which is made possible by data and analysis provided by Montel's energy market analysis functions; EnAppSys, Energy Brainpool and Energy Quantified.

Tracking progress in these areas on an annual basis helps market participants to both identify opportunities and understand challenges in specific territories, something which is now more important than ever given the recent conflict in Iran and accompanying energy price shocks.

It is our sincere hope that this report will help those with either decision-making power, or the agency to invest, understand that now is the time to make sure that European countries are accelerating their clean power efforts if they are to deliver on decarbonisation goals. The recent crisis in the Gulf brings not just costs and security into sharp focus, but also the continuing damage caused by relying on fossil-fuelled power generation. Whilst these assets still undoubtedly have a role to play as energy systems around the world continue to transition, the costs of using them continue to rise, be it in financial, climate or security terms.

Despite all of the challenges such as regulation, geopolitics, increasing power demand and many others too numerous to mention, Europe's decarbonisation story for 2025 is an encouraging one overall. Record renewable capacity, reduced overall emissions and continued decommissioning of the most polluting plants all speak to Europe's bravery in tackling one of the greatest challenges of our time.

We hope you enjoy this report as it takes you on the European power sector's decarbonisation journey, flagging challenges, future areas for improvement and above all, an optimistic view of the future for net-zero.

Executive summary

On the pan-European level, decarbonisation of power generation continues. 2025 saw operational carbon emissions across Europe fall by 2.6 million tonnes of CO₂ equivalent (tCO₂eq.) representing an overall reduction of 0.5%.

Nordic countries led the way in 2025, with Finland, Norway and Sweden ranking as the top three countries in Europe for reducing the carbon intensity of their overall power generation. In fact, Finland is the biggest success story in this year's Clean Power Progress Index, also ranking second for fuel mix improvement, seventh for deployed renewable capacity and sixth for projected demand to be met by renewable generation by 2030.

Moving across to Eastern Europe, Poland also finds itself in a positive place. Long known as the last great bastion of coal in Europe, the country used 2025 to decommission more than 600MW of coal plants, whilst simultaneously deploying nearly 3GW of solar power. This helped contribute to a 3.5% increase in zero-carbon power generation in the country, while carbon-emitting power generation fell 1.8%, resulting in a 4.2% reduction in operational carbon emissions from the Polish power sector.

Neighbours Lithuania saw a setback however, with operational carbon intensity rising 53.9% after multiple years of sustained decline. As total power generation in the country continues to rise, the marginal generation seems to be more carbon-intensive, showing the challenges faced by countries looking to generate more power.

In central Europe, Austria also saw a significant rise in the use of carbon-emitting generation following a difficult weather year for hydro generation, characterised by heatwaves and low rainfall.

Across the rest of Europe, the indices tell a tale of positive contradictions, clearly setting out the new challenges for the green transition. Put simply, more renewable capacity is no longer enough. Whilst deployment must continue, more effective siting of renewables, improved grid planning and adding more flexibility to systems will be crucial for Europe's ability to decarbonise its power systems.

Germany, for example, led Europe in 2025 for the deployment of new renewable capacity, while at the same time remaining Europe's biggest emitter of power sector emissions.

While it is no surprise that Europe's largest power system faces the biggest challenge in order to decarbonise, especially given the shift away from nuclear power in the country, this does at least show both willingness and tangible progress towards achieving a zero-carbon power system.

Spain saw interesting developments too. Despite a record level of solar generation in 2025, coupled with wind capacity overtaking fossil fuel generating capacity, gas-fired power generation still rose 22.9% in 2025. This can partly be explained by gas-fired generation meeting demand when solar power falls away at the end of the day, but decisions from the Spanish TSO to rely less on renewables after the April blackout (in order to preserve security of supply) also played its part in a 12.9% year-on-year increase in operational carbon emissions from the Spanish power sector.

Similarly, power generation from carbon-emitting sources rose 5.7% in Great Britain in 2025, even despite the complete phase out of coal-powered generation in the country. Despite making good progress on renewable deployment, GB continues to rely on gas to effectively balance its power system, address renewable curtailment and meet evening demand peaks.

Further south, Italy led Europe for coal decommissioning, having taken plants in both Puglia and Lazio offline last year. Continuation of this progress now looks under threat following the Italian Government's decision to pass a decree aimed at lowering power prices, including a provision to postpone the phasing out of coal-fired generation to 2038, given the country's acute exposure to rising oil and gas prices caused by the effective closure of the Strait of Hormuz.

On Europe's western flank, France has positioned itself well to continue as one of Europe's leading exporters of zero-carbon power by 2030. Now supplementing its already sizeable nuclear fleet with ever increasing levels of solar and wind power, the country's future ambitions are less likely to focus on increased zero-carbon generation, instead looking for ways to electrify demand across transport, heating and industrial processes.

Returning to the pan-European level, renewables supplied approximately 47% of electricity in the EU in 2024. Considering projected demand growth and the planned build-up of renewable capacity, the share of renewables in net electricity generation is expected to rise to 57% by 2030. This report helps show the realities of 2025 and what must improve in order for Europe to move closer to that target in 2026.

Carbon emissions and intensity



Konstantin Peltz
Carbon Analyst, Montel Energy Quantified

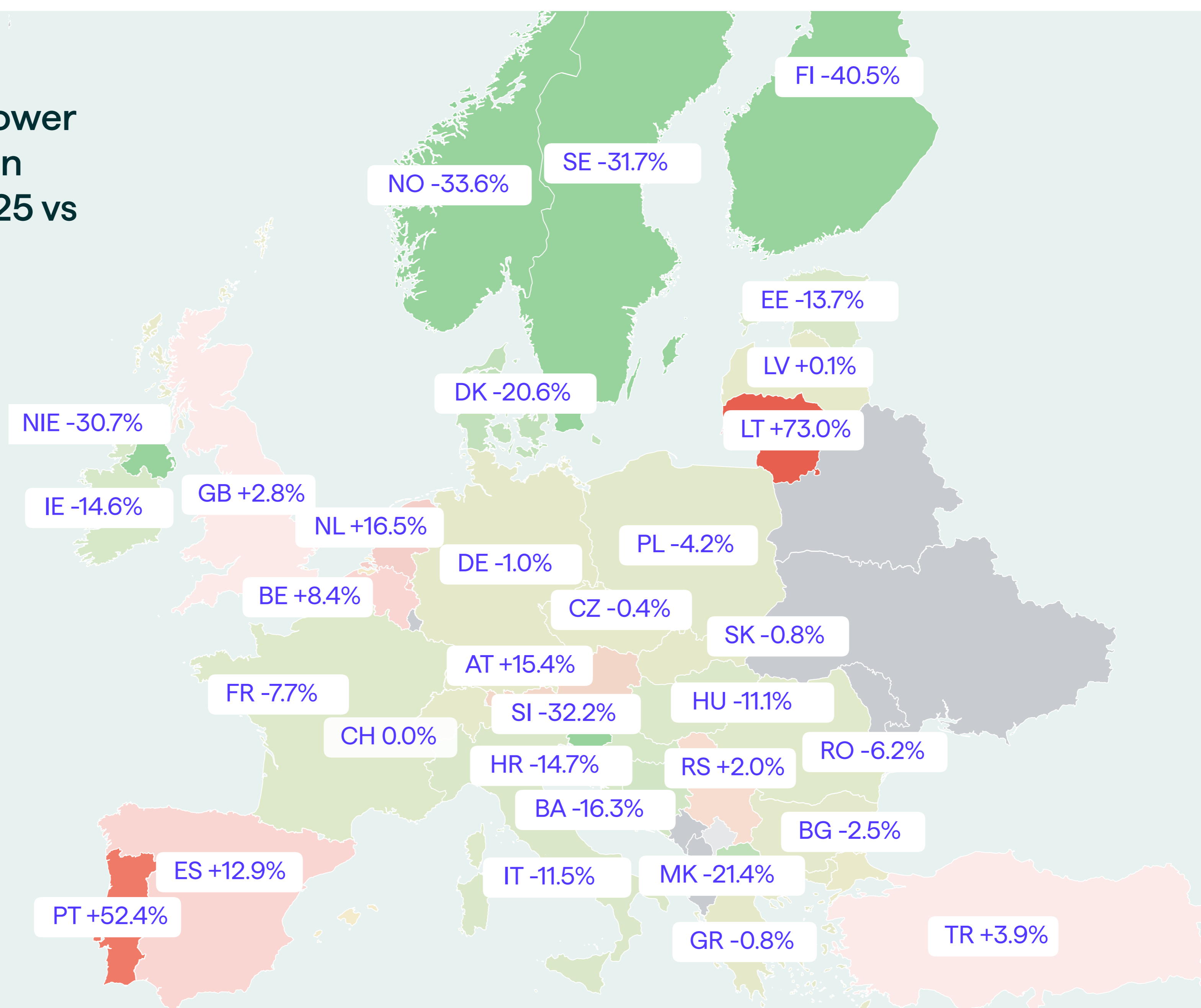
Carbon emissions

From a pan-European perspective, 2025 marked another, albeit modest, step toward net-zero in the power sector. Both operational and lifecycle carbon emissions from electricity generation declined across Europe year-on-year.

Operational emissions represent the direct greenhouse gas emissions released while generating electricity, for example through fuel combustion in a gas turbine. In 2025, operational emissions across Europe fell from 520.5 to 517.9 million tCO₂eq, a reduction of 0.5%¹.

The direction of travel across the continent remains consistent; incremental improvements across both the power generation mix and supply chain continue to reduce overall levels of carbon emissions. This can be considered a genuine success story as the path to net-zero continues to come under increasing scrutiny relating to consumer costs and reliability of supply.

Change in power sector carbon emission 2025 vs 2024



Carbon intensity

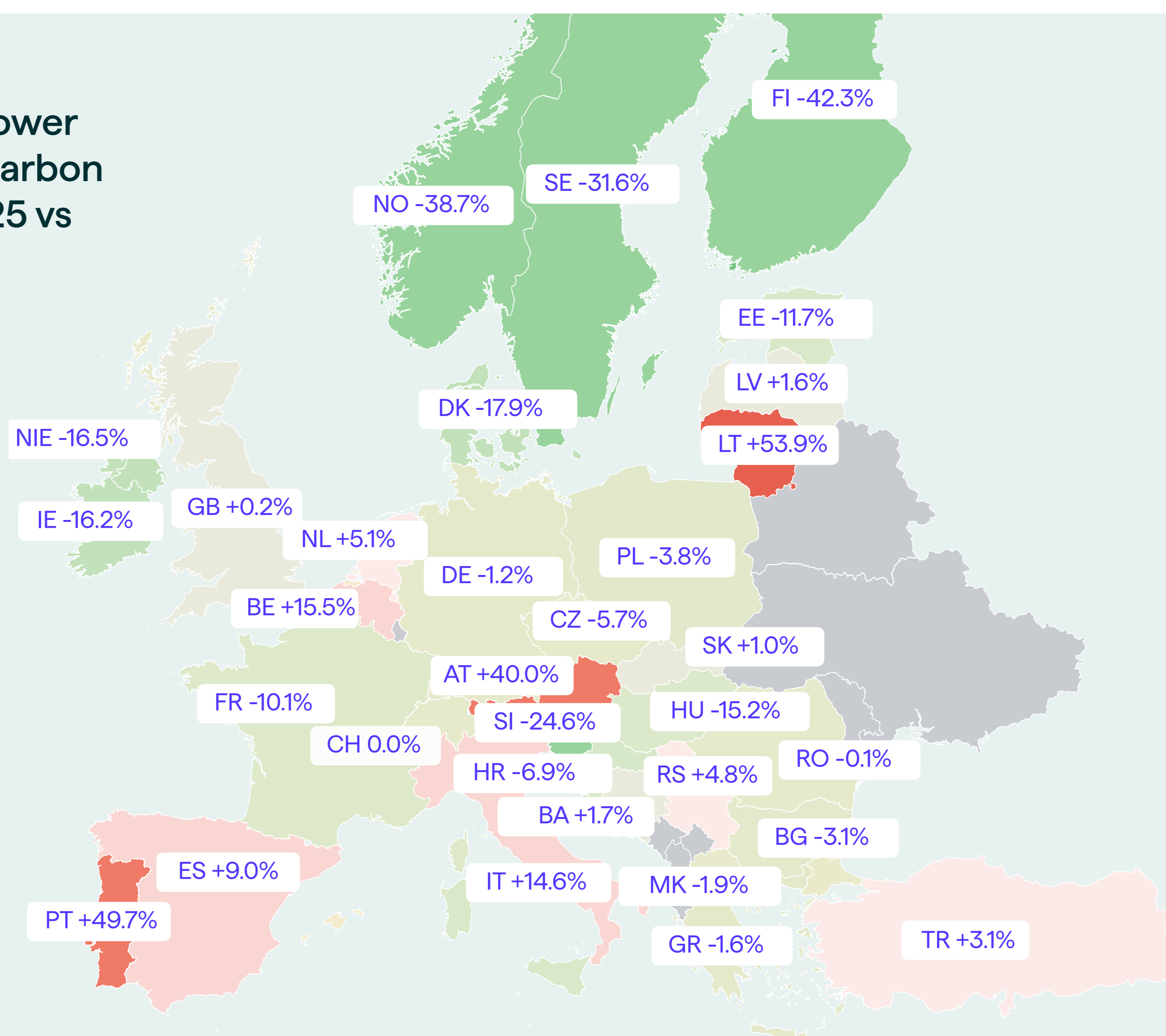
A similar trend is visible in carbon intensity, which indicates the emissions released per megawatt-hour (MWh) of electricity produced (measured in kgCO₂eq/MWh). Carbon intensity is a key indicator because it normalises emissions against power output, allowing more meaningful comparison across years and countries.

In 2025, average operational carbon intensity across Europe declined from 175.1 to 172.0 kgCO₂eq/MWh, a drop of 1.8%. This improvement suggests that emission reductions were not solely driven by lower overall output from carbon producing generation, but also by a slightly cleaner generation mix overall, as well as system efficiency gains.

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These numbers confirm overall progress, even if the pace remains slow at the pan-European level. National developments show that change is far from uniform. Some countries recorded substantial shifts in either direction, underlining the importance of market structure, weather conditions, generation availability and policy implementation.

Change in power generation carbon intensity 2025 vs 2024



The Nordics led the way in reducing carbon intensity in 2025, with Finland, Norway, Sweden all achieving significant improvements. Each reduced both operational carbon intensity and operational emissions by more than 30%. However, the already low levels of carbon emissions from power generation in Norway and Sweden means that hitting such a benchmark was more easily achievable.

In absolute terms, both Finland and Denmark made more measurable improvements than their Nordic neighbours, with drops in carbon intensity of 15.4 kgCO₂eq/MWh and 20.4 kgCO₂eq/MWh respectively, indicating a meaningful shift in both generation mix and output-related emissions performance.

Among countries where the overall carbon intensity of power generation increased, Lithuania, Austria, and Portugal saw increases of more than 40% in operational carbon intensity. Portugal and Lithuania also experienced similar increases in total operational emissions, indicating that higher intensity translated into higher absolute emissions as well. Austria, by contrast, saw only a small increase in absolute emissions despite the sharp rise in intensity, suggesting that lower overall output or offsetting changes in generation volume played a role.

Country spotlight:

Finland leads Europe in reducing power sector carbon emissions



Finland stands out as one of the strongest performers in Europe's power-sector decarbonisation trend. In 2025, the country achieved a sharp reduction in both absolute operational emissions and operational carbon intensity. This provides evidence of a structural shift in the generation mix rather than a temporary fluctuation.

Finland's operational carbon emissions from power production fell from 3.0 million tCO₂eq in 2024 to 1.8 million tCO₂eq in 2025, a decline of 40.5% in just one year. This is not an isolated result; it continues a consistent multi-year downtrend. In 2021, operational emissions still stood at 7.3 million tCO₂eq. Compared with that baseline, Finland has reduced operational emissions by 75.3% over four years, an exceptionally steep drop for a mature power system.

The same pattern is visible in operational carbon intensity. Finland's operational intensity declined from 99 kgCO₂eq/MWh in 2021 to 36 kgCO₂eq/MWh in 2024, before falling further to 21 kgCO₂eq/MWh in 2025. That represents a total reduction of 78.8% since 2021. At this level, Finland now ranks as one of the lowest carbon intensity power systems in Europe, illustrating how quickly the country has been able to shift away from high-emission generation while maintaining reliable electricity supply.

Finland has achieved this by materially reducing its reliance on the highest-emitting fuels; particularly peat, hard coal, and natural gas, replacing them with low-carbon production (mostly wind and nuclear).

While these fossil fuels represented a relatively modest share of Finland's power generation in 2021, they accounted for a disproportionate share of emissions. In 2021, they accounted for; 5.1% (peat) 5.1% (hard coal) and 6.1% (natural gas) each. In 2025, those shares dropped sharply to 1.4% for peat, 0.5% for hard coal, and 1.1% for natural gas. This reduction in fossil generation, especially peat and coal, has had an outsized impact on emissions, given their high carbon intensity.

At the same time, Finland has increased the contribution of low-carbon sources. The combined share of low-carbon generation rose from 68.9% in 2021 to 82.1% in 2025, filling the gap left by fossil fuels and tightening overall emissions performance.

The expansion was driven primarily by two pillars: wind and nuclear. Wind power output more than doubled, rising from 8.1 TWh in 2021 to 21.6 TWh in 2025, an increase of 165.6%. Nuclear generation increased from 22.6 TWh to 31.3 TWh, a gain of 38.1%. While wind delivered the faster growth rate, nuclear remains Finland's single largest generation source, accounting for 38.9% of total production in 2025.

In summary, Finland's progress is the result of sustained structural changes: shrinking fossil capacity utilisation, rapidly scaling wind generation, and strengthening the role of nuclear as a stable low-carbon backbone. The outcome is a dramatic improvement in both absolute emissions and carbon intensity, providing a clear example of how policy, investment and system planning can translate into measurable decarbonisation at national scale.

Country spotlight:

Germany chases emission reductions after nuclear phase-out



Germany remains Europe's largest overall contributor to power-sector carbon emissions. Operational emissions declined slightly from 100.6 million tCO₂eq in 2024 to 99.7 million tCO₂eq in 2025, a reduction of 1.0%. Operational carbon intensity followed a similar trajectory, easing from 239.3 to 236.6 kgCO₂eq/MWh, a 1.2% decrease. These represent modest year-on-year improvements, however they do come on top of more substantial shifts in previous years.

The broader context is critical: Germany's power mix has been restructured significantly since the nuclear phase-out, completed in 2023. In 2022, nuclear generation still contributed 32.8 TWh, equivalent to 6.6% of total power production. Removing that source of firm, low-carbon power, created a sizable gap that needed to be filled quickly; either by fossil generation or by accelerating renewables.

Germany has largely addressed this challenge through rapid growth in wind and solar. In 2025, low-carbon power sources accounted for 50.3% of electricity generation, marking a gradual improvement compared with previous years. Wind and solar have now become the two dominant generation technologies in the country. Wind led the mix with a 30.1% share, while solar reached 16.8%, notably overtaking lignite as a power source. This is an important milestone given lignite's role as one of the highest-emitting fuels in the system.

Overall, Germany's 2025 results point to steady forward movement, but at a slower pace than some peers. Whether this represents a temporary plateau or the start of renewed momentum will become clearer in 2026, as renewable build-out and fossil displacement continue to compete with demand, system constraints, and market conditions.

Country spotlight:

Gas remains crucial in Spain despite solar record



Spain delivered one of the more unexpected outcomes in 2025, as strong growth in solar photovoltaic generation coincided with higher operational emissions and rising carbon intensity. The result highlights a growing challenge for the Spanish power system, rather than a slowdown in renewable deployment.

Total electricity generation increased from 250.1 TWh in 2024 to 258.8 TWh in 2025, a rise of 3.5%. Solar PV reached a new record, expanding by 13.0% from 43.3 TWh to 48.9 TWh, supported by continued capacity additions and favourable weather conditions. This firmly consolidated solar as a core pillar of Spain's power mix.

Despite this progress, Spain's operational carbon intensity increased from 187 to 215 kgCO₂eq/MWh in 2025, a rise of 14.6%, alongside higher absolute operational emissions. The main driver was a sharp increase in natural gas generation, which climbed by 22.9% from 42.4 TWh to 52.1 TWh. As a result, gas overtook both solar and nuclear to become Spain's second-largest source of power generation in 2025, behind onshore wind.

Wind generation declined by 5.8% year-on-year, falling from 59.0 TWh to 55.6 TWh. Although wind remained the single largest source of electricity in Spain, this reduction meant that part of the additional demand (and the shortfall from lower wind output) was met by gas rather than zero-carbon generation.

Intraday emissions patterns also partly explain the outcome. High solar generation in Spain leads to significantly reduced emissions during daylight hours, but its contribution drops sharply in the evening and at night, when demand remains high. During these periods, gas-fired plants provided the marginal supply, driving up overall emissions. Interestingly, this a pattern which is increasingly being observed across Europe.

In summary, Spain's 2025 results underline the limits of solar-led decarbonisation without sufficient system flexibility. Continued progress will depend on scaling storage, flexibility and other low-carbon balancing options to reduce reliance on gas during non-solar hours.

Country spotlight:
Lithuania



Lithuania was one of the most notable underperformers in 2025, posting a sharp reversal in emissions performance after several years of improvement. Operational carbon intensity rose from 42 to 64 kgCO₂eq/MWh, an increase of 53.9%. This stands out because Lithuania had previously achieved a strong decline, falling from 107 kgCO₂eq/MWh in 2020 to a stable level of around 42 kgCO₂eq/MWh between 2022 and 2024. A look at operational emissions helps explain why intensity rose again. After a steep reduction from 574.4 thousand tCO₂eq in 2020 to 188.0 thousand tCO₂eq in 2022, emissions have climbed steadily, reaching 554.9 thousand tCO₂eq in 2025, almost back to the 2020 level. This rebound is closely linked to a

rapid expansion in total electricity production. Lithuania's generation increased from 4.8 TWh in 2020 to 9.0 TWh in 2025, a rise of 85.7%.

The growth itself is largely renewable-led. Solar generation expanded by 2,115.1% and wind by 155.7%. Together, these technologies accounted for 61.1% of total production in 2025.

While renewable output grew significantly, the renewables share in the mix did not keep pace with overall generation growth. Renewables increased from 63.9% in 2020 to a peak of 76.3% in 2022–2023, but fell back to 67.9% in 2025.

In short, Lithuania expanded supply rapidly, but the marginal generation appears to have become more carbon-intensive. Whether 2025 proves to be a temporary setback, or the start of a longer reversal, will depend on how future demand is met; especially if generation continues growing at the same speed observed in 2026.

Renewable capacity deployment



Elena Dahlem
Analyst, Montel Energy Brainpool

2025 was an important year for the energy transition in Europe. Many countries saw progress on renewables and battery buildouts. Some were also accompanied by market exits from coal and lignite assets.

Across Europe, over 70 GW of renewable capacity has been added. Alongside solar and wind, this also includes other renewable technologies such as biomass, hydropower (not including pumped storage) and energy from waste. In some cases, capacity has declined for some technologies where for example old hydropower plants or energy-from-waste installations have been decommissioned. This is why for some countries, the sum of capacity added across all renewable technologies is smaller than the sum of added capacity for wind and solar. However, it's important to keep in mind that the net added renewable capacity also accounts for the decommissioning of old technologies. The buildout figures show that in all European countries, wind and solar farms are built at least at the rate that old ones leave the market, and in most cases at a much higher rate, increasing the capacity from year to year and making Europe's grids greener. This is why, in the table below, that a country's 'All renewable technologies' figure, can appear lower than the sum of their solar and wind deployment.

With official data from some countries still incomplete or unpublished, more than 56 GW of net (also referred to as AC for the alternating current of the grid that solar power is converted into) solar capacity has been added across Europe in 2025. That comes out to over 60 GW of added gross (also referred to as DC for the direct current that solar panels operate on) solar capacity within the last year that has already been confirmed by official sources. That number may grow slightly when final reports come out. The trade association Solar Power Europe already estimated that 65.1 GW of solar capacity (gross) had been added across the EU in December 2025. With over 27 GWh of added battery storage capacity across Europe, power from the new solar panels will be available not just in the afternoon, but also during peak demand hours in the evening.

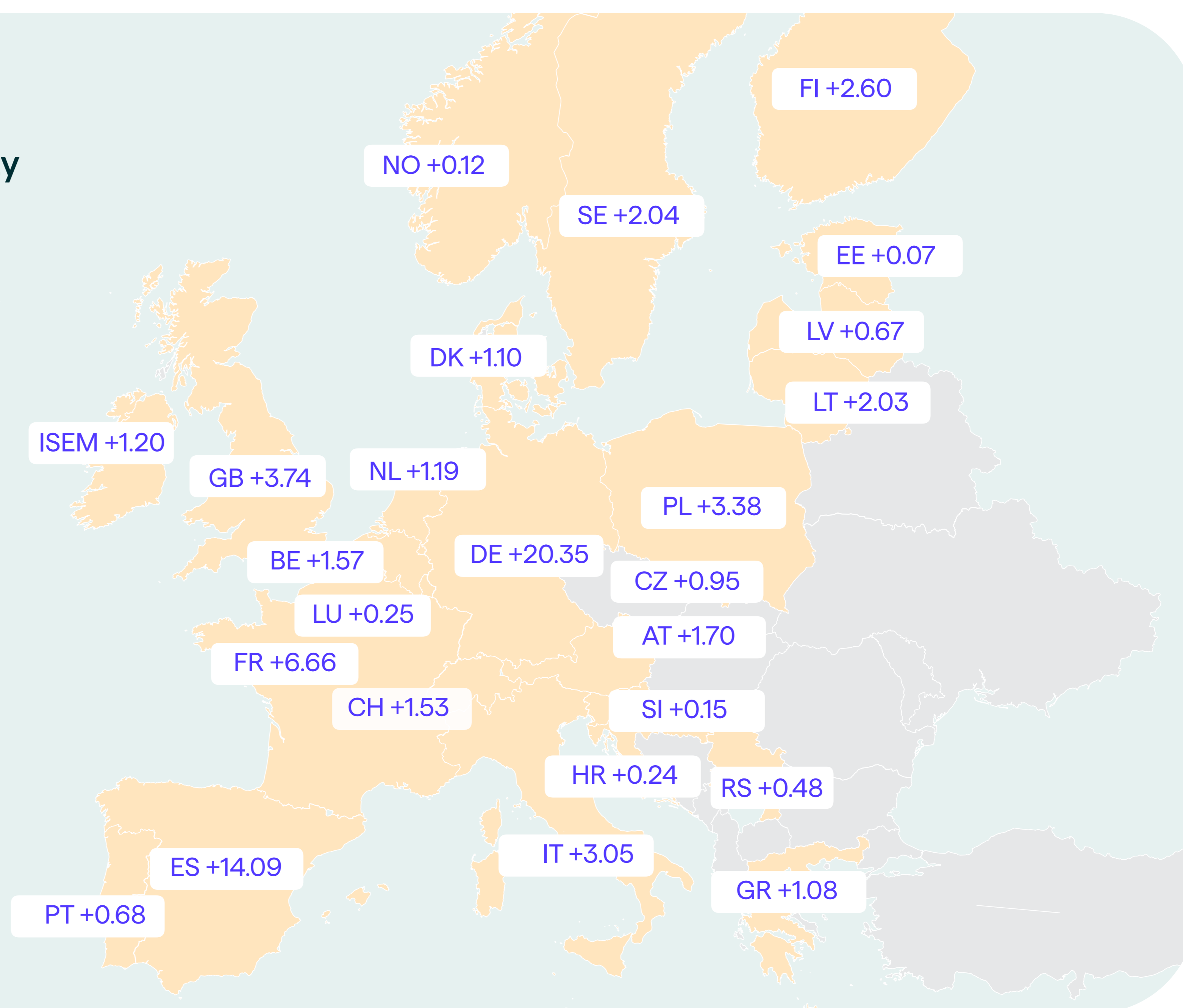
Although buildout figures for solar fell slightly compared to the 65.6 GW recorded the previous year, the decline puts 2025 buildout only slightly under the record-breaking figure from 2024. However, the solar power industry may need to brace itself for two further years of declining buildout, Solar Power Europe assumes.

In addition to the new solar capacity, over 12.9 GW (net) of new onshore wind capacity was deployed across Europe in 2025. Most of that was built in Germany, Spain, Sweden and Finland, which have built a stable and growing onshore wind sectors in the past few years. Perhaps less expected by some observers was the strong growth in onshore wind capacity in Lithuania, which added a net 0.82 GW in 2025. This lifted the country's onshore wind capacity from 1.68 GW at the start of 2025 to 2.51 GW at the end of the year, increasing by almost 50% in just one year. The Baltic country has been focusing quite strongly on improving energy security and decreasing its dependence on imports, especially from Russia, since the 2010s. As part of this push, Lithuania disconnected its power grid from Russia's in February 2025. It then joined the Continental Europe Synchronous Area, and its renewables have helped drive up domestic power generation at low generating costs and reduce dependence on fossil fuels.

The offshore wind industry has had a tougher year than its onshore counterpart. In all of Europe, only 1.75 GW of new net offshore wind capacity has been confirmed for 2025.

The known deployment is spread between Germany, France and the UK. Recent tenders for offshore wind in Germany, France and Lithuania have failed to attract bids as the industry struggles to create a project pipeline due to higher interest rates, policy uncertainty and suboptimal auction design. Even with countries such as Poland expecting to see their first offshore wind farms come online in 2026, the European 2030 goals for offshore wind capacity may be out of reach due to the tough conditions that the industry now face.

**Net added
renewable capacity
in 2025 (GW)**



Net added renewable capacity in 2025 (GW)ⁱⁱⁱ

Area	Solar	Onshore Wind	Offshore Wind	All renewable technologies*
Germany	15.16	4.63	0.52	20.35
Spain	12.39	1.52	0.00	14.09
France	5.39	0.76	0.50	6.66
GB	2.76	0.22	0.73	3.74
Poland	2.92	0.40	0.00	3.38
Italy	2.95	0.64	0.00	3.05
Finland	1.47	1.11	0.00	2.60
Sweden	0.73	1.31	0.00	2.04**
Lithuania	1.23	0.82	0.00	2.03
Austria	1.51	0.10	N/A	1.70
Belgium	0.99	0.41	0.00	1.57
Switzerland	1.53	0.00	N/A	1.53
ISEM	1.03	0.20	0.00	1.20**
Netherlands	1.11	0.08	0.00	1.19**
Denmark	1.10	Data not yet published	0.00	1.10***
Greece	0.80	0.24	0.00	1.08
Czech Republic	0.92	0.02	N/A	0.95
Portugal	0.65	0.03	0.00	0.68
Latvia	0.68	0.00	0.00	0.67
Serbia	0.11	0.37	0.00	0.48
Luxembourg	0.23	0.02	N/A	0.25
Croatia	0.17	0.07	0.00	0.24
Slovenia	0.17	0.00	0.00	0.15
Norway	0.03	0.00	0.00	0.12
Estonia	0.06	0.01	0.00	0.07
Totals	56.09	12.96	1.75	70.92

Country spotlight:

Germany leads renewable rollout in Europe in 2025



German solar and battery buildout slowed in 2025, declining slightly from the record levels seen in 2024. 15.53 GW of net added solar capacity, 17.46 GW gross solar capacity and 4.29 GW of battery power were added in the country in 2024. Despite that, Germany retained top spot for solar (and renewable) deployment across Europe in 2025. 15.16 GW net solar capacity (17.12 GW gross capacity) was added, adjusted for decommissioned units. To help balance the market, 4.12 GW worth of new battery power (corresponding to 6.66 GWh of added battery storage capacity) also came online.

Onshore wind also saw its strongest levels of deployment in the country since 2017. 4.63 GW of onshore wind (and 0.52 GW of offshore wind) entered into the German power market in 2025.

One of the reasons why project developers have shied away from investing in more solar projects in Germany is revenue cannibalisation. 573 hours with negative prices were observed in the German power market in 2025, compared to 457 in 2024. At the same time, extremely high prices have also been observed more frequently, which drive continued investment in battery storage as flexible assets can take advantage of high prices to optimise revenues.

The provisions of the EEG (“Renewable Energy Sources Act”) and the Solar Peak Act that limit remuneration from feed-in tariffs during periods of negative prices will reduce incentives for solar and wind parks to offer power during these times moving forward. It is expected that this will reduce the occurrence of negative pricing

periods, as the provisions to limit remuneration will apply to more and more assets in the future.

Montel’s long-term scenario analysts assume that the number of hours with extremely low prices will fall to 0 within the first half of the 2030s, with batteries expected to step in to help take excess generation off the grid during those periods. Demand will therefore increase in low-price periods, further reducing revenue cannibalisation among renewable assets.

Other factors impeding the buildout of renewables, such as grid access problems and permitting processes, have been addressed by the current German government. Whether their policy changes will prove sufficient to continue deploying significant numbers of new renewable assets will only become apparent in the buildout figures of future years.

Germany is pursuing decarbonisation not just by producing more green power, but also by shutting down some of its conventional generating assets. In February 2025, the coal-fired unit 5 of the Zolling power plant exited the regular power market. The 501 MW (gross) unit had been active since 1986. As it has been deemed relevant to maintain stable grid operations in the region, it remains part of the grid reserve until at least 31st March 2031 and will occasionally produce power in times of scarcity.

At the end of 2025, lignite-fired unit A of the Jänschwalde power station exited the market and entered the security reserve to ensure security of supply in times of scarcity. For the next three years, the 512 MW (gross) power unit needs to be ready to supply power on a few days’ notice. Although three of the six total units of Jänschwalde power station remain active on regular power markets, the decommissioning of unit A should significantly reduce the CO2 emissions of Germany’s third most polluting power station.

Country spotlight:

Spain sees solar deployment record as wind overtakes conventional generation capacity



The Spanish power market has provided many talking points over the past year. Between the blackout on 28th April, the investigation into its causes and frequent low prices, the Iberian market has been difficult to understand for investors looking to add new projects to their portfolio. Nonetheless, over 12 GW of new solar capacity was added in 2025. Entso-e reports a net increase of 12.39 GW in the amount of installed solar generation capacity in Spain at the end of 2025 at the time of writing. This is a record amount after 2023 and 2024 saw net increases of 5.34 GW and 5.18 GW in solar capacity respectively. These had been the strongest years for new solar deployments in the country until the 2025 figures more than doubled the solar buildout record.

In 2025, Spain also installed 1.52 GW of new onshore wind. This brings the wind capacity in the country to 32.45 GW in total at the end of the year, overtaking conventional capacity for the first time. Thermal generating capacity in Spain amounts to 32.05 GW in total and is mostly comprised of gas-fired power stations.

On the mainland, several coal-fired power stations were decommissioned in 2025. The Aboño power station in Asturias that supplied over 900 MW has now been converted to run on natural gas and, in the future, hydrogen. Originally, the government had aimed for a complete coal exit by the end of the year, but the Soto de Ribera 3 unit in Asturias and the Es Murterar / Alcúdia plant on Mallorca remain available. This is to ensure security of supply this year at times when renewables would leave the system exposed to fluctuations. For Soto de Ribera, a range of renewables and battery projects are planned to keep this site as a key component of Spain's energy system in the future, and a possible conversion to gas for the coal-fired unit 3 is being discussed.

Country spotlight:

Solar capacity takes off in GB as wind deployment struggles



In Great Britain, the solar industry experienced a strong year with about 2.76 GW of new capacity added (2.52 GW was deployed in 2024). Between 2017 and 2022, solar buildout had been rather sluggish in the UK. Since then, each year has seen bigger solar buildout figures than the previous one, and 2025 now represents the strongest year for solar buildout since 2015. The buildout has been so strong that at the end of 2025, 12.95% of all solar capacity available to the GB grid had been built in that same year.

Fortunately for solar project developers, the solar industry is less exposed to inflationary pressures and has also benefitted from faster build times due to a simpler construction process. Since 2023, solar projects have won many auctions, which has improved investor confidence and paved the way for readily available financing. In 2025, a new “First Ready, First Connected” policy entered into force that prioritises grid connections for projects that can quickly be deployed, which has helped move many solar projects forward. The solar pipeline remains significant, which suggests another strong year in solar buildout.

Wind buildout slowed down in 2025 for both onshore and offshore wind, although there is still progress being made. The onshore wind industry saw 0.22 GW of new capacity added, which is a decline of nearly 70% compared to the 0.72 GW added in 2024. Offshore wind buildout fell from 1.18 GW in 2024 to 0.73 GW in 2025, which corresponds to a 38% decline.

Grid connection delays have hampered the buildout of wind capacity in the UK in the past few years. For onshore wind in particular, slow planning and permitting processes have become a major barrier effectively stalling new development. At the same time, the offshore wind industry has been dealing with increased costs due to inflation in vessel, fuel and personnel costs as well as supply issues stemming from constrained port and vessel availability. Wind projects continue to be affected by long lead times, supply-chain pressures and earlier planning and grid constraints, which may mean another slow year or the start of a slow recovery. New auction designs have been received positively by investors, but the path to rebuild investor confidence is not finished yet.

Coal decommissioning

Coal and lignite assets exit the market in various countries amid competitive pressure

In 2025, Europe saw roughly 9.7 GW gross or 9 GW net coal and lignite capacity taken off the system: about 1.38 GW (gross) or 1.29 GW (net) of lignite and 8.34 GW (gross) or 7.69 GW (net) of hard coal.

Decommissioning is concentrated in a few countries. Italy alone accounts for almost half of the hard coal total (3.96 GW gross), followed by Spain (1.54 GW gross), Ireland (0.92 GW gross) and Germany (0.86 GW gross). For lignite, Germany makes up roughly two thirds of the closures (0.93 GW gross), with Greece contributing about 0.33 GW gross.

In Ireland, Moneypoint power station burnt its last charge of coal after 40 years of operation on 20th June 2025. It had a gross capacity of 915 MW and was not just the country's only coal-fired power station, but also the largest power station in Ireland for many years. It will now act as an out-of-market generator of last resort until 2029 and will burn oil to generate power on short notice in the event of supply shortages.

This switch from coal to oil marks Ireland's exit from coal, even if its only coal plant remains in the market in a different form for a little while longer. In 2023, a synchronous condenser was installed at Moneypoint so that the site can continue to provide the market with inertia in the future.

Italy, in contrast to Ireland, is still preparing for its coal exit. The country shut down two large coal power stations this year in Puglia and Lazio. The Brindisi Sud and Torrevaldaliga Nord (also known as Federico II) power stations had a capacity of 1980 MW each. They were the last coal-fired power stations on the Italian mainland. Their exit from the market came at the end of 2025, when both power stations lost their environmental authorisations. However, they had not been competitive in the Italian power market in their final years of operation, evidenced by their scarce generation over the past few years. The last time the two plants regularly provided power to the Italian market was in 2023. For both plants, plans to install gas capacity have been discussed but abandoned for now.

Coal decommissioning in Europe 2025 (MW)

Fuel	Location	Gross Capacity	Net Capacity
Lignite	Europe	1379	1287
	Germany	925	875
	Greece	330	300
	Slovenia	74	67
	Spain	50	45
Hard coal	Europe	8337	7688
	Italy	3960	3600
	Spain	1544	1474
	Ireland	915	855
	Germany	864	802
	Poland	531	482
	Finland	468	425
	Romania	55	50

Data includes units that have been co-firing biomass alongside their primary fuel prior to being decommissioned.

Country spotlight:

Poland sees light at the end of the tunnel as solar overtakes hard coal capacity

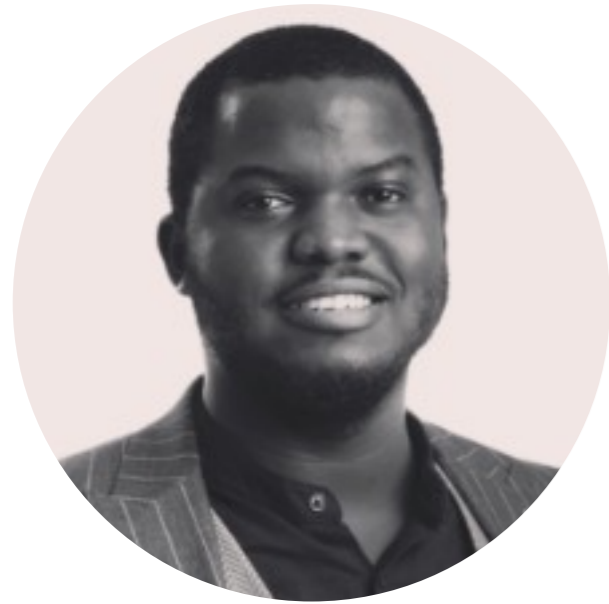


Poland saw 2.92 GW of new solar capacity added to the grid in 2025. This is another strong year for the Polish solar industry after considerable growth since 2019, but the capacity growth has slowed to its lowest level since 2020 when 2.16 GW of new capacity were deployed. Still, the growth in solar capacity in 2025 is significant, not least because it increases the amount of solar capacity (20.73 GW total) beyond the level of hard coal capacity (18.54 GW total) for the first time. In a country where coal plays the biggest role in power generation, that is a significant milestone. The solar industry has been doing well not least because of the short construction times and existing pipeline, where many projects had already secured a grid connection. While the pipeline for solar parks is promising, grid connections remain a hurdle for future projects to become viable.

Even more so than the solar industry, the Polish onshore wind industry is facing a tougher climate than in the past years. In 2025, only 0.4 GW of new onshore wind capacity was added, which makes this the weakest year since 2019 for developers. Wind projects have been struggling to obtain permits and grid connections and have often been unable to achieve success in auctions. The Polish government has adjusted its auction design to realise more wind projects; the results in this year will show if the changes were enough to build momentum for a stumbling onshore and a nascent offshore wind industry.

At the same time, Poland has continued to decommission coal assets. In 2025, 531 MW (gross) or 482 MW (net) of hard coal exited the market in Bydgoszcz and Dolna Odra. In Bydgoszcz, two units with a combined capacity of 87 MW exited the market and PGE welcomed a new gas-fired CHP unit of 53 MW, all in the autumn of 2025. PGE also decommissioned units 5 and 6 of 222 MW each at its Dolna Odra site near Gryfino after 50 years of generating both power and heat. Already in 2024, units 9 and 10 of the plant, gas-fired CCGT units with a capacity of 683 MW each, entered into operation. For 2030, another 600 MW OCGT unit is planned in Gryfino. Hard coal still remains the energy source with the second biggest generation capacity in Poland, but it's undeniable that the country is slowly moving away from coal and towards renewables and more efficient gas-fired power stations.

Fuel mix changes



Henry Oguns,
Analyst, Montel EnAppSys

The fuel mix data assessed in this report compares the amount of electricity produced from zero-carbon power generation sources and electricity produced by carbon-emitting power generation sources by country.

The 2024–25 data shows that Europe’s shift towards clean power is continuing, but at very different speeds across individual countries. On aggregate, zero-carbon generation (defined as generation from wind, solar, hydro, biomass, nuclear, geothermal and other renewables) edged higher, while Carbon-emitting generation (defined as generation from CCGT, OCGT, coal, coal-gas, lignite, oil, shale oil, peat, waste, and others) fell in some markets but rose sharply in others.

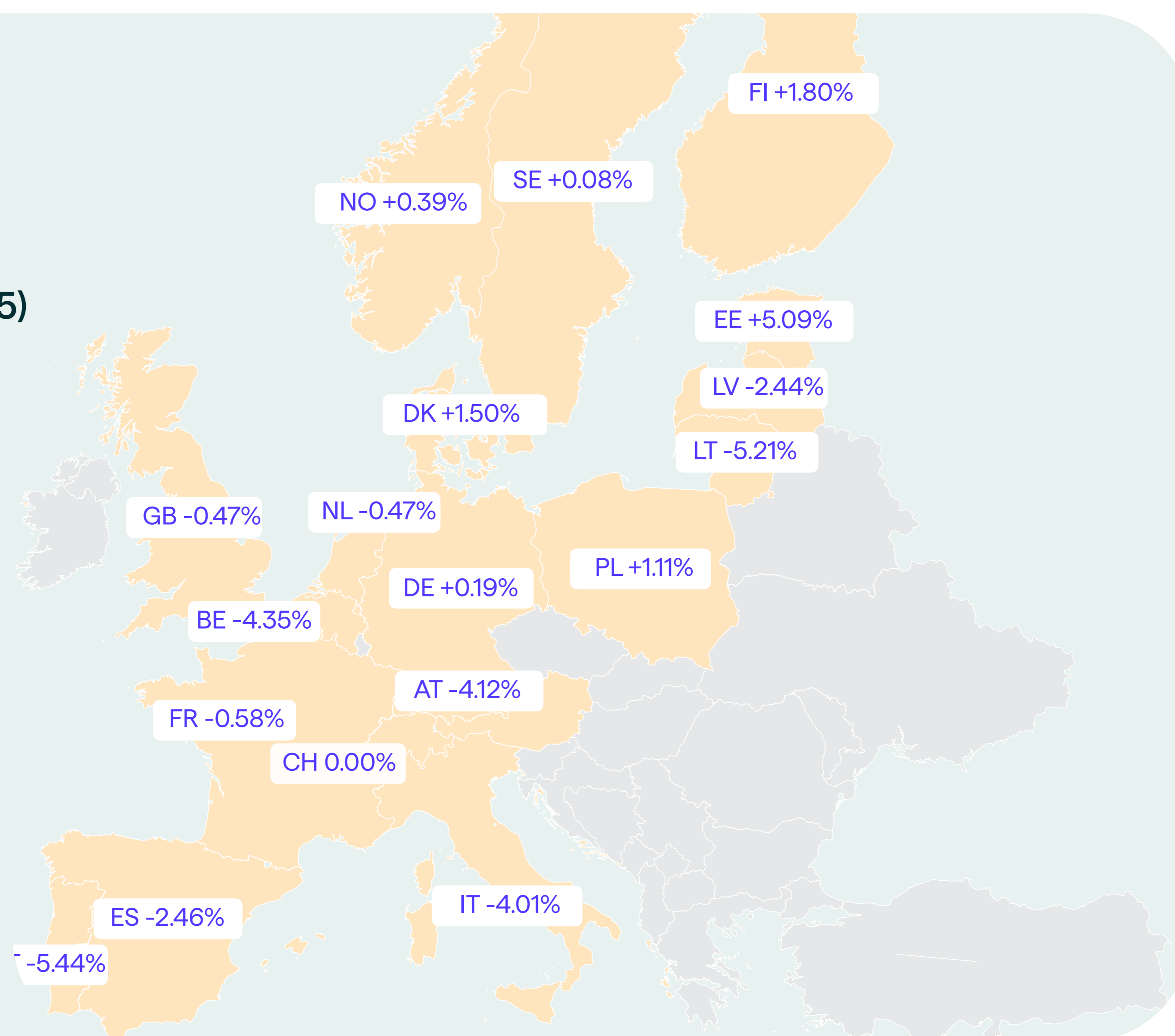
Zero-carbon generation as share of overall fuel mix:

In 2025, some European countries saw the share of zero-carbon power generation in their fuel mix increase, while others saw the share of zero-carbon sources in their annual fuel mix decline. Some of these changes were significant, suggesting a weaker contribution from zero-carbon sources in 2025 relative to 2024.

The fuel mixes in which zero-carbon generation gained the greatest shares came from Estonia, where the zero-carbon share rose from 52.89% to 57.98% (+5.09pp) and Finland with a modest uplift (92.40% to 94.20%, +1.80pp) albeit from a low level. Nordic and adjacent countries remained structurally high in terms of zero-carbon generation and improved slightly, generally speaking: Denmark (+1.50pp) Poland (+1.11pp) and Norway (+0.39pp). Germany was effectively flat (+0.19pp) while Sweden showed no meaningful change (+0.08pp). Switzerland remained fully zero-carbon at 100% in both years. By contrast, several other countries posted notable declines.

The fuel mixes which lost the greatest share of zero-carbon generation were observed in Portugal (-5.44pp) Lithuania (-5.21pp) Belgium (-4.35pp) Austria (-4.12pp) and Italy (-4.01pp). Additional weakness was seen in Spain (-2.46pp) and Latvia (-2.44pp), with smaller decreases in France (-0.58pp) the Netherlands (-0.47pp) and Great Britain (-0.47pp). Overall, the distribution indicates that it was only the Nordic countries, neighbouring Estonia, as well as Germany and Poland that saw a greater share of their overall fuel mix made up of zero-carbon in 2025, compared to 2024. Comparatively, Western Europe all saw zero-carbon generation make up a lesser share of their annual fuel mix than in the year before.

Zero-carbon generation as share of overall fuel mix (percentage point change 2024 vs 2025)



In order to reach the figures shown above, it was necessary to assess two things:

- Which countries increased zero-carbon power generation in their overall fuel mix compared to 2024 and;
- Which countries reduced carbon-emitting power generation in their overall fuel mix compared to 2024

Figures for both of these measurements are detailed in the next section of this report.

Change in zero-carbon generation

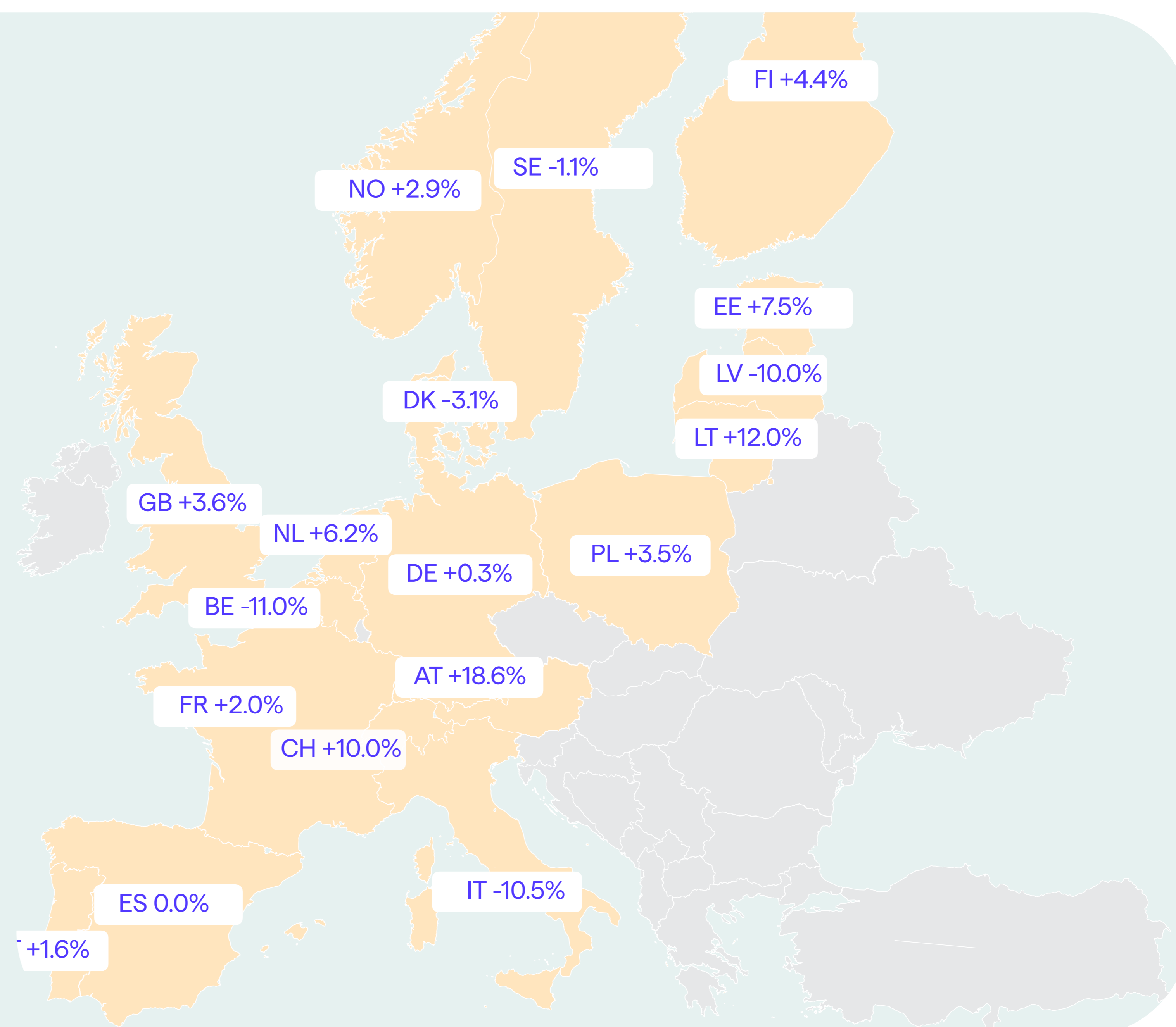
Finland stands out as one of the most improved systems overall: zero-carbon generation in Finland grew 4.4% compared to 2024, a solid gain from an already high level, whilst carbon-emitting generation fell by 21.8%, the second-highest reduction across the European countries covered in this report.

This combination indicates that Finland is meeting a growing share of demand with zero-carbon sources while significantly reducing the role of carbon-emitting power generation. The pattern is consistent with the impact of recent additions of zero-carbon capacity (including nuclear and wind) which allow gas and coal units to run fewer hours and focus on balancing the system.

Lithuania ranks top having increased its zero-carbon generation output by 12.0%, which reflects continued expansion of wind and solar from a relatively small base. However, the carbon-emitting generation chart (see next section) shows that Lithuanian carbon-emitting generation also jumped by 45.3%. This suggests that higher electricity demand and weaker hydro conditions still required an increase in gas-fired generation to meet demand at times. Lithuania therefore scores highly on zero-carbon growth, but its overall decarbonisation record is more mixed.

Switzerland (10%) also posted very strong improvement, placing it second only to Lithuania (43%) in zero-carbon generation growth. With zero-carbon-emitting output in Switzerland in both years, additional clean generation (particularly from hydro and nuclear) further strengthened its zero-carbon carbon power generation mix.

Change in zero-carbon generation 2025 vs 2024

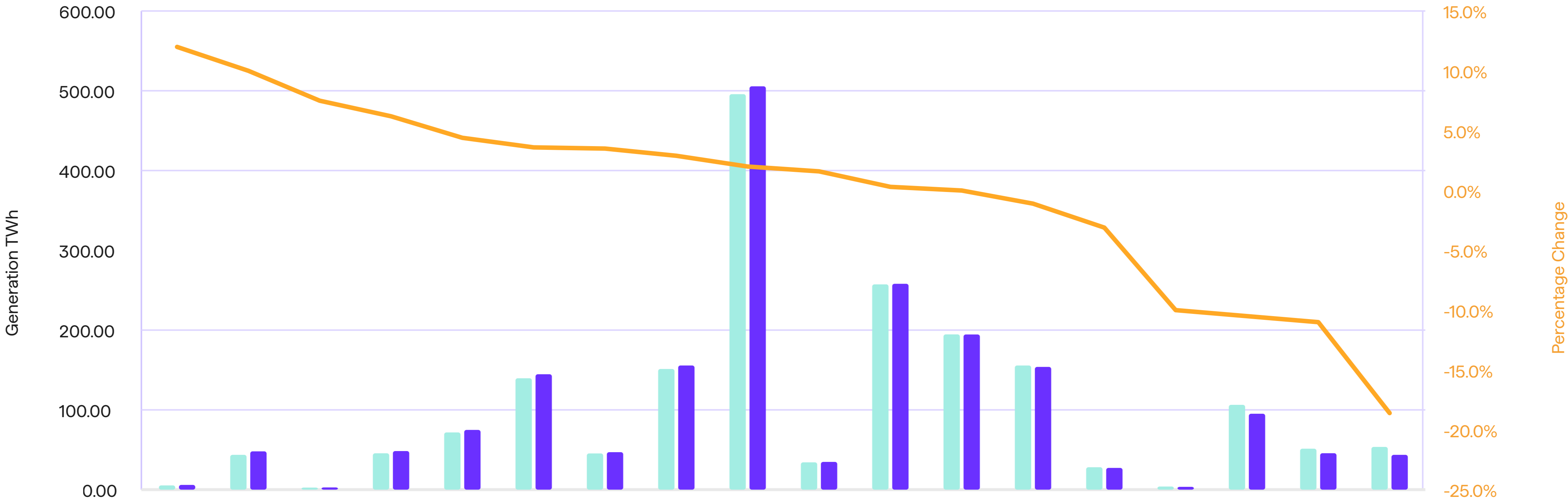


Estonia also posted strong zero-carbon growth (+7.5%) and, crucially, managed to cut carbon-emitting generation by 12.6%. This points to an improvement in the fuel mix, as new low-carbon capacity is increasingly displacing other carbon-emitting generation like coal and gas rather than simply meeting demand growth.

They are followed closely by the Netherlands (+6.2%), Finland (+4.4%) and Great Britain (+3.6%).

At the other end of the scale, Austria recorded the sharpest fall (-18.6%), with Belgium (-11.0%) and Italy (-10.5%) also seeing sizeable declines in zero-carbon output.

Zero-carbon generation by country (2024 vs. 2025)



	LT	CH	EE	NL	FI	GB	PL	NO	FR	PT	DE	ES	SE	DK	LV	IT	BE	AT
2024	5.31	43.60	2.61	45.57	71.75	139.63	45.38	151.30	495.72	34.22	257.31	194.61	155.61	28.12	3.90	106.37	51.35	53.62
2025	5.95	47.96	2.80	48.40	74.91	144.62	46.98	155.63	505.60	34.77	258.04	194.54	153.86	27.25	3.52	95.19	45.71	43.64
%	12.0%	10.0%	7.5%	6.2%	4.4%	3.6%	3.5%	2.9%	2.0%	1.6%	0.3%	0.0%	-1.1%	-3.1%	-10.0%	-10.5%	-11.0%	-18.6%

2024 2025 Percentage Change (%)

Country spotlight:

Great Britain records steady zero-carbon gains, but retains need for carbon-emitting generation



Great Britain's zero-carbon output rose from around ~139.63TWh in 2024 to ~144.62TWh in 2025 (+3.6% year-on-year) building on an already substantial level of clean generation.

GB continues to add renewable capacity, particularly wind and solar, lifting zero-carbon generation levels. However, power generated by carbon-emitting sources also increased around 5.7% in 2025, despite the complete removal of coal from the GB energy mix in September 2024. This indicates that gas-fired generation is now in merit more often, especially during periods of low wind or high demand. In absolute terms, this means that GB is both producing cleaner electricity and still relying on carbon-emitting units for both flexibility and security of supply.

Assessing the full view, GB shows incremental but not transformative progress. While the country's fuel mix is moving in the right direction, gains in zero-carbon output are partly offset by higher use of carbon-emitting generation. Continued investment in grid infrastructure, storage, interconnection and firm zero-carbon capacity will be essential to reduce the usage of carbon-emitting generation in future. The need for grid investment is particularly evident in GB given the 10TWh of zero-carbon generation that was curtailed thanks to grid constraints in 2025 (mostly wind in Scotland) which is mostly replaced by gas generation further south in the country in order to meet demand.

Change in carbon-emitting generation

On the carbon-emitting side, the rankings shift:

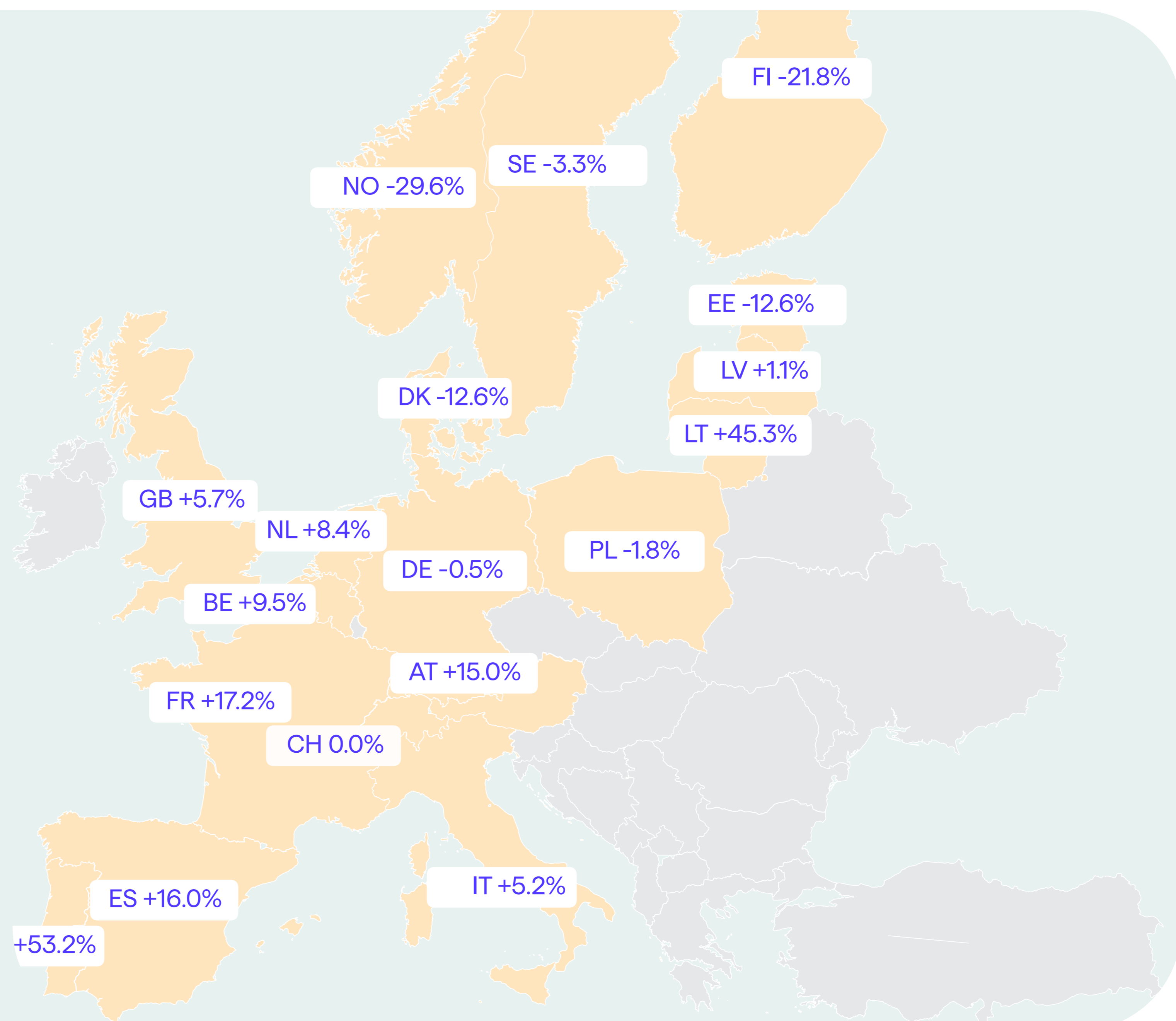
The largest cuts in output from carbon-emitting generation in percentage terms came from Norway (-29.6%) Finland (-21.8%) Denmark (-12.6%) and Estonia (-12.6%).

The decline in carbon-emitting generation across these countries was primarily driven by periods of strong low-marginal-cost supply in the Nordic region. This was led by hydro generation (reservoir and river inflows) supported by robust wind output and expanding wind capacity. With EU ETS costs raising the operating costs of fossil generation, Nordic hydro and wind set lower market prices more often, pushing thermal units out of merit across these interconnected bidding zones. Estonia's reductions were further helped by access to Nordic imports via interconnectors, which displaced domestic carbon-emitting generation whenever cheaper Nordic supply was available.

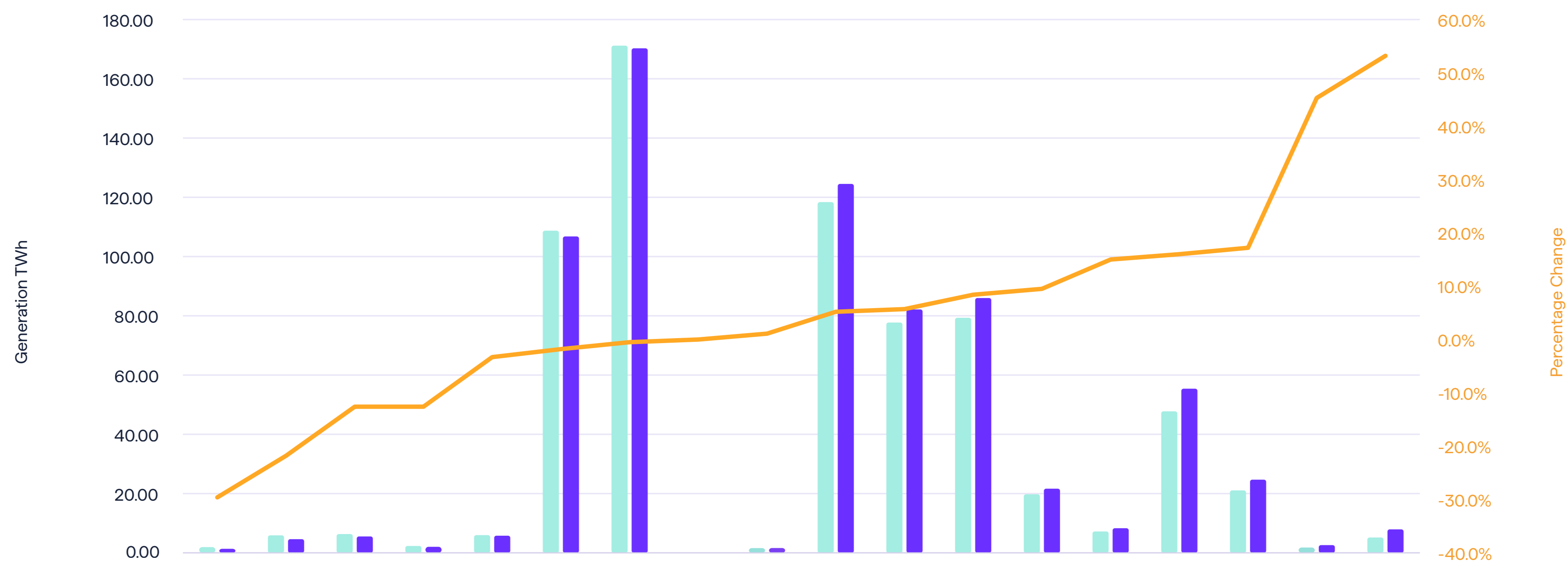
By contrast, carbon-emitting generation rose strongly in Portugal (+53.2%) Lithuania (+45.3%) France (+17.2%) Spain (+16.0%) and Austria (+15.0%). Portugal and Spain provided cautionary examples in 2025. While their zero-carbon output remained almost flat (+1.6% and +0.0%), carbon-emitting generation rose sharply, suggesting that demand growth and weather variability were largely met by carbon-emitting power generation rather than zero-carbon sources of power.

The April 2025 blackout was central to this pattern. During this event, the Spanish power system entered a loop of generation trips, with the loss of generating units and spiraling voltage rising above normal levels. This culminated in a regional outage that exposed the system's vulnerability when non-synchronous generation repeatedly peaked above 70%. In the months that followed, there were notable curtailments of renewables, as well as heavy reliance on gas-fired capacity to preserve security of supply. This kept thermal units online for longer, with system operators remaining cautious in allowing renewables alone to carry the margin.

Change in carbon-emitting generation 2025 vs 2024



Carbon-emitting generation by country (2024 vs. 2025)



	NO	FI	DK	EE	SE	PL	DE	CH	LV	IT	GB	NL	BE	AT	ES	FR	LT	PT
2024 Generation (TWh)	1.93	5.90	6.33	2.32	5.97	108.73	171.19	0.00	1.60	118.38	77.73	79.34	19.76	7.21	47.75	21.07	1.79	5.17
2025 Generation (TWh)	1.36	4.61	5.53	2.03	5.78	106.79	170.29	0.00	1.62	124.52	82.15	86.00	21.65	8.30	55.40	24.69	2.60	7.92
Percentage Change (%)	-29.6%	-21.8%	-12.6%	-12.6%	-3.3%	-1.8%	-0.5%	0.0%	1.1%	5.2%	5.7%	8.4%	9.5%	15.0%	16.0%	17.2%	45.3%	53.2%

■ 2024 Generation (TWh)
 ■ 2025 Generation (TWh)
 — Percentage Change (%)

Country spotlight:

Austria faces a clear setback



Austria's progress towards a net-zero power generation mix shifted into reverse in 2025. Zero-carbon generation in the country fell by 18.6%, from about 53.62TWh to 43.64TWh, the steepest drop among all the countries measured in this report. At the same time, carbon-emitting generation increased by 15% over the course of the year.

Austria's electricity mix is heavily dependent on hydropower, so a year with poor water inflows or drought conditions can translate directly into lower zero-carbon output. The charts suggest that this is exactly what happened: reduced hydro output had to be replaced by greater levels of carbon-emitting generation.

For a country that normally scores highly on clean electricity, this represents a notable setback. It also underlines the importance of diversifying renewable portfolios, strengthening interconnections and continuing to increase storage to manage dry-year risks.

European power outlook 2030

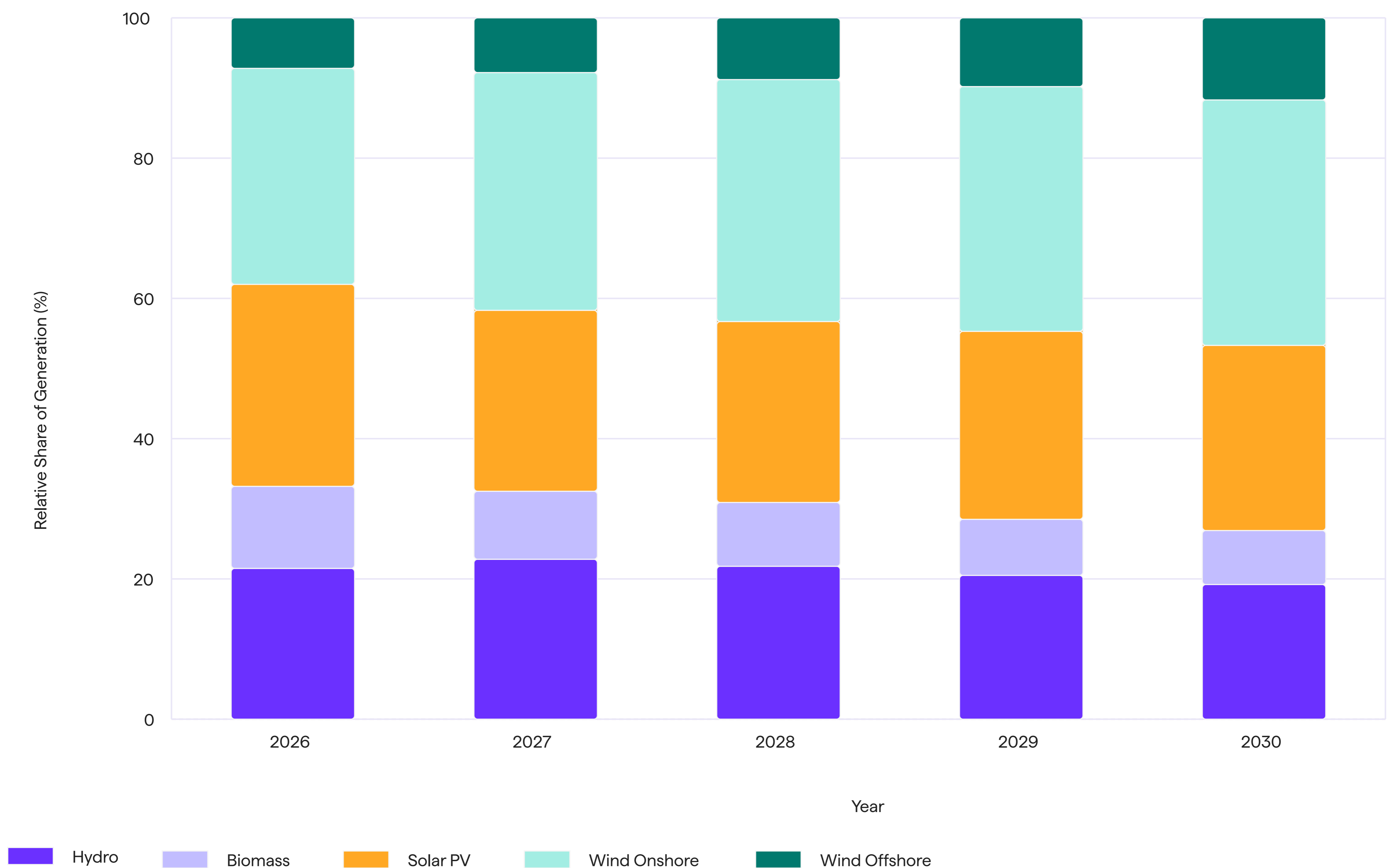


Huangluolun Zhou
Senior Analyst, Montel Energy Brainpool

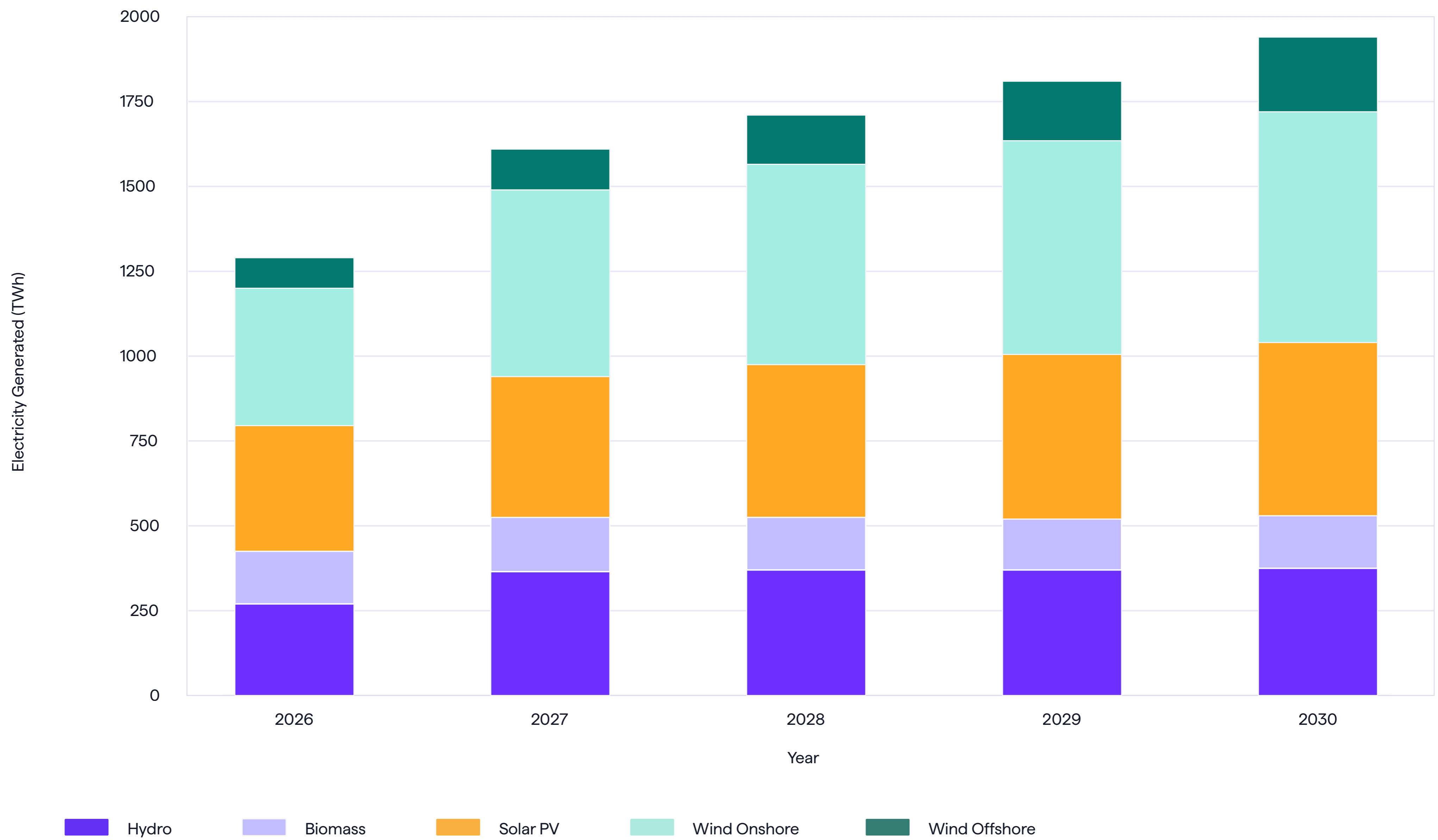
Looking at the expected development of renewable generation and capacity build-out across the EU27 for 2026–2030, solar PV, onshore wind and offshore wind are all projected to see steady growth. Both solar and onshore wind are expected to continue to dominate the renewable mix, both in terms of electricity generated and the levels of installed capacity, with onshore wind contributing the largest share to total renewable generation.

Offshore wind, while starting from a smaller base, is expected to grow rapidly, increasing its share of renewable generation from around 10% in 2026 to over 15% by 2030, reflecting ongoing investment and expansion in offshore infrastructure. Overall, the EU's renewable capacity is set to expand significantly, supporting the region's electrification goals and Fit for 55 targets.

EU 27 renewable energy generation mix (percentage share)

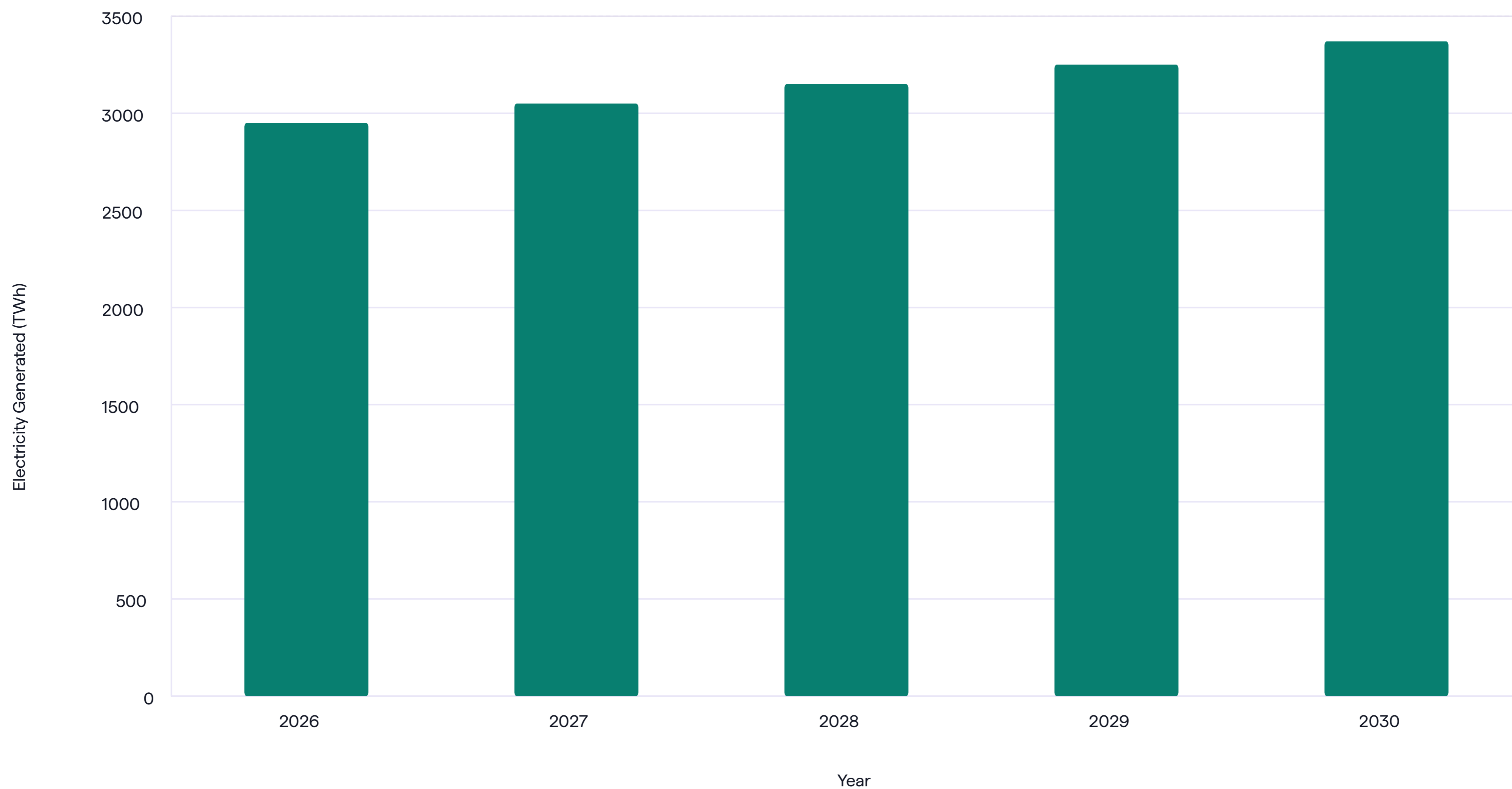


EU 27 renewables generation mix (TWh)



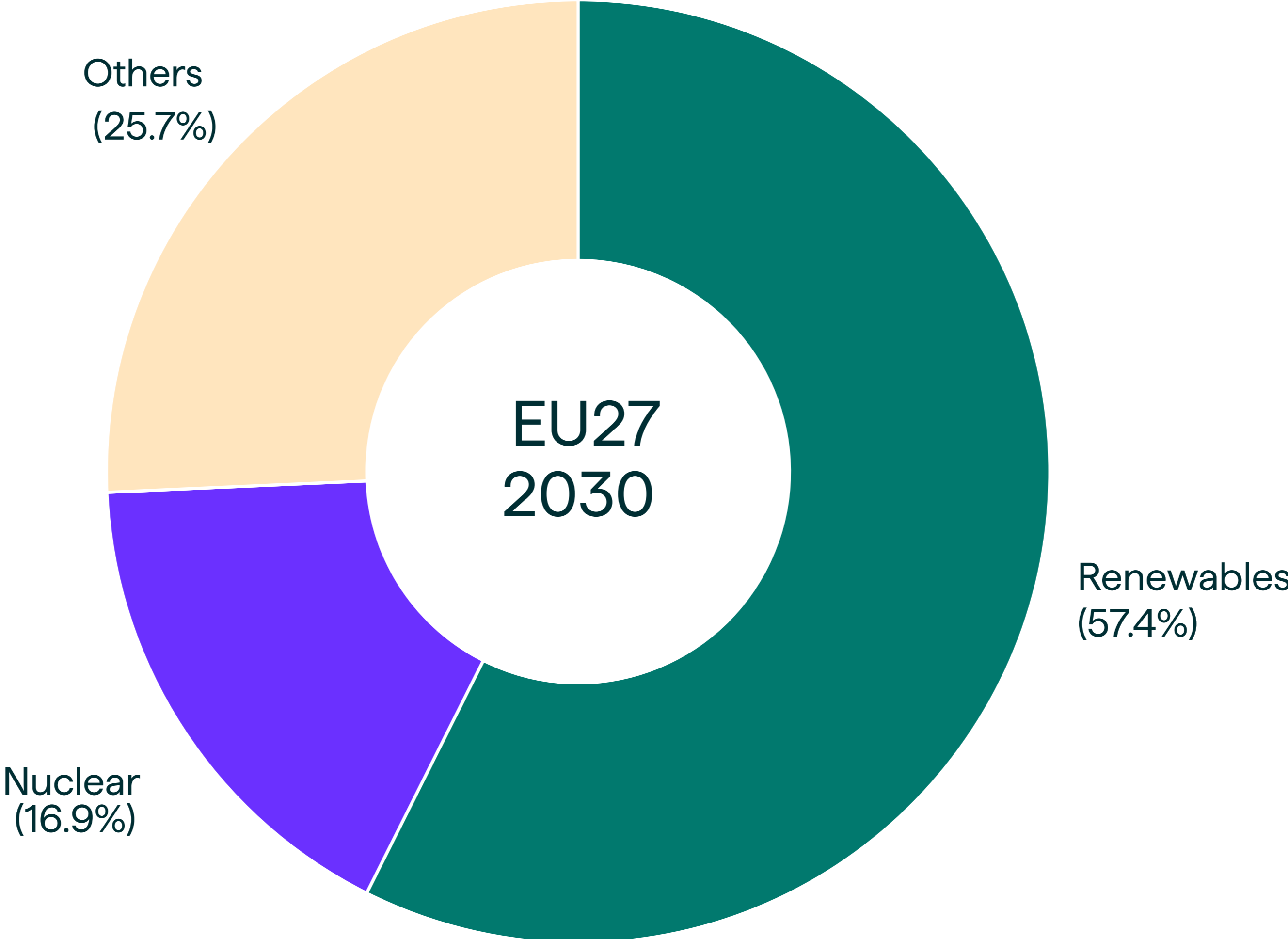
Electricity demand in the EU27 is expected to grow steadily but at a moderate pace, as efficiency gains in industry and households begin to saturate, while sectors like heating and transport continue to rely heavily on fossil fuels. This gradual growth in demand reinforces the importance of planned renewable capacity, ensuring that the share of clean generation keeps pace with overall consumption.

EU 27 electricity demand growth over time (TWh)

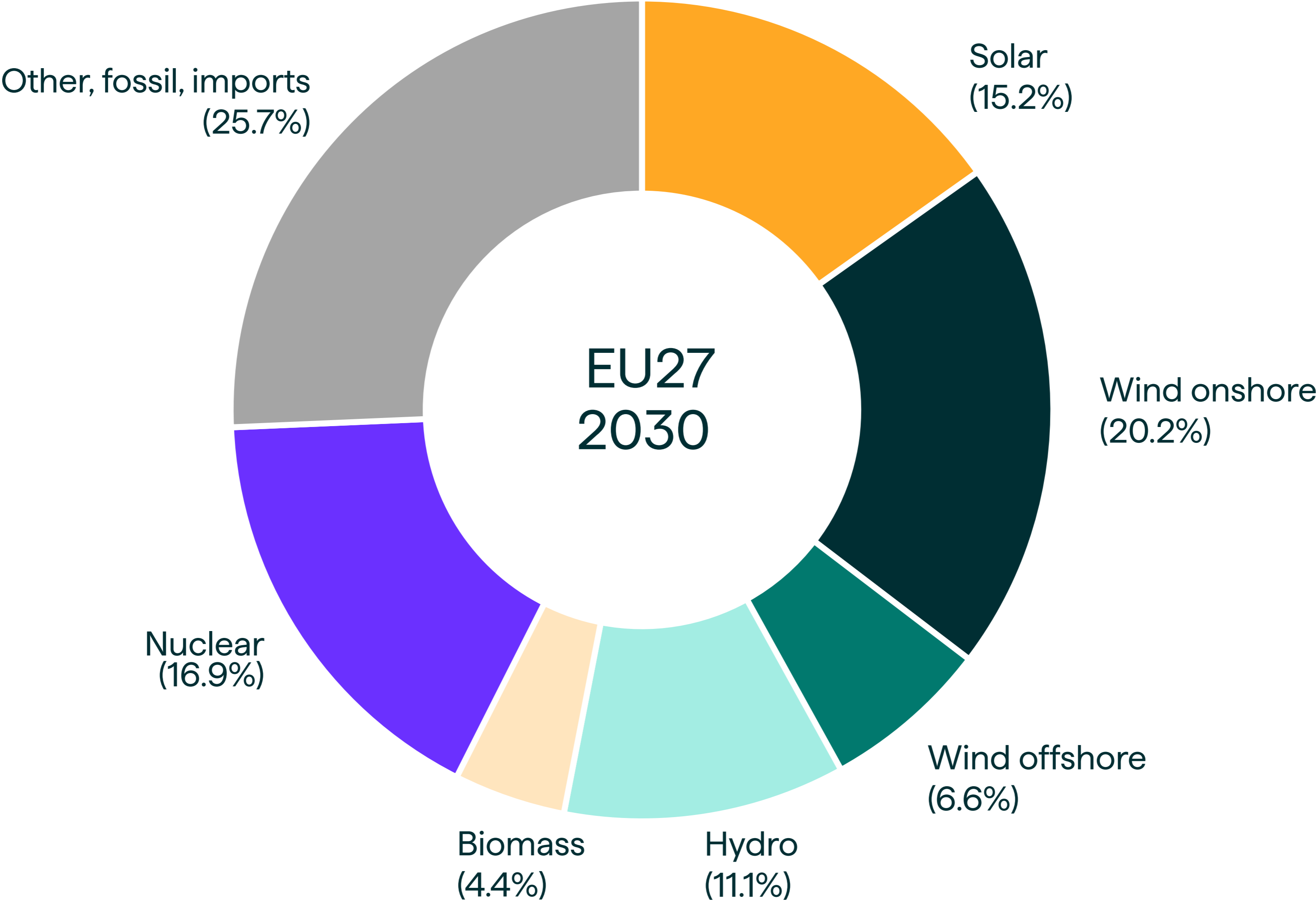


Renewables supplied approximately 47% of electricity in the EU in 2024^{iv}. Considering projected demand growth and the planned build-up of renewable capacity, the share of renewables in net electricity generation is expected to rise to 57% by 2030. This indicates a clear trajectory towards decarbonisation in the power sector, although is still needed in other sectors to achieve economy-wide climate targets. Despite this positive trend in electricity, the overall share of renewables in total energy consumption is likely to remain below the Renewable Energy Directive (RED) target of 42.5%, due to continued reliance on fossil fuels in heating, transport and industry.

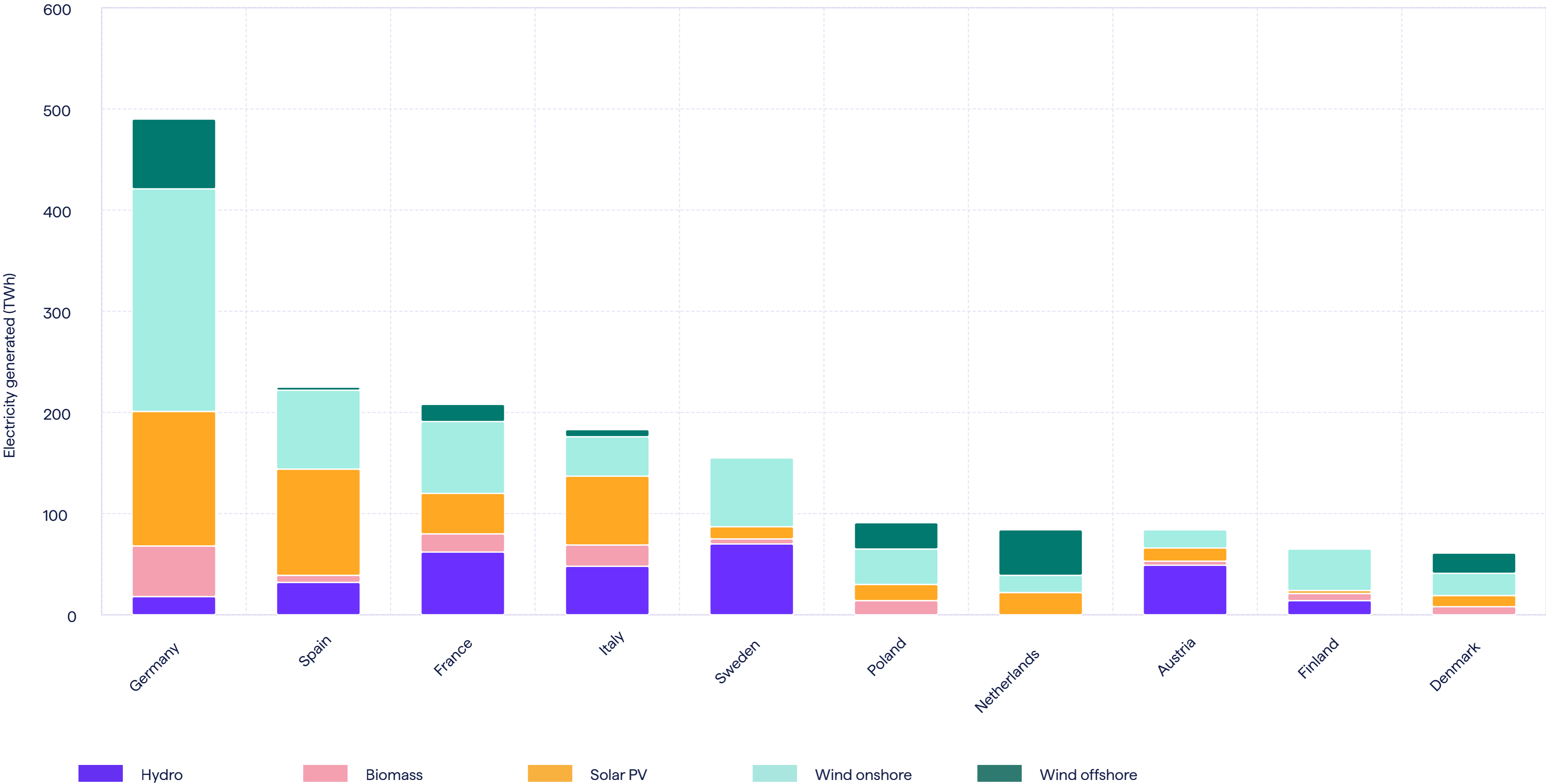
EU 27 electricity demand coverage by clean energy



EU 27 electricity demand coverage by clean energy



EU 27 renewables generation in EU27 (2030)



Country spotlight:

Germany to lead Europe's net-zero race with demand set to rise by a third



In Germany, electricity demand is projected to rise sharply from around 525 TWh (in 2023) to roughly 700–750 TWh by 2030. This is expected to be driven by the electrification of industry, transport and heating. The Renewable Energy Act (EEG 2023) sets a legally binding target of 80 % renewable electricity by 2030, supported by defined expansion paths for solar PV, onshore wind and offshore wind. This is complemented by the Federal Climate Change Act (Klimaschutzgesetz), which anchors economy-wide emissions reductions. While renewable deployment remains strong, ongoing permitting constraints, grid integration challenges and plans for new hydrogen-ready gas-fired capacity to safeguard system adequacy highlight the transitional nature of the power system. At the same time, the heated political debate around the revision of the Buildings Energy Act in 2024–2025 underscored the difficulties of accelerating electrification in the heating sector. As a result, even if Germany meets its electricity-sector renewable targets, progress in total energy decarbonisation may lag without faster alignment across power, heating, and transport.

Country spotlight:

Sweden to set to surpass 2030 EU target



Sweden is a European leader in renewable energy, with roughly two-thirds of its total energy consumption already sourced from renewables. Electricity generation in the country is largely fossil-free due to strong hydropower, wind and nuclear resources. The national target in Sweden aims for 100 % fossil-free electricity by 2040, while the share of renewables in total final energy consumption is expected to reach around 67 % by 2030, well above the EU minimum target. This will be driven by growing electricity demand, caused by industrial and transport electrification, necessitating further expansion of wind and solar capacity alongside existing hydropower. Policymakers are also exploring the possibility of new nuclear projects to help maintain system reliability as demand rises.

Country spotlight:

Solar surge to fuel Italy's decarbonisation ambitions



Italy has also made strong progress in deploying renewable energy, making particular progress on solar PV and onshore wind deployment^{vii}. Today, renewables account for over 40% of Italy's electricity generation, but natural gas still dominates overall energy consumption.

Under the National Energy and Climate Plan (NECP)^{viii}, Italy aims to reach at least 55 % renewable electricity by 2030, which translates to roughly 70 GW of solar PV and 19 GW of onshore wind capacity. Electricity demand is expected to rise moderately due to electrification of transport and heating, highlighting the need for continued grid upgrades. While incentives and policy frameworks support renewable deployment, permitting delays, regional disparities and grid congestion remain key challenges in the country, requiring coordinated planning to ensure Italy meets its 2030 renewable targets.

Predicted percentage of demand to be met by zero-carbon power in 2030

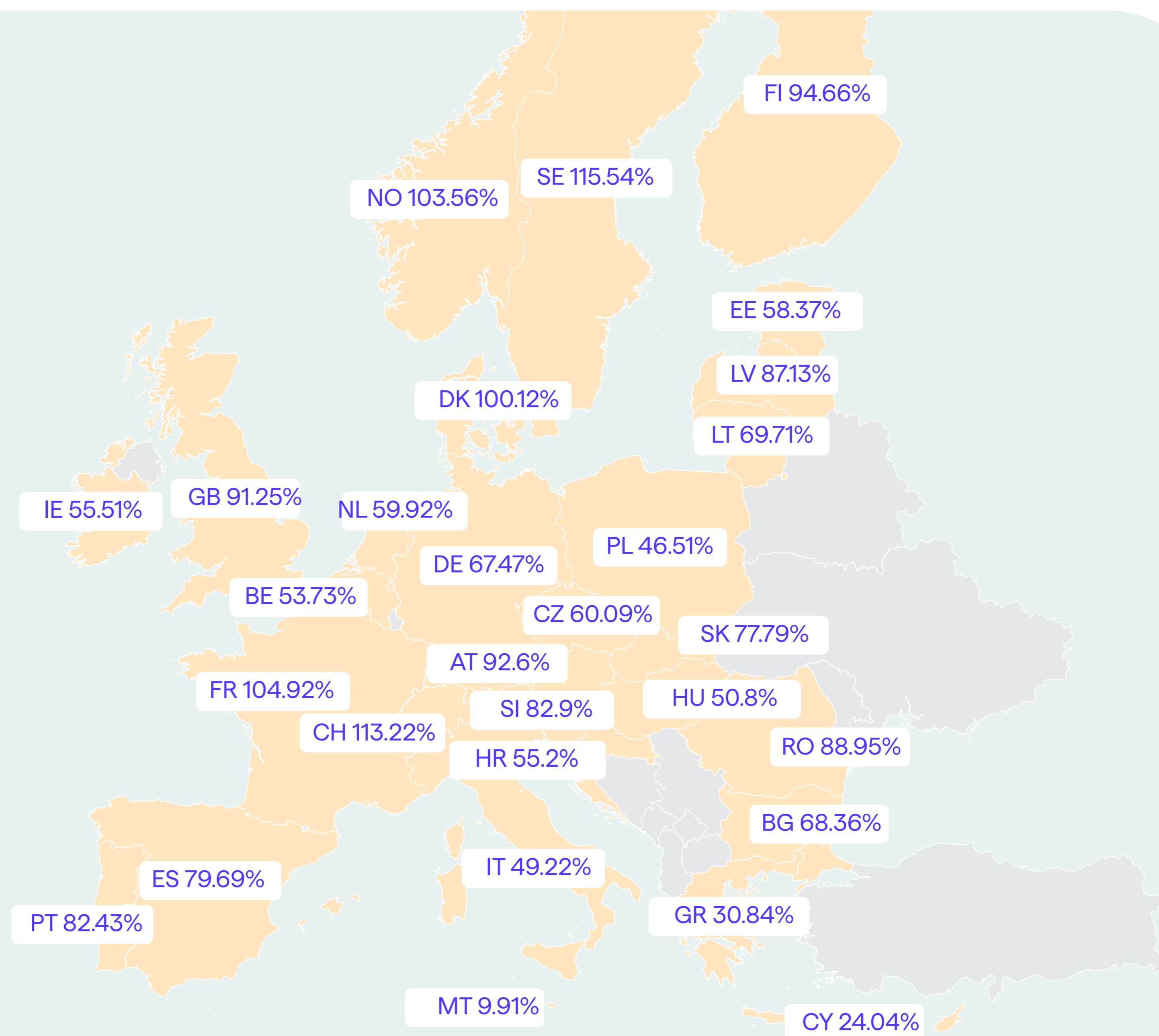
It is generally easier for smaller countries with lower absolute electricity demand to reach net zero in the power sector than for larger, more energy-intensive economies. With less demand to decarbonise, the scale of infrastructure build-out (whether generation, storage, or networks) is more manageable and policy implementation can be faster and more coordinated. However, size alone does not determine success. Two fundamental prerequisites tend to distinguish the most advanced countries in this transition.

First, strong domestic renewable resources are essential. Countries that benefit from favourable wind conditions, high solar irradiation, and especially established hydro capacity have a clear structural advantage. These resources enable them to scale up zero-carbon generation relatively quickly and at lower cost, reducing reliance on fossil fuels without compromising security of supply.

Second, robust integration with neighbouring power systems is critical. Well-developed interconnector capacity allows countries to balance variability in renewable output by importing and exporting electricity as needed. This flexibility reduces the need for costly overbuild of domestic capacity and enhances system resilience.

When examining the leading countries in the transition to zero-carbon power, a clear pattern emerges: the top performers consistently combine abundant renewable resources with strong cross-border grid connectivity, allowing them to decarbonise efficiently while maintaining reliability.

Predicted percentage of demand to be met by zero-carbon power in 2030^{ix}



Country spotlight:

Denmark set to meet all demand with renewables by 2030



Denmark is one of the strongest candidates in Europe to run a very low-carbon power system by 2030. It also faces one of the sharpest demand-growth challenges because electrification is happening at the same time as new power-intensive loads arrive. In its updated National Energy and Climate Plan (NECP) Denmark says electricity consumption is expected to rise significantly as heating, transport, data centres and power-to-X generation expands. The same document says Danish electricity consumption can, on average, be fully covered by renewable energy from 2030 onward. This will depend on large additions of wind and solar, as well as greater system flexibility.

The backbone of the Danish 2030 story is offshore wind. The Danish Energy Agency says the 2024 tender framework enables at least 6 GW of offshore wind to be completed in 2030, while broader political agreements have set a framework for 9 GW of offshore wind with operations starting by the end of 2030 at the latest. Denmark's NECP also highlights that at least 4 GW of offshore wind by 2030 would help cover the extra electricity demand coming from electrification. In practice, that means Denmark's ability to hit a zero-carbon power balance is less about technology readiness and more about execution. This means that elements such as permitting, supply chains, transmission reinforcement and getting projects built on time will define the country's ability to meet its entire power demand with zero-carbon electricity.

Denmark is also planning a major hydrogen build-out too. The NECP says Denmark aims for 4-6 GW of electrolysis capacity by 2030, which could result in power-to-X plants accounting significant share of Danish electricity consumption. That raises the bar for clean generation because Denmark is not merely replacing petrol cars and gas boilers with electric alternatives; it is also trying to create a new green-fuels industry. This is a strength for long-term industrial decarbonisation, but it means the 2030 power system must cope with far larger and more variable loads than in the past.

Electrification of end use is also relevant. Denmark's NECP says the 2020 Green Road Transport Agreement is expected to raise the number of zero and low-emission cars to 775,000 by 2030. On heat, the plan shows district-heating heat pumps rising strongly through 2030, with the renewable share in district heating increasingly driven by new heat pumps rather than biomass alone. Denmark is also targeting biogas production equivalent to 100% of total Danish gas consumption by 2030, which reduces dependence on fossil gas even where direct electrification is slower.

Country spotlight:

Nuclear baseload to smooth French path to net-zero power system



France has an advantage in the race to net-zero. It already has a very low-carbon electricity mix centred on nuclear, supported by hydropower and rising levels of both wind and solar. This means France's 2030 challenge is less about decarbonising power itself and more about using that clean electricity to decarbonise transport, buildings and industry.

The French Transmission System Operator, Réseau de Transport d'Électricité's (RTE) forward study remains quite upbeat for 2030. It says electricity consumption should rise only modestly (about 5% versus 2019,) even as transport, industry and buildings shift toward electricity. RTE also says that with energy efficiency and flexibility, non-flexible winter peak demand could actually fall by around 3 GW. This shows that France expects electrification to grow against a stable backdrop, because efficiency offsets part of the new load.

On the supply side, France remains relatively secure compared with its peers. RTE's projected supply outlook says shows improving margins by the second half of the decade as nuclear availability recovers and more offshore wind and onshore wind, as well as solar come online. The French government's updated energy strategy continues to lean on both nuclear and renewables, rather than choosing between them. The core point is that France does not need a revolutionary power-sector redesign by 2030; it needs steady nuclear performance plus continued renewables additions and grid adaptation.

Electrification policy is substantial too. France's NECP says the state is supporting a domestic production target of 2 million electric vehicles per year by 2030. For buildings, it says public support should allow France to produce and install 1 million heat pumps per year by the end of 2027. The harder part of the target for France is demand conversion, not zero-carbon power availability.

France's clean power progress depends on keeping the nuclear fleet reliable, while accelerating grid buildout, heat-pump deployment and better siting renewables. By 2030, the country is expected to remain a major exporter of low-carbon electricity.

Country spotlight:

GB facing multiple challenges to hit 2030 clean power targets



Great Britain has an explicit 2030 clean power target. The government's "Clean Power 2030" plan sets out goals for Great Britain to generate enough clean power to meet total annual electricity demand by 2030, with unabated gas used only rarely for security of supply. The GB TSO's (NESO) advice is clear that this is technically possible, but only if multiple elements all deliver: offshore wind, onshore wind, solar, networks, storage, flexibility, planning reform and supply chains. That makes Britain's outlook ambitious.

Demand is expected to rise as transport, heat and industry electrify. Electricity demand is expected to grow with decarbonisation, while the planned deployment of data centres, along with increased take up of heat pumps and Electric Vehicles across the country continue to make the 2030 clean power target more demanding. NESO's message is that electrification is central to the 2030 plan, but growth in demand must be moderated by efficiency, flexible charging, thermal storage and smarter operation of electric heating. Britain's clean-power strategy is therefore not just about building more generation; it is also about reshaping demand so the system remains operable during winter peaks and low-wind periods.

The supply build-out required is significant. NESO says offshore wind is the backbone of a 2030 clean-power system and that without it, about 140 TWh of power would need to come from other sources. Its stakeholder-backed deployment range is 43-50 GW of offshore wind by 2030. NESO also says onshore wind generation must grow by around 75%, implying roughly 14 GW of additional onshore wind and around 58 TWh of clean generation, while solar is expected to provide about 45 TWh. Government documents align with this, with the action plan and related strategies centred on mass deployment of offshore wind, onshore wind and solar plus major network reform. Previous Montel analysis has also shown that should GB continue on its current trajectory, the goals of the 2030 Clean Power Plan will not be met, falling ^x14GW short of the required capacity^{xi}.

Britain's strength is that the direction of travel is very clear and the policy machine is now aligned around one date, one target, one outcome. It also has an exceptional offshore-wind resource and a mature renewables market. However, the country must now add generation, transmission, distribution upgrades, flexibility, storage and demand-side response almost simultaneously.

The real uncertainty for GB is whether consenting, grid connections, investment and network constraints can all be solved fast enough. On electrification, Britain is moving in the right direction, but the power system needs to both expand and become smarter at the same time.

Country spotlight:

Germany facing Europe's biggest decarbonisation challenge



Germany's 2030 pathway is both the biggest in scale and arguably the hardest in Europe in system-management terms. Official policy is now very clear: renewables are supposed to provide at least 80% of gross electricity consumption by 2030 and the government assumes gross electricity consumption of 750 TWh in 2030. That is much higher than today (2026) and reflects the central role of electrification in Germany's wider decarbonisation strategy. The country has already completed its nuclear phase-out, so its 2030 model depends overwhelmingly on a very rapid wind-and-solar build-out, backed by grids, storage, flexibility and dispatchable backup.

The build targets are enormous. Germany's updated NECP and Bundesministerium für Wirtschaft und Klimaschutz (BMWK) communications say that it is targeting 215 GW of solar PV, about 115 GW of onshore wind and at least 30 GW of offshore wind by 2030. Those numbers are consistent with the government's view that electricity becomes the main decarbonisation vector across transport, heat and parts of industry. They also explain why the power system question in Germany is not merely about generation shares. It is about whether the grid can move huge volumes of variable renewable power across the country quickly enough, especially from northern wind resources to southern industrial demand centres.

Electrification of demand is built directly into the 2030 plan. Germany's NECP says at least 15 million fully electric vehicles are expected to be registered by 2030. It also says heat pumps are a key technology for buildings, with a goal of installing at least 500,000 new heat pumps per year from 2024 onward. The same document gives a sense of scale for district heat electrification: large heat pumps are meant to generate 86 TWh per year in heating networks by 2030. These are not marginal adjustments. Germany is trying to rewire the energy basis of transport, heating and industry within one decade.

The good news is that Germany has already shifted into faster renewables deployment. BMWK says renewables supplied 54.4% of electricity in 2024, up from about 53% in 2023, and the Umweltbundesamt says the 80% target is achievable if wind and PV expansion continues at the required pace. But Germany's challenge is still larger than the headline renewable share suggests. Because total electricity demand is expected to grow sharply, Germany must add clean generation faster than demand rises. It also has to solve transmission bottlenecks, local opposition in some regions, permitting and the design of a market that can keep enough flexibility and dispatchable capacity available after nuclear exit and ongoing coal reduction.

Methodology and sources

This report draws on a range of sources to provide insights into energy market developments. It is based primarily on data available from Montel's analytics entities, Energy Quantified, EnAppSys and Energy Brainpool. Publicly available data is also used.

- i) All data relating to carbon emissions and carbon intensity in this report are taken from Montel Energy Quantified's Carbon intensity Toolkit.
- ii) Carbon intensity is calculated by multiplying power the total number of MWh of electricity produced by carbon-emitting generation sources in each country by the operational emissions factor of that generation type.

Production type	Operational Emissions (kgCO ₂ eq/MWh)	Source
Hard coal	760.0	IPCC 2014
Lignite	760.0	IPCC 2014
Gas	370.0	IPCC 2014
Oil	406.0	BEIS 2021
Oil shale	298.8	Talinn University of Technology 2013
Peat	760.0	Assumed same as coal
Unknown/Other	575.0	IPCC 2014

iii) Last updated Wednesday 29 April 2026. Sources: AGEE, BMWi, Bundesnetzagentur; Energimyndigheten Sverige; Energistyrelsen Danmark; CBS Nederland; entso-e; Solar Ireland via pv magazine; Wind Energy Ireland; EirGrid; DESNZ.

* The renewable technologies included are solar, onshore and offshore wind, waste, marine power, reservoirs, run-of-river, biomass, geothermal power and what countries report as "other renewables".

** Only data about wind and solar available. The number is the sum of solar and wind deployment.

*** Only data about solar and offshore wind available. The number is the sum of solar and offshore wind deployment.

iv) <https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20250319-1>

v) <https://www.eea.europa.eu/en/analysis/indicators/share-of-energy-consumption-from>

vi) https://www.oecd.org/en/publications/oecd-environmental-performance-reviews-sweden-2025_91dcc109-en/full-report/towards-green-growth_f8a4c0e1.html

vii) <https://www.pv-magazine.it/2024/07/01/inviato-il-pniec-italiano-a-bruxelles-792-gw-di-fotovoltaico-su-131-gw-di-rinnovabili/>

viii) <https://www-pub.iaea.org/MTCD/publications/PDF/cnpp2022/countryprofiles/Italy/Italy.htm>

ix) Projection methodology not made public due to reliance on commercially confidential data.

Appendices

Carbon Emissions [tCO₂eq]

2024 vs 2025 by area

Area	Lifecycle				Operational				Average change	
	2024	2025	Nominal change	Relative change	2024	2025	Nominal change	Relative change	Avg. nominal change	Avg. relative change
FI	5,769,003	4,833,585	-935,418	-16.2%	3,000,041	1,784,480	-1,215,561	-40.5%	-1,075,490	-28.4%
NO	2,539,770	2,330,640	-209,130	-8.2%	605,059	401,979	-203,080	-33.6%	-206,105	-20.9%
SI	3,792,960	2,512,822	-1,280,138	-33.8%	2,588,659	1,756,196	-832,463	-32.2%	-1,056,300	-33.0%
SE	1,773,594	1,718,292	-55,302	-3.1%	93,187	63,667	-29,520	-31.7%	-42,411	-17.4%
NIE	1,939,433	1,358,125	-581,309	-30.0%	1,467,816	1,016,716	-451,100	-30.7%	-516,204	-30.4%
MK	2,635,513	2,076,267	-559,247	-21.2%	2,196,121	1,725,645	-470,475	-21.4%	-514,861	-21.3%
DK	5,138,847	4,383,655	-755,192	-14.7%	3,321,313	2,637,893	-683,421	-20.6%	-719,306	-17.6%
BA	6,460,733	5,414,384	-1,046,349	-16.2%	5,949,471	4,980,143	-969,328	-16.3%	-1,007,839	-16.2%
HR	2,365,547	2,067,376	-298,171	-12.6%	1,621,596	1,383,916	-237,680	-14.7%	-267,925	-13.6%
IE	7,533,376	6,022,318	-1,511,058	-20.1%	5,040,780	4,307,548	-733,231	-14.6%	-1,122,145	-17.3%
EE	1,176,383	1,024,714	-151,669	-12.9%	754,716	651,202	-103,513	-13.7%	-127,591	-13.3%
IT	63,564,077	55,994,408	-7,569,669	-11.9%	43,426,504	38,448,636	-4,977,868	-11.5%	-6,273,769	-11.7%
HU	6,889,902	6,103,275	-786,627	-11.4%	4,295,440	3,817,967	-477,473	-11.1%	-632,050	-11.3%
FR	15,333,345	14,923,650	-409,696	-2.7%	7,388,173	6,822,661	-565,512	-7.7%	-487,604	-5.2%
RO	15,065,072	14,171,781	-893,291	-5.9%	9,092,019	8,530,454	-561,565	-6.2%	-727,428	-6.1%
PL	112,275,712	107,011,638	-5,264,075	-4.7%	74,972,845	71,847,610	-3,125,235	-4.2%	-4,194,655	-4.4%
BG	12,783,746	12,519,853	-263,893	-2.1%	8,197,344	7,995,335	-202,009	-2.5%	-232,951	-2.3%
DE	148,063,063	145,906,755	-2,156,308	-1.5%	100,627,105	99,656,344	-970,760	-1.0%	-1,563,534	-1.2%
SK	2,021,593	2,020,343	-1,250	-0.1%	1,352,690	1,341,720	-10,970	-0.8%	-6,110	-0.4%
GR	16,616,270	16,475,443	-140,828	-0.9%	10,281,756	10,199,536	-82,220	-0.8%	-111,524	-0.8%
CZ	30,258,068	30,385,216	127,148	0.4%	20,648,064	20,561,282	-86,782	-0.4%	20,183	0.0%
CH	1,365,790	1,510,368	144,577	10.6%	0	0	0	0.0%	72,289	5.3%
LV	774,937	752,786	-22,152	-2.9%	592,865	593,712	847	0.1%	-10,652	-1.4%
RS	18,465,291	18,833,726	368,435	2.0%	16,907,805	17,237,058	329,253	2.0%	348,844	2.0%
GB	45,529,892	47,422,245	1,892,354	4.2%	28,862,284	29,681,554	819,270	2.8%	1,355,812	3.5%
TR	132,377,674	138,658,088	6,280,414	4.7%	112,262,351	116,654,748	4,392,397	3.9%	5,336,406	4.3%
BE	7,403,934	7,984,345	580,411	7.8%	5,321,766	5,768,753	446,987	8.4%	513,699	8.1%
ES	30,222,550	33,209,141	2,986,590	9.9%	17,973,739	20,292,505	2,318,766	12.9%	2,652,678	11.4%
AT	4,320,257	4,646,759	326,502	7.6%	2,303,359	2,658,329	354,970	15.4%	340,736	11.5%
NL	32,608,226	37,985,199	5,376,973	16.5%	27,174,334	31,654,800	4,480,467	16.5%	4,928,720	16.5%
PT	3,756,430	5,034,309	1,277,880	34.0%	1,873,972	2,855,285	981,313	52.4%	1,129,596	43.2%
LT	672,706	938,773	266,067	39.6%	320,718	554,863	234,145	73.0%	250,106	56.3%
TOTAL	741,493,695	736,230,278	-5,263,418	-0.7%	520,513,892	517,882,539	-2,631,353	-0.5%	-3,947,386	-0.6%

Carbon Intensity [kgCO₂eq/MWh]

2024 vs 2025 by area

Area	Lifecycle								Operational							
	Production				Consumption				Production				Consumption			
	2024	2025	Nominal change	Relative change	2024	2025	Nominal change	Relative change	2024	2025	Nominal change	Relative change	2024	2025	Nominal change	Relative change
FI	71.4	59.2	-12.2	-17.1%	66.1	55.7	-10.4	-15.8%	36.5	21.1	-15.4	-42.3%	32.8	19.5	-13.2	-40.4%
NO	16.6	14.6	-2.0	-12.0%	17.9	15.6	-2.3	-12.7%	4.1	2.5	-1.6	-38.7%	5.0	3.1	-1.9	-38.7%
SE	10.9	10.8	-0.2	-1.5%	11.8	11.5	-0.3	-2.4%	0.6	0.4	-0.2	-31.6%	1.4	1.1	-0.3	-21.7%
SI	245.6	180.4	-65.2	-26.6%	270.2	178.4	-91.8	-34.0%	167.6	126.4	-41.2	-24.6%	183.6	124.1	-59.5	-32.4%
DK	173.8	153.2	-20.5	-11.8%	139.9	116.7	-23.2	-16.6%	113.7	93.3	-20.4	-17.9%	89.4	69.4	-20.0	-22.4%
NIE	313.5	264.3	-49.2	-15.7%	273.2	200.0	-73.2	-26.8%	237.2	198.1	-39.0	-16.5%	206.3	148.2	-58.0	-28.1%
IE	320.6	251.4	-69.2	-21.6%	228.3	184.2	-44.1	-19.3%	214.6	179.8	-34.8	-16.2%	152.2	130.5	-21.7	-14.2%
HU	222.5	187.6	-34.8	-15.7%	198.7	177.5	-21.2	-10.7%	139.5	118.2	-21.2	-15.2%	126.3	113.0	-13.3	-10.5%
EE	262.1	223.5	-38.6	-14.7%	161.9	136.3	-25.6	-15.8%	163.2	144.1	-19.1	-11.7%	102.1	83.9	-18.2	-17.9%
FR	27.9	26.7	-1.3	-4.5%	28.0	26.7	-1.3	-4.6%	13.0	11.7	-1.3	-10.1%	13.1	11.7	-1.3	-10.3%
HR	187.3	179.6	-7.7	-4.1%	171.6	161.9	-9.6	-5.6%	128.4	119.5	-8.9	-6.9%	116.8	107.6	-9.2	-7.9%
CZ	429.4	408.8	-20.6	-4.8%	426.2	407.1	-19.1	-4.5%	292.8	276.1	-16.6	-5.7%	290.4	274.8	-15.6	-5.4%
PL	732.3	700.4	-31.9	-4.4%	686.8	668.9	-17.9	-2.6%	489.2	470.5	-18.7	-3.8%	458.7	449.1	-9.6	-2.1%
BG	353.0	343.2	-9.8	-2.8%	336.2	321.4	-14.7	-4.4%	226.7	219.7	-7.0	-3.1%	217.2	206.0	-11.2	-5.2%
MK	556.2	546.3	-9.9	-1.8%	530.7	515.3	-15.4	-2.9%	469.1	460.4	-8.7	-1.9%	441.3	425.8	-15.6	-3.5%
GR	344.2	337.9	-6.3	-1.8%	334.4	325.1	-9.3	-2.8%	213.7	210.3	-3.4	-1.6%	209.6	202.9	-6.8	-3.2%
DE	351.8	345.3	-6.6	-1.9%	313.7	307.7	-6.0	-1.9%	239.3	236.6	-2.8	-1.2%	212.8	209.9	-2.9	-1.4%
RO	303.1	303.6	0.5	0.2%	289.0	280.1	-8.9	-3.1%	182.8	182.6	-0.2	-0.1%	176.0	170.0	-6.0	-3.4%
CH	18.4	25.1	6.7	36.7%	21.4	32.5	11.1	51.9%	0.0	0.0	0.0	0.0%	2.4	6.4	4.0	168.4%
GB	188.2	190.7	2.5	1.3%	173.1	181.5	8.4	4.9%	118.3	118.5	0.2	0.2%	108.6	112.6	4.0	3.7%
SK	66.9	67.8	1.0	1.4%	68.2	71.4	3.1	4.6%	44.2	44.6	0.4	1.0%	45.0	46.8	1.8	4.0%
LV	135.6	126.9	-8.6	-6.4%	113.1	106.2	-6.8	-6.0%	93.9	95.4	1.5	1.6%	80.1	78.8	-1.3	-1.7%
BA	538.8	548.2	9.4	1.7%	539.5	568.4	29.0	5.4%	495.9	504.5	8.6	1.7%	496.0	522.9	26.9	5.4%
TR	398.0	413.8	15.8	4.0%	389.5	406.0	16.5	4.2%	338.0	348.6	10.6	3.1%	330.7	342.0	11.3	3.4%
RS	538.9	565.1	26.3	4.9%	527.9	549.3	21.4	4.1%	493.5	517.3	23.7	4.8%	480.9	499.2	18.3	3.8%
NL	275.6	289.5	13.9	5.0%	261.7	284.2	22.5	8.6%	230.3	242.0	11.7	5.1%	217.8	237.2	19.4	8.9%
ES	123.6	131.3	7.6	6.2%	121.9	129.6	7.7	6.4%	74.0	80.7	6.7	9.0%	72.8	79.5	6.7	9.2%
IT	274.8	313.6	38.8	14.1%	232.6	233.1	0.5	0.2%	187.4	214.6	27.3	14.6%	158.3	158.5	0.2	0.1%
BE	103.9	119.5	15.6	15.0%	97.1	110.0	12.9	13.3%	75.1	86.8	11.7	15.5%	69.2	79.0	9.7	14.0%
AT	68.1	87.3	19.3	28.4%	71.1	92.6	21.5	30.3%	35.9	50.3	14.4	40.0%	38.3	54.3	16.1	42.0%
PT	86.4	111.6	25.1	29.1%	79.0	102.0	22.9	29.0%	42.6	63.7	21.2	49.7%	39.5	57.7	18.2	46.0%
LT	93.3	110.9	17.6	18.9%	79.8	85.1	5.3	6.7%	41.7	64.2	22.5	53.9%	39.9	49.1	9.2	23.1%
TOTAL	244.5	238.7	-5.8	-2.4%	226.9	220.1	-6.8	-3.0%	175.1	172.0	-3.1	-1.8%	163.0	158.6	-4.4	-2.7%

Zero-carbon generation as share of overall fuel mix

2024 vs 2025 by country

Countries	Code	2024 Proportion (%)	2025 Proportion (%)	Percentage Difference (%)
Estonia	EE	52.89%	57.98%	+5.09%
Finland	FI	92.40%	94.20%	+1.80%
Denmark	DK	81.63%	83.13%	+1.50%
Poland	PL	29.44%	30.55%	+1.11%
Norway	NO	98.74%	99.13%	+0.39%
Germany	DE	60.05%	60.24%	+0.19%
Sweden	SE	96.30%	96.38%	+0.08%
Switzerland	CH	100.00%	100.00%	0.00%
Great Britain	GB	64.24%	63.77%	-0.47%
Netherlands	NL	36.48%	36.01%	-0.47%
France	FR	95.92%	95.34%	-0.58%
Latvia	LV	70.90%	68.46%	-2.44%
Spain	ES	80.30%	77.84%	-2.46%
Italy	IT	47.33%	43.32%	-4.01%
Austria	AT	88.14%	84.02%	-4.12%
Belgium	BE	72.21%	67.86%	-4.35%
Lithuania	LT	74.79%	69.58%	-5.21%
Portugal	PT	86.88%	81.44%	-5.44%

League table: change in zero-carbon generation

2024 vs 2025 generation by country

Countries		2024 Generation (TWh)	2025 Generation (TWh)	Percentage change (%)
Lithuania	LT	5.31	5.95	+12.0%
Switzerland	CH	43.60	47.96	+10.0%
Estonia	EE	2.61	2.80	+7.5%
Netherlands	NL	45.57	48.40	+6.2%
Finland	FI	71.75	74.91	+4.4%
Great Britain	GB	139.63	144.62	+3.6%
Poland	PL	45.38	46.98	+3.5%
Norway	NO	151.30	155.63	+2.9%
France	FR	495.72	505.60	+2.0%
Portugal	PT	34.22	34.77	+1.6%
Germany	DE	257.31	258.04	+0.3%
Spain	ES	194.61	194.54	0.0%
Sweden	SE	155.61	153.86	-1.1%
Denmark	DK	28.12	27.25	-3.1%
Latvia	LV	3.90	3.52	-10.0%
Italy	IT	106.37	95.19	-10.5%
Belgium	BE	51.35	45.71	-11.0%
Austria	AT	53.62	43.64	-18.6%

League table: change in carbon-emitting generation

2024 vs 2025 by country · Negative values indicate lower carbon-emitting generation

Countries	Code	2024 Generation (TWh)	2025 Generation (TWh)	Percentage Change
Norway	NO	1.93	1.36	-29.6%
Finland	FI	5.90	4.61	-21.8%
Denmark	DK	6.33	5.53	-12.6%
Estonia	EE	2.32	2.03	-12.6%
Sweden	SE	5.97	5.78	-3.3%
Poland	PL	108.73	106.79	-1.8%
Germany	DE	171.19	170.29	-0.5%
Switzerland	CH	0.00	0.00	0.0%
Latvia	LV	1.60	1.62	+1.1%
Italy	IT	118.38	124.52	+5.2%
Great Britain	GB	77.73	82.15	+5.7%
Netherlands	NL	79.34	86.00	+8.4%
Belgium	BE	19.76	21.65	+9.5%
Austria	AT	7.21	8.30	+15.0%
Spain	ES	47.75	55.40	+16.0%
France	FR	21.07	24.69	+17.2%
Lithuania	LT	1.79	2.60	+45.3%
Portugal	PT	5.17	7.92	+53.2%

Projected demand met by renewables and zero-carbon energy

Country ranking · projected percentage of demand supplied · values may exceed 100%

Country	Projected % demand met by renewables	Projected % demand met by zero-carbon energy
Norway	103.56	103.56
Denmark	100.12	100.12
Austria	92.6	92.6
Switzerland	91.08	113.22
Sweden	88.81	115.54
Latvia	87.19	87.19
Portugal	82.43	82.43
United Kingdom	82.36	91.25
Spain	71.51	79.69
Lithuania	69.71	69.71
Romania	69.29	88.95
Germany	67.47	67.47
Finland	64.15	94.66
Estonia	58.37	58.37
Netherlands	57.41	59.92
Ireland	55.51	55.51
Croatia	55.2	55.2
Slovenia	52.49	82.9
Italy	49.22	49.22
Poland	46.51	46.51
France	39.21	104.92
Belgium	39.16	53.73
Greece	30.84	30.84
Bulgaria	29.85	68.36
Slovakia	26.85	77.79
Cyprus	24.04	24.04
Hungary	23.72	50.8
Czech Republic	22.26	60.09
Malta	9.91	9.91

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