Electricity Mid-Year Update 2025

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Abstract

Despite a slowdown in global economic growth prospects, the world's electricity consumption increased strongly in the first half of 2025, driven by rising demand from industry, appliances, cooling, data centres and electrification. At the same time, electricity supply from renewables, natural gas and nuclear continues to grow, with all set to reach new milestones.

This mid-year update follows the extensive Electricity 2025 report released in February, examining the latest trends and the outlook for the remainder of the year. It includes updated data for 2024 along with new forecasts for 2025 and 2026 covering areas such as global electricity demand, supply by fuel type, and carbon dioxide (CO_2) emissions from electricity generation. The report also analyses the latest developments in major economies including China, the European Union, India and the United States and provides updated tracking of wholesale electricity prices across markets worldwide.

Acknowledgements, contributors and credits

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Questions or comments?

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Executive summary

Global electricity demand on course to expand robustly in 2025 and 2026 despite economic headwinds

Global power demand is expected to rise much faster over the forecast 2025-2026 period than it did during the past decade. While slower than the 4.4% surge in 2024, growth forecasts of 3.3% for 2025 and 3.7% for 2026 remain among the highest rates observed in the past decade and well above the 2015-2023 average of 2.6%. Despite a slowdown in economic activity, which has weighed on global electricity use so far in 2025, heatwaves continue to add to demand in many regions, as they did in 2024. Rising demand from industry, appliances, growing air conditioning use, the expansion of data centres, and ongoing electrification will remain major drivers of strong global electricity demand growth through 2026. As a result, electricity demand is expected to rise more than twice as fast as total energy demand in 2025 and to continue this trend in 2026.

Electricity demand in China and India is expected to rise at a more moderate pace in 2025 than the rapid growth seen in 2024. After a 7% surge in 2024, electricity consumption in China is projected to increase by 5% in 2025, reflecting slower demand growth in the industrial sector. Nonetheless, China alone will account for 50% of global electricity demand growth, as it did in 2024. Similarly, after 6% growth in 2024, electricity demand in India is forecast to rise by 4% this year. However, stronger growth is forecast for both China (+5.7%) and India (+6.6%) in 2026, as activity in the industry and services sectors picks up. Together, these two economies will account for 60% of global demand growth through 2026.

The United States is seeing above-trend electricity demand growth in 2025, similar to 2024, whereas the European Union is still recovering at a modest pace following earlier steep declines. After rising by 2.1% in 2024, US electricity demand is boosted further by the rapid expansion of data centres in both 2025 and 2026, reaching 2.3% and 2.2%, respectively, more than double the average growth rate over the past decade. In the European Union, electricity consumption is forecast to increase by 1.1% in 2025, before accelerating to 1.5% in 2026, similar to the growth of 1.6% in 2024. While the demand contraction in the EU industrial sector came to a halt in 2024 following consecutive declines in 2022 and 2023, a significant recovery has still not been observed as of the first half of 2025.

The first half of 2025 showed contrasting trends across regions in thermal generation

In the first half of 2025, while coal-fired generation declined year-on-year in China and India, it increased in the United States and the European Union. The declines in China and India were due to more moderate demand growth compared with the same period in 2024 and strong expansion in output from renewables. By contrast, in the United States, both renewable generation and coal-fired output rose strongly, with the latter boosted by gas-to-coal switching due to higher natural gas prices compared with 2024. In the European Union, even though solar PV output broke new records, lower wind and hydropower generation resulted in increased gas- and coal-fired generation year-on-year. For full-year 2025, EU coal-fired power generation is forecast to decline compared with the previous year, while India is expected to see an increase, contrary to the trend observed in these regions in the first half of the year. Low-emissions sources are expected to record strong growth over our forecast period in many regions, raising their share in the global electricity generation mix.

Renewables, natural gas and nuclear energy are all contributing to meet additional demand through 2026

Wind and solar PV are expected to cover over 90% of the increase in global electricity demand in 2025. After exceeding the 4 000 TWh mark in 2024, wind and solar PV generation combined is set to surpass 5 000 TWh in 2025 and 6 000 TWh in 2026.

Electricity generation from renewable energy sources is forecast to overtake coal-fired generation in our outlook. Depending on weather trends and economic developments, coal-fired output is expected to be surpassed by renewable generation as early as 2025 or by 2026 at the latest. Following this milestone, coal's share in total generation will drop below 33% for the first time in a century. Solar PV and wind energy are central to this shift, with their combined share of global electricity generation forecast to grow from 15% in 2024 to 17% in 2025, reaching almost 20% by 2026 – a near-fivefold increase from just 4% a decade ago.

Global coal-fired generation is forecast to move into slightly negative territory in 2025 following growth of 1.3% in 2024. Contractions in China and Europe are only partially offset by increases elsewhere, notably in the United States, India and other Asian countries. Following this modest decline, global coal-fired generation is expected to contract by 1.3% in 2026 amid continued renewables growth and higher coal-to-gas switching in multiple regions.

Global gas-fired generation is expected to increase by 1.3% in 2025, and reach a new high, following growth of 1.9% in 2024. The gains in 2025 are driven by continued oil-to-gas switching in the Middle East and sustained growth in gas-fired generation in Asia. While higher natural gas prices supported increased gas-to-coal switching in the United States in the first half of 2025, lower wind and hydropower output in Europe bolstered gas-fired generation there. For 2026, we forecast growth in global power generation from natural gas of around 1.3%.

Global nuclear power generation is on track to reach a new record high in 2025 and will continue its upward trajectory in 2026. This is driven by plant restarts in Japan, robust output in the United States and France, and the commissioning of new reactors in China, India, Korea and several other countries. Global nuclear generation is expected to rise by an average of 2% over the 2025-2026 period, approaching 3 000 TWh in 2026.

Power sector emissions are plateauing as low-emissions sources grow strongly

Global carbon dioxide emissions from electricity generation are expected to plateau this year, with a slight decline forecast in 2026 as low-emissions sources displace fossil-fired supply. Emissions from electricity generation already showed signs of slowing in 2024 when they rose by 1.2%, following growth of 1.6% in 2023. This was despite even hotter temperatures in 2024 than in 2023, which boosted electricity demand for cooling. The rapid deployment of renewables is limiting increases in power generation from fossil fuels, but abnormal weather conditions – such as intense heat waves, cold spells or below-average rainfall (affecting hydropower output) – can lead to fluctuations in emissions levels from one year to the next. Developments in China, where more than half of the world's coal-fired power generation takes place, can significantly influence global trends.

Wholesale electricity prices rose in some regions, while negative prices are becoming more common

Average wholesale electricity prices rose in the first half of 2025 year-on-year in a number of markets. Wholesale electricity prices in the European Union and the United States rose by about 30-40% amid higher gas prices. While average prices remained below the 2023 annual levels, they were still higher than in 2019. By contrast, wholesale prices in countries such as India and Australia declined by around 5-15% in 2025 compared with the previous year. At the same time, many markets continued to observe an increase in the occurrence of negative electricity prices. The share of hours with negative prices on the wholesale market reached 8-9% in the first half of the year in countries such as Germany, the Netherlands and

Spain – up from 4-5% in 2024. The rise in occurrences of negative prices highlights the urgent need for greater flexibility in supply and demand. Appropriate regulatory frameworks and market designs to facilitate solutions like storage and demand response will be essential.

Significant variations in electricity prices for energy-intensive industries continue across regions. Following steady declines in 2023 and 2024 from their 2022 peak, electricity prices for energy-intensive industries in the European Union are forecast to increase in 2025 after a rise in wholesale prices. Average electricity prices for these industries in the European Union remain roughly twice the levels in the United States and 50% above those in China. In contrast, back in 2019, EU prices were only around 50% higher than in the United States and 20% higher than in China. Higher electricity costs are expected to continue to put competitive pressure on EU energy-intensive industries.

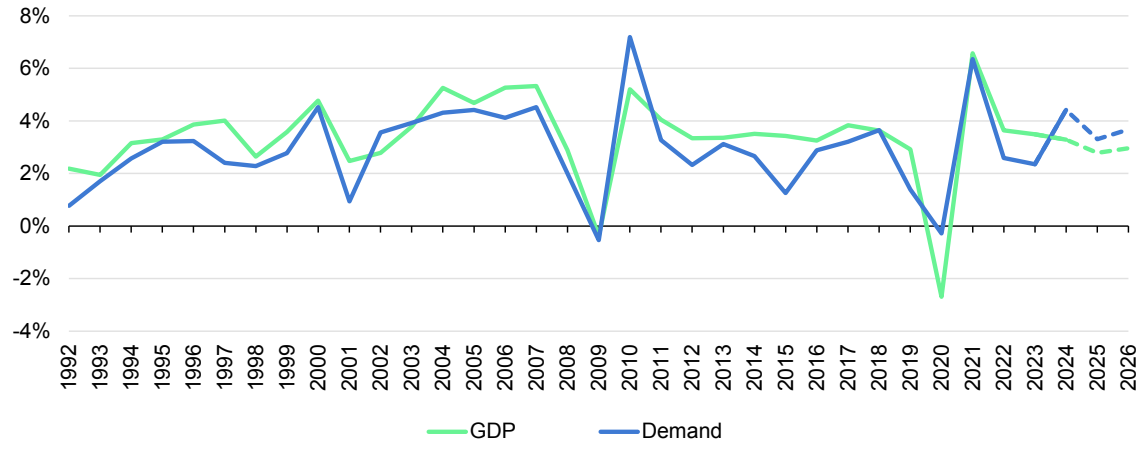
The need for secure and resilient power systems is more important than ever

Recent blackouts around the world highlight the critical importance of electricity security for modern economies and societies. On 25 February 2025, a transmission system failure in Chile left 99% of the country's 20 million residents without power for 17 hours. Just weeks later, on 28 April, a complex series of events triggered a blackout in Spain and Portugal that lasted over 10 hours, affecting tens of millions of people and businesses. As power systems expand and become more complex with electrification spreading into different parts of the economy, ensuring a secure and reliable electricity supply has never been more vital. Robust grid infrastructure and secure supply chains, combined with diverse flexibility resources and technical stability solutions, are key pillars of electricity security. As power systems evolve, it will be essential for stakeholders to adapt operational frameworks by updating grid codes, reserve requirements and regulatory structures.

Demand: Global electricity use to grow strongly in 2025 and 2026

Global electricity demand is forecast to increase by an average annual 3.3% in 2025 and by 3.7% in 2026, a moderation from 4.4% in 2024 but still some of the highest growth rates observed over the last decade. This is a slight downward revision from our previous forecast in February 2025 of 4% growth for this year and 3.8% in 2026. The change is partly due to the IMF's downgrade of the global GDP growth outlook compared with its January 2025 update amid elevated uncertainty surrounding trade tariffs and economic prospects. Despite these downside risks, strong demand increases from industries, air conditioning (AC) and data centres, as well as significant strides in electrification, are expected to support growth in electricity use through 2026. Electricity demand is set to rise more than twice as fast as total energy demand over the forecast period. Overall, global electricity consumption will reach a new high of over 29 000 terawatt-hours (TWh) in 2026.

Year-on-year percent change in global electricity demand, 1992-2026

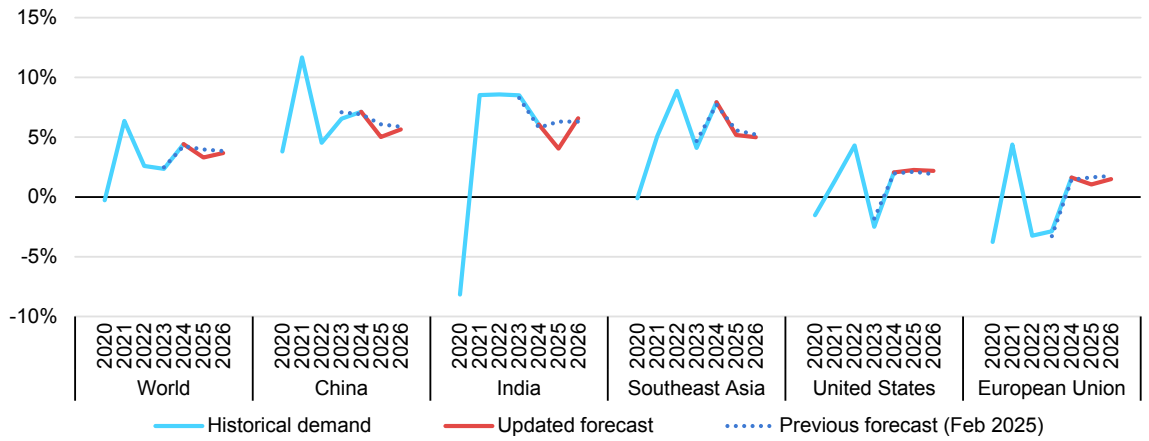


Note: Data for 2025-2026 are forecast values.

Following strong surges in electricity demand in 2024 driven by intense heatwaves and strong economic activity in the industrial and services sectors, the People's Republic of China (hereafter, "China") and India are expected to see more moderate growth rates in 2025. By contrast, US electricity demand is set to increase at a faster rate than in 2024, boosted by power consumption from

expanding data centres. After a modest rebound in 2024 following two consecutive years of significant decline, demand in the European Union is forecast to continue rising, albeit at a moderate pace as the industrial sector has still yet to recover.

Year-on-year percent change in electricity demand in selected regions, 2020-2026

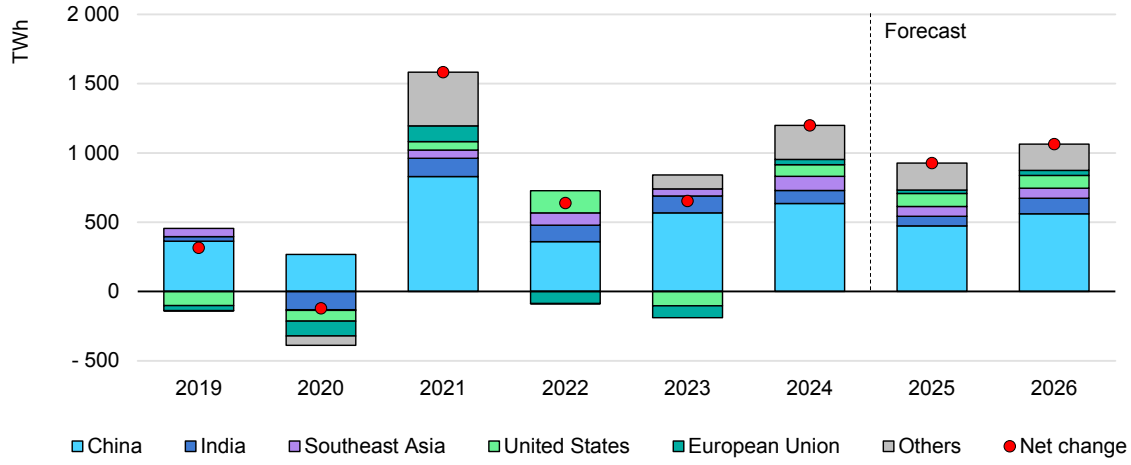


Note: Data for 2025-2026 are forecast values.

Demand growth moderates in China, India and the EU while the US powers ahead

After rising by 7% y-o-y in 2024, we expect electricity consumption in **China** to increase by a more moderate 5% y-o-y in 2025, following subdued growth of 3.7% y-o-y in the first half of 2025. Economic headwinds and the impact of tariffs on Chinese exports saw demand growth in the industry sector slow to an average 2.4% in the first six months of the year, partially offsetting continued strong gains from electrification. China's services sector has seen significant growth in recent years, with expanding AC use, EV charging, data centres and 5G networks driving gains of 7.1% y-o-y in H1 2025. In addition, electricity use in the manufacturing of new energy products continued to rise at a fast pace, as factory output of new energy vehicles and solar cells was up by 36% and 18% y-o-y, respectively, in H1 2025, while production of batteries rose by 51%. Electricity consumption in the residential sector increased by 4.9% in H1 2025, underpinned by greater penetration of appliances, which saw retail sales rise 31%, and a sharp increase in cooling degree days in June.

Year-on-year change in electricity demand in selected regions, 2019-2026



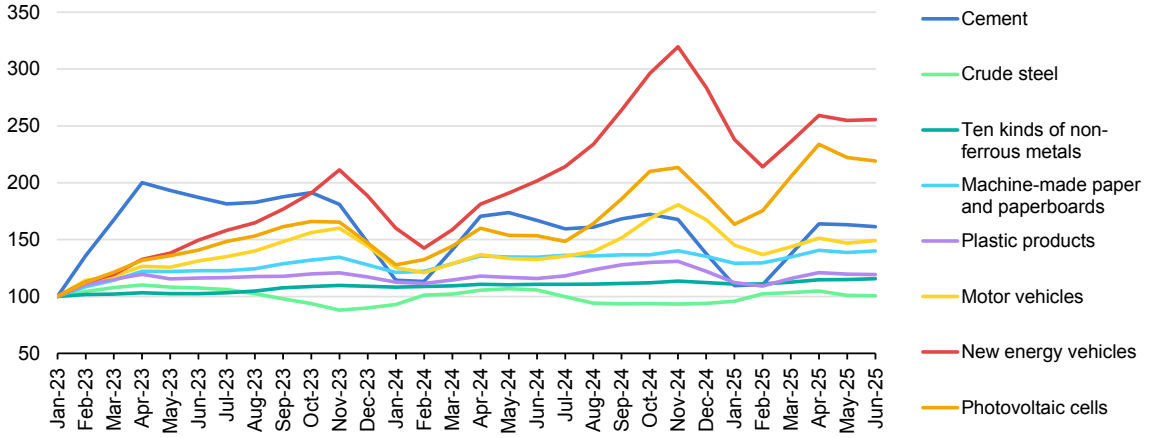
Note: Data for 2025 and 2026 are forecast values.

The rapid rise in electric vehicle sales combined with the robust expansion of charging infrastructure continued to further support Chinese electricity demand growth in the first half of the year. China, where the share of electricity demand from EVs reached a milestone of 1% in 2024, added more than 5 million new electric vehicles to its domestic fleet in H1 2025, up 32% y-o-y, while consumption from public EV charging infrastructure was 50% higher than in H1 2024.

Heat pumps are also set to be a key driver of China's electrification in the industry and buildings sectors. Driven by growing demand for space, water and industrial heating, China plans to further accelerate deployment of heat pumps with new policy initiatives. The Action Plan for Promoting High-Quality Development of the Heat Pump Industry was issued in April, which defines new objectives to promote heat pumps both in terms of upgrading the domestic industry and of applications on the demand side, including the replacement of coal and gas boilers.

China's electricity demand growth is expected to accelerate in the second half of the year, mainly due to a recovery in industry and a lower base effect in H2 2024 as the gains were more muted compared to H1 2024. The 5% increase forecast for the full year 2025 is revised lower from projections in the Electricity 2025 report amid rising economic uncertainties. We expect demand to accelerate in 2026, reaching 5.7%. In terms of peak load, following the record high in 2024, the National Energy Administration (NEA) and the China Electricity Council (CEC) expect 7% growth this summer, potentially reaching 1 570 GW in the event of severe heatwaves. Latest data shows that peak load hit new record-highs three times by mid-July 2025, reaching 1 506 GW, as summer temperatures in most parts of the country were above the same period last year.

Production indices of selected products in China, 2023-2025



Note: Values for January and February have been estimated based on the 2-month aggregate provided by the National Bureau of Statistics of China.
Source: IEA analysis based on data from the National Bureau of Statistics of China.

In **India**, the impact of global economic uncertainties on industrial activity and cooler summer temperatures compared to 2024 led to electricity demand increasing by 1.4% y-o-y in H1 2025. Demand is forecast to rise at a higher rate for the remainder of the year, reaching an annual growth rate of 4%. We expect demand to grow at a robust 6.6% in 2026, driven by stronger activity in industry and services, and increasing AC stock.

According to estimates from the Ministry of Power for 2025, peak load could reach 270 GW (+8% y-o-y) and shift to September instead of summer this year, although this should be fully met by rising generation capacity. To manage peak load growth, the Indian government is implementing AC standards which would cap temperature settings between 20ºC and 28ºC, potentially reducing peak load by up to 60 GW in 2035.

In the **United States**, electricity demand increased by 2.1% in 2024, supported by economic growth, the expansion of data centres and electrification. The same underlying factors continued to shape demand dynamics in early 2025, which rose by around 2.7% in the first half of the year. Demand is projected to maintain strong growth over the outlook period, rising by an average annual rate of 2.3% in 2025 and 2.2% in 2026. This marks a slight upward revision from our previous forecast of 2.1% in 2025 and 1.9% in 2026.

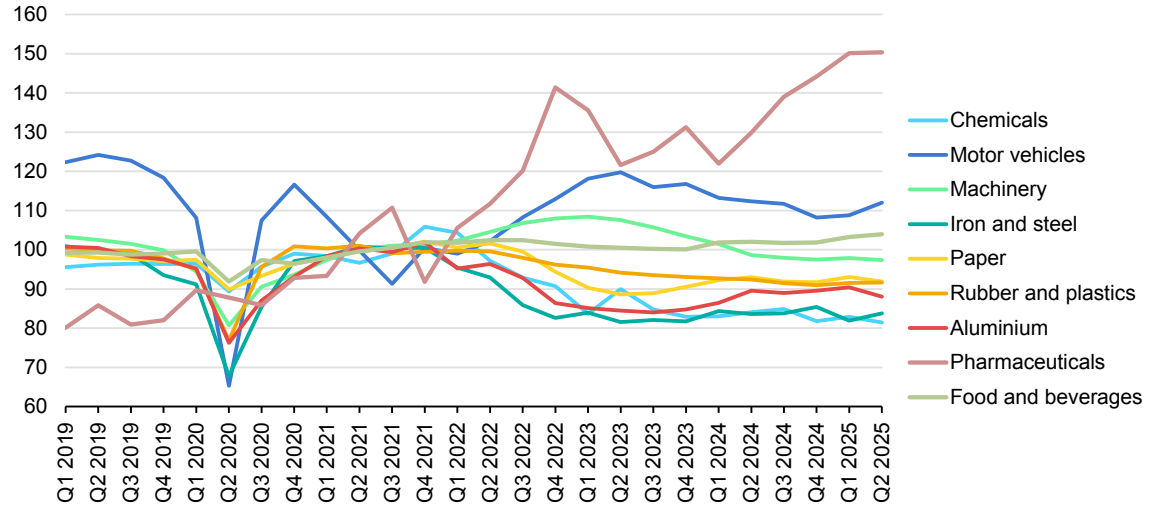
A major driver of this demand growth in the United States is the expansion of data centres, which consumed around 180 TWh of electricity in 2024, according to the IEA's Energy and AI report. Investment in artificial intelligence and data centres continues to accelerate, with companies such as Meta, Amazon, Alphabet and Microsoft committing to spend USD 320 billion in 2025, up from USD 230 billion

the previous year. Data centre electricity demand is expected to steadily rise through 2030, with consumption projected to increase by approximately 240 TWh relative to 2024 levels.

Another catalyst behind electricity demand growth is the emergence of new large industrial loads in high technology manufacturing sectors such as semiconductor fabrication and battery production. According to the United States Census Bureau, total construction spending in manufacturing has risen sharply in recent years, with spending in Q1 2025 more than double that of Q1 2022. Once operational, these new and upgraded facilities are expected to significantly increase electricity demand in the manufacturing sector. Electrification of the transport and heating sectors is also supporting growth in electricity demand. Electric cars sold in the United States grew 10% y-o-y in Q1 2025. Following growth in air-source heat pumps of 14% y-o-y in 2024, sales rose further, albeit at a more moderate pace of 9.5% in the first five months of 2025.

The **European Union**'s electricity demand rose by less than 1% in the first half of 2025, following an increase of 1.6% in 2024. We expect electricity consumption growth of 1.1% y-o-y for full-year 2025, before accelerating to 1.5% in 2026. This represents a downward revision from our previous forecast of 1.6% and 1.7%, respectively. A contributing factor to this revision is the GDP forecast for the European Union, which was revised downwards by the IMF compared to their January 2025 update.

Production indices of selected industries in the European Union, 2019-H1 2025



Notes: The data is seasonally and calendar adjusted, with data presented as an index with 2021=100. Data for Q2 2025 includes data from April to May.

Source: IEA analysis based on data from Eurostat.

Overall industrial electricity demand in the European Union is estimated to have stayed relatively flat in the first half of 2025, similar to its trend in 2024. Manufacturing activity in the euro zone has shown signs of stabilisation, as indicated by the Manufacturing Purchasing Managers' Index (PMI), a composite indicator based on new orders, output, employment, delivery times and stocks of purchases. The index signals expansion if above 50 and contraction if below. In June, the PMI rose to 49.5, its highest level since August 2022, though it remained below the expansion threshold for the thirty-fourth consecutive month. In July, the Flash[1] Manufacturing PMI rose to 49.8, reflecting further improvement.

At the sector level, primary metal production showed a mixed performance in the first half of 2025. Aluminium production saw some recovery in output, while crude steel fell by 3.3% y-o-y in H1 2025. Production of motor vehicles was 2% lower year-on-year in the first half of 2025. By contrast, pharmaceutical production posted particularly robust growth. It should be noted that EU industrial electricity demand had consecutively contracted by about 6% both in 2022 and 2023, and a return to 2021 levels is not anticipated within our outlook period.

[1] The flash estimate is based on 85-90% of total PMI survey responses and provides an early indication of the manufacturing sector ahead of the final release.

Supply: Renewables grow the most, followed by gas and nuclear

As highlighted in our annual Electricity 2025 report, low-emissions energy sources are reaching new milestones globally in our forecast period. Renewables are poised to surpass coal-fired generation, depending on weather trends and economic developments, either as early as 2025 or in 2026. As a result, coal's share in total generation is set to drop below 33% for the first time in the last 100 years.

Solar PV and wind energy are key drivers of this trend, with their combined share in global electricity generation expected to rise from 15% in 2024 to 17% in 2025 and to above 19% in 2026 – up from 4% a decade earlier. Wind and solar PV generation together are projected to provide almost an additional 1 000 TWh in 2026, roughly equivalent to the annual electricity consumption of Japan.

Global hydropower generation, the largest source of renewable electricity supply globally with a 14% share, is forecast to remain relatively flat in 2025 amid droughts in the first half in various regions, after a significant recovery in 2024 following the strong reductions due to droughts the year before. We project a rebound of more than 2% in 2026, assuming normal hydrological conditions.

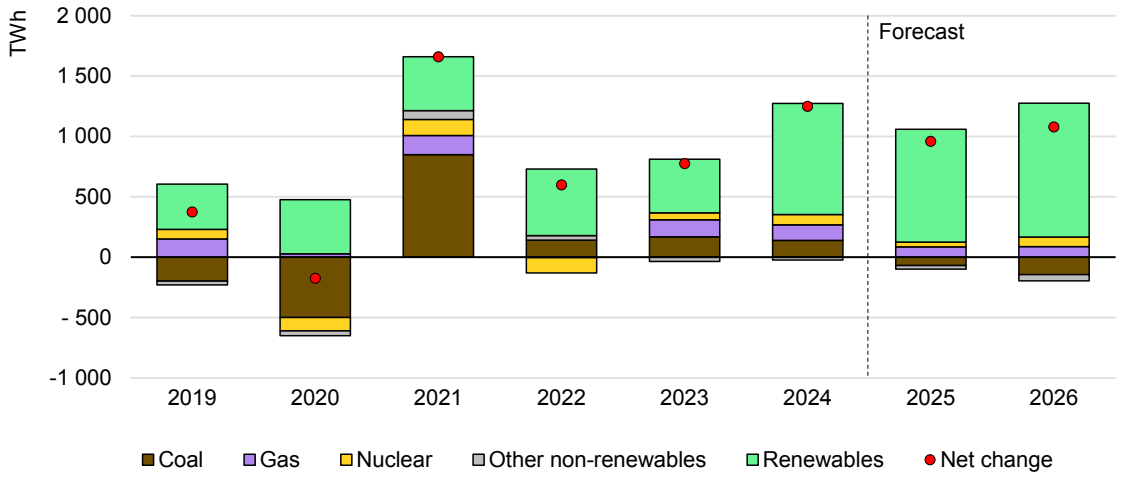
Nuclear power generation is set to hit a new record in 2025, and will continue to rise in 2026. This is fuelled by restarts in Japan, commissioning of new reactors in China, India, Korea and other countries, along with robust output in the United States and France. We forecast global nuclear generation to grow on average close to 2% over the period 2025-2026.

Global gas-fired generation is expected to increase by 1.3% in 2025 and reach a new high, following growth of 1.9% in 2024. The gains in 2025 are driven by continued oil-to-gas switch in the Middle East and sustained growth in gas-fired generation in Asia. While higher gas prices supported an increased gas-to-coal switch in the United States in 2025, constrained wind generation in Europe amid low wind speeds boosted gas-fired generation. In 2026, we forecast global gas-fired generation to rise by 1.3%, similar to its rate in 2025.

By contrast, following growth of 1.3% in 2024, global coal-fired generation is forecast to decline very slightly by around 0.5% in 2025. Declines in China and Europe are partly offset by increases in other regions, most notably, in the United States, India and other Asian countries. Following this modest contraction, we expect global

coal-fired output to decline by around 1.3% in 2026 due to continued growth of low-emissions generation and higher coal-to-gas switching in various regions.

Year-on-year global change in electricity generation by source, 2019-2026



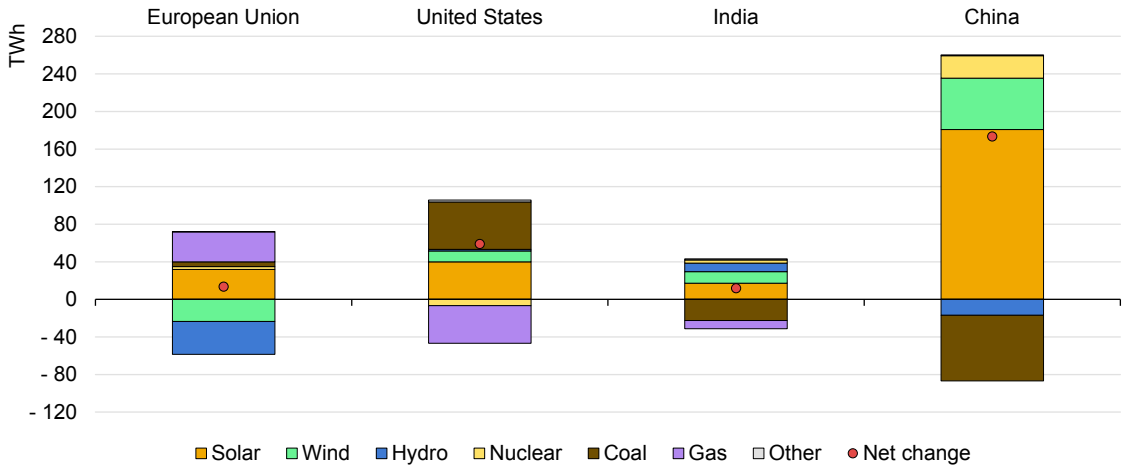
Notes: Other non-renewables includes oil, waste and other non-renewable energy sources. Data for 2025 and 2026 are forecast values.

Coal-fired generation fell in China and India in H1 2025, but rose in the US and EU

In **China**, record-high growth in generation from low-emission sources and a moderate increase in demand led to coal-fired power falling by an estimated 2.6% y-o-y in H1 2025, reversing trends of the previous two years. Drought conditions in Sichuan and Yunnan provinces, where most of China's hydro capacity is located, led hydropower output to drop by 2.9% y-o-y in H1 2025, with a particularly sharp 14% y-o-y decline in May. For the first time in the past decade – excluding 2020 – both coal and hydropower generation decreased in the first half of the year.

The record-level capacity additions in 2024 and continuous expansion from January to June this year, led to growth in solar PV generation of around 45%. The additional PV generation in China fully covered the moderate growth in H1 2025 demand. China's installed capacity of solar PV surpassed 1 TW of alternating current (AC) power capacity in May 2025, with over 92 GW additions only that month, and the aggregate of wind and solar PV capacity now exceeds thermal capacity in the country. The strong growth in solar PV installations in H1 2025 was primarily due to policy deadlines. Wind power generation increased by 11% in H1 2025, while nuclear energy also grew by 11%. The share of low-emission sources in the mix exceeded 40% for the period, significantly above the 35% average during H1 in the last five years.

Year-on-year change in electricity generation by source in selected regions, H1 2025



Hydropower generation in China is forecast to increase by 1% for the full year 2025, supported by heavy rains in June that helped refill reservoirs in the southwest. Solar PV and wind generation are also expected to rise significantly during this period, with projected growth of 45% and 17%, respectively. These developments are expected to reduce reliance on coal, with coal-fired generation forecast to decline again in H2 2025 year-on-year, resulting in an annual decrease of 1.9%. Nuclear generation is expected to increase by 2.2% in 2025.

Looking ahead to 2026, the upward trend in renewables is set to continue. Solar PV and wind generation are forecast to grow by 27% and 19%, respectively. Coal-fired generation is expected to remain broadly stable, while nuclear generation is projected to grow by 3%. Gas-fired generation in China will remain robust and is forecast to rise by an average 3.6% over the period 2025-2026.

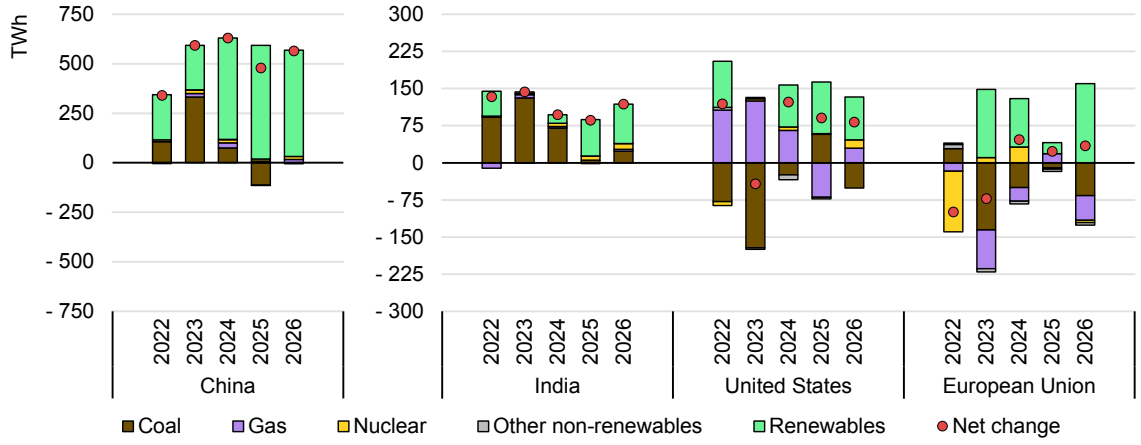
In **India**, the combined output from solar PV and wind was 20% higher in H1 2025 y-o-y, which reached an almost 14% share in the mix, up from 11% in H1 2024. Solar PV generation grew by 25% and wind by slightly less than 30%. A significant improvement in hydro conditions since mid-2024 resulted in hydropower generation increasing 16% y-o-y between January and June. Additional capacity, including the 700 MW Unit 7 at the Rajasthan nuclear power station that connected with the Northern grid in March, contributed to the 14% rise in nuclear generation for the same period. A twin unit, RAPP-8, is expected to start operations in FY 2025/26 as part of plans to reach a nuclear capacity of 100 GW by 2047 announced under the Nuclear Energy Mission by the Government of India.

Multiple extensions by the Ministry of Power of the directive mandated imported coal-based power plants to operate at full capacity. Amid strong rise in output of low-emissions sources and more moderate demand growth, coal-fired generation

decreased by 3% in the first six months of the year – the first decline in the first half of the year since 2020. Gas-fired generation dropped by around 30% in H1 2025, falling back to 2023 levels.

We expect coal-fired generation to rise again in H2 2025, reaching around 0.5% growth for full year, followed by a 1.6% increase in 2026. Gas-fired generation is forecast to decline by 3% in 2025 before rebounding by 7% in 2026. The above-mentioned capacity additions for nuclear power are expected to drive generation from this source higher, up by 15% this year and 19% in 2026. Output from renewable energy sources is set to continue growing in H2 2025, with solar PV rising by 40% y-o-y in 2025 and 28% in 2026, while wind is projected to post more moderate growth of around 10% both in 2025 and 2026. Hydropower output is forecast to continue rising as well in H2 2025, resulting in an increase of 7% y-o-y this year before reaching a growth of 10% in 2026.

Year-on-year change in electricity generation by source in selected regions, 2022-2026



Notes: Other non-renewables includes oil, waste and other non-renewable energy sources. Data for 2025 and 2026 are forecast values.

In the first half of 2025, gas-fired generation in the **United States** declined by more than 4% y-o-y, whereas coal-fired generation rose sharply by more than 15%. This shift was primarily driven by higher natural gas prices compared to 2024. Nuclear output was moderately weaker, recording around 1.5% y-o-y decline. Renewable generation grew by approximately 11% in H1 2025, supported by an around 30% increase in solar PV output and a 5% increase in wind generation. Hydropower output was up slightly by 1.3% y-o-y as hydrological conditions improved.

For full-year 2025, gas-fired generation is forecast to decline by 3.6% before rebounding to 1.6% growth in 2026, with its share in the power mix remaining above 40%. Coal-fired generation is projected to rise by 8% in 2025 and then decline by about 6.5% in 2026. Nuclear generation is anticipated to remain broadly

stable in 2025, followed by a growth of 2% in 2026. Renewables are projected to continue expanding at around 10% in 2025 and 7.5% in 2026. Solar PV is expected to lead this expansion, with growth of 26% in 2025 and 18% in 2026, making it the largest contributor to new power generation. Wind generation is forecast to increase by around 5% in 2025 and 2% in 2026.

In the first half of 2025, gas-fired generation in the **European Union** is estimated to have increased by almost 20% y-o-y. Coal-fired generation also rose by around 3% in H1 2025, in contrast to the declines observed during the same period in both 2023 and 2024. The rise in fossil-fired generation was driven by weak renewables output, which necessitated a greater reliance on dispatchable thermal output. Hydropower generation declined by a sharp 15% y-o-y during H1 2025 due to a lack of rainfall and above-average temperatures across much of the region. Wind power output also fell by almost 10% due to poor wind speeds. By contrast, solar PV generation continued to expand, increasing by more than 20% compared with the same period in 2024. Nuclear output rose by just over 1%, supported by improved plant availability, particularly in France, which accounts for over half of the nuclear power generation in the European Union.

In the forecast period, coal-fired generation is projected to decline by around 3% in 2025, as a rise in the first half of the year is expected to be more than offset by a decline in the second half, driven by an assumed recovery in renewable generation. This is expected to be followed by a more pronounced contraction of more than 20% in 2026 under normal weather assumptions, and as a result, the share of coal-fired generation is set to fall below 10% for the first time. Gas-fired generation, on the other hand, is expected to rise by around 4% in 2025, before decreasing by around 10% in 2026.

Renewable power generation is forecast to rise by a muted 2% in 2025 amid lower wind and hydro output in H1, then by a further 12% in 2026 under normal weather conditions. Solar PV is expected to lead the growth, with output increasing by around 22% in 2025 and 16% in 2026. Wind generation is expected to record a decline of around 3% in 2025 for the full year amid lower wind speeds in H1, before rising sharply by 17% in 2026. Together, wind and solar PV are projected to surpass fossil-fired power generation in 2025, assuming normal weather conditions in the second half of the year. As a result, the share of low-emissions sources in the power mix is projected to exceed 75% in 2026, up from 71% in 2024.

In a complex sequence of events, on 28 April Spain and Portugal experienced a blackout, which affected tens of millions of people and businesses across these countries. According to the European Network of Transmission System Operators for Electricity (ENTSO-E), the system parameters of the Spanish and Portuguese electricity systems collapsed at 12:33:24 CEST. Restoration of the transmission

grid was completed on 29 April at just after midnight in Portugal and then around four hours later in Spain. A small area in France close to the Spanish border was also affected for a limited duration. Official assessments conducted by national authorities as well as the expert panel convened by the ENTSO-E, with participation from regulators, including the EU Agency for Cooperation of Energy Regulators (ACER), will be vital in providing data-driven insights to fully understand the event. The blackout underscores the critical importance of electricity security, as emphasised in a recent IEA commentary.

Emissions: Power generation CO_2 emissions are plateauing

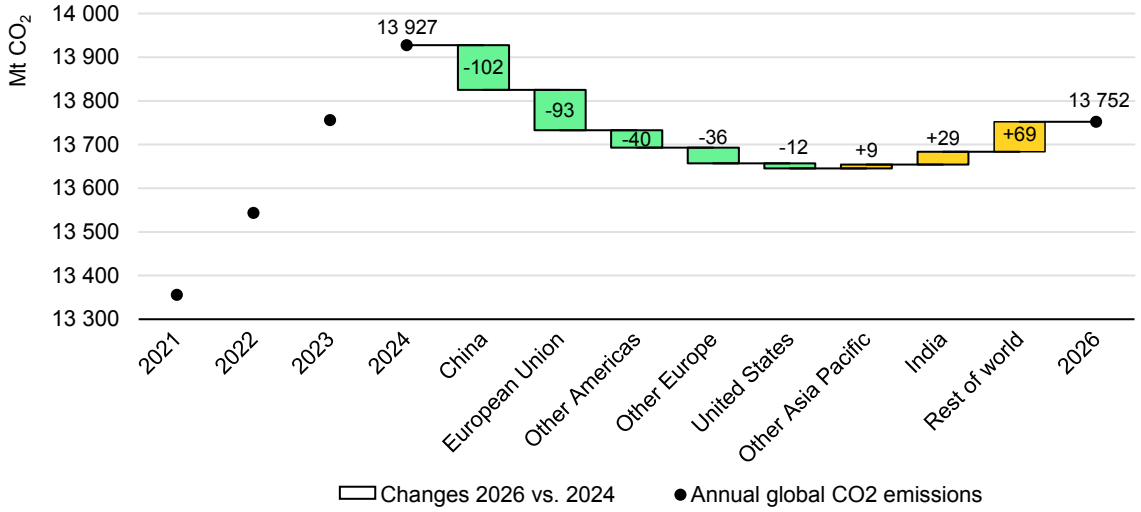
Global emissions from electricity generation rose by 1.2% in 2024, following an increase of 1.6% in 2023. Last year was even hotter than in 2023 – making it the warmest year on record – with the heat waves boosting electricity demand for cooling. Nonetheless, growth in power sector emissions showed signs of slowing down as rapid deployment of renewables constrained increases in fossil-fired generation. As this trend continues, we expect 2025 emissions to plateau and remain relatively unchanged. In 2026, we forecast a slight decline of less than 1%, as the increase in low-emissions generation depresses fossil-fired output. Deviations from normal weather conditions, such as intense heat waves, cold spells or below-average hydropower output, can lead to an increase in emissions in individual years. Moreover, developments in China, where more than half of the world's coal-fired generation takes place, can significantly influence global trends.

Declines in China, Europe and the Americas offset rising emissions in other regions

Multiple regions in the world are expected to record falling emissions from electricity generation out to 2026. The largest decrease in terms of absolute emissions is expected in China. This corresponds to a modest average annual decline rate of less than 1% for China in 2025-2026. This is highly sensitive to fluctuations in electricity demand, which can result from deviations from the latest economic projections as well as variations in weather conditions in individual years. Nevertheless, the rapid growth of renewable energy in China, accompanied by rising nuclear generation, will limit fossil-fired power generation and continue to support the trend towards flattening emissions from electricity generation.

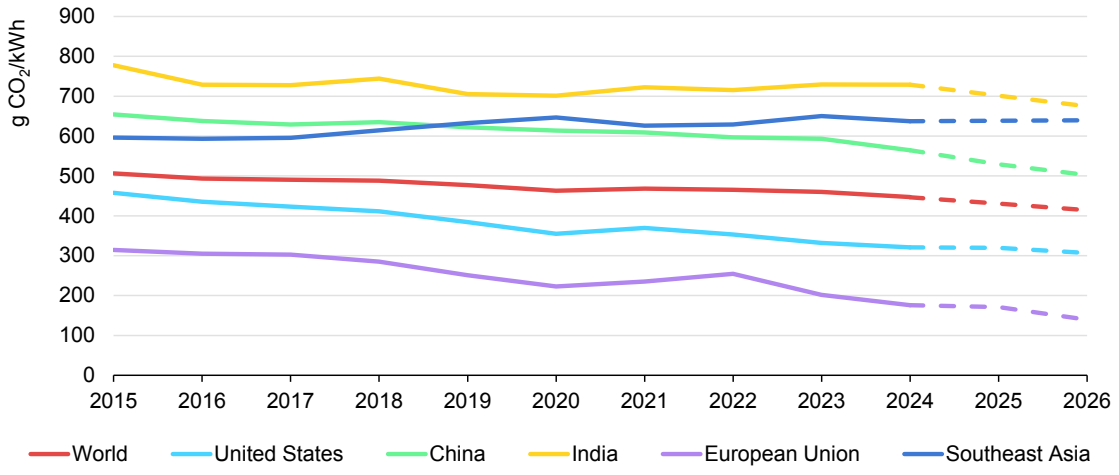
The European Union follows China with substantial declines in emissions from power generation over the 2025-2026 period. US power sector emissions are expected to decline only slightly over the same period. By contrast, emissions in India and Southeast Asia will continue to rise as coal-fired generation grows at a significant pace.

Forecast changes in global CO_2 emissions from electricity generation, 2026 vs. 2024



As the share of low-emissions sources increases, the carbon intensity of global electricity generation is forecast to decline at an average annual rate of 3.7%, falling from 445 g CO_2/kWh in 2024 to 415 g CO_2/kWh by 2026. The European Union is expected to lead this trend, with the steepest average annual reduction of around 10%, dropping from 175 g CO_2/kWh to 140 g CO_2/kWh over the same period. China is also forecast to see a significant decline of more than 5% per year, from 565 g CO_2/kWh in 2024 to 505 g CO_2/kWh in 2026. India's emissions intensity is expected to fall by 3.8% annually, while the United States is projected to see a 2.2% average annual reduction over the same period.

CO_2 intensity of electricity generation in selected regions, 2015-2026



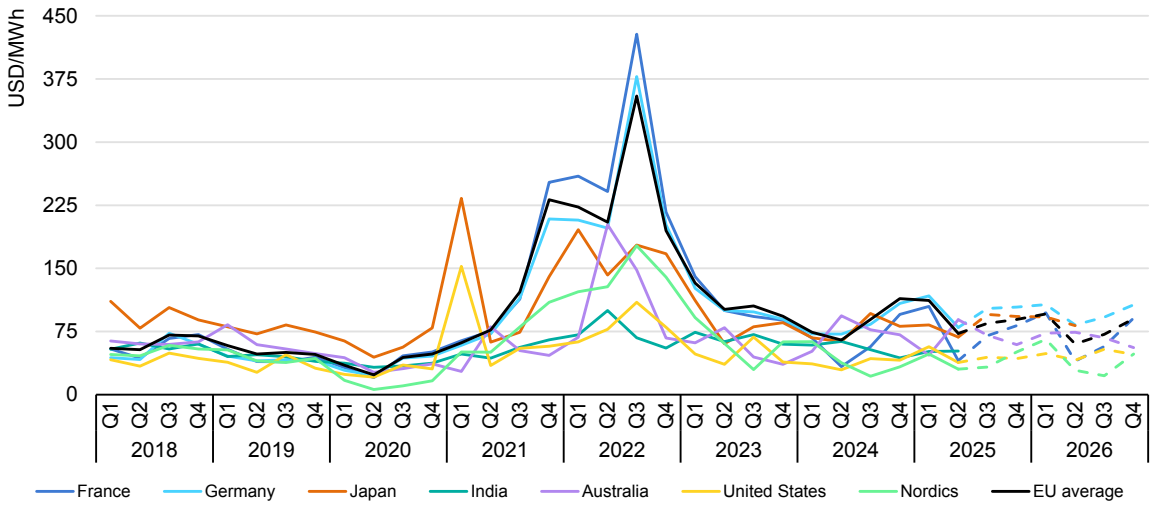
Note: The CO_2 intensity is calculated as total CO_2 emissions divided by total generation.

Prices: Trends in wholesale markets differ across regions

Average wholesale electricity prices in the first half of 2025 rose year-on-year in various regions, including Europe, the United States and Japan, amid higher gas prices. By contrast, countries such as India and Australia saw lower wholesale prices compared to the previous year in the face of varying demand and generation trends, among other factors. At the same time, a number of markets continued to observe an increase in the occurrence of negative electricity prices. A detailed discussion of negative electricity prices and their drivers can be found in our Electricity 2025 report.

Higher gas prices put upwards pressure on European and US electricity prices

Quarterly average wholesale electricity prices for selected regions, 2018-2026



Notes: Prices for Australia and the United States are calculated as the demand-weighted average of the available prices of their regional markets. Continuous lines show historical data and dashed lines refer to forward prices.

Sources: IEA analysis based on data from RTE (France) – accessed via the ENTSO-E Transparency Platform; Bundesnetzagentur (2025), SMARD.de; Australian Energy Market Operator (AEMO), 2025, Aggregated price and demand data; EIA (2025), Short-Term Energy Outlook, July 2025; IEX (2025), Day-Ahead Market; EEX (2025), Power Futures; ASX (2025), Electricity Futures © ASX Limited ABN 98 008 624 691 (ASX) 2020. All rights reserved. This material is reproduced with the permission of ASX. This material should not be reproduced, stored in a retrieval system or transmitted in any form whether in whole or in part without the prior written permission of ASX. Latest update: 15 July 2025.

In the **European Union**, wholesale electricity prices averaged around USD 90/MWh in the first half of 2025, about 30% higher compared to the same period in 2024. During H1 2025, natural gas prices were on average about 20% above the levels observed through 2024. The cost of carbon allowances under the European Union Emissions Trading System (EU-ETS) increased from an average of about EUR 65 per tonne of CO_2 (t CO_2) in H1 2024 to around EUR 70/t CO_2 in H1 2025. At the same time, lower year-on-year electricity generation from wind and hydropower during this period boosted fossil-fired generation, which further contributed to higher power prices. Latest futures prices in the European Union average USD 80/MWh for 2026, indicating a decline of around 15% compared to 2025.

Negative prices are becoming more common in many markets across Europe. The share of hours with negative prices on the wholesale market reached 8-9% in the first half of the year in countries such as Germany, Netherlands and Spain – up from 4-5% in 2024.

Germany saw an increase in wholesale electricity prices in H1 2025 (+37%), with average prices slightly below USD 100/MWh. In addition to the higher gas prices compared to 2024, the significant reduction in wind power generation due to less favourable weather conditions also contributed to the price rise. To meet demand, Germany had to rely more on gas- and coal-fired power generation, which put upward pressure on power prices. German futures contracts for 2026 indicate a similar price level to 2025. The premium over French prices remains, reaching an average USD 30-40/MWh during the summer period.

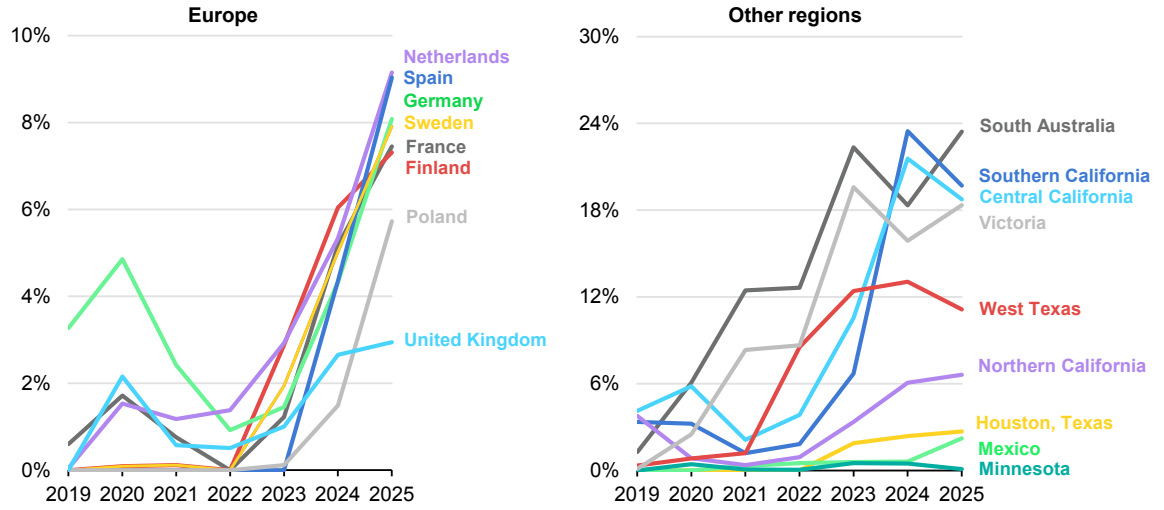
In **France**, average wholesale electricity prices rose around 45% y-o-y in H1 2025 to USD 73/MWh. A colder winter contrasted with comparatively mild conditions in 2024, which led to higher heating use, raising electricity demand. While hydropower declined in the first six months of 2025 following a strong performance in H1 2024, nuclear output continued to grow, helping to moderate price rises. French futures for 2026 indicate stable price levels similar to those in 2025.

In the **United Kingdom**, wholesale electricity prices rose by 40% y-o-y in H1 2025, averaging just under USD 115/MWh. The UK's electricity system, where gas-fired power generation makes up around 30% of total generation, was particularly affected by colder weather and reduced wind output in early 2025. This led to an increase in the use of gas-fired plants to meet demand, contributing to the rise in wholesale prices. UK futures prices for 2026 indicate about 10% lower prices on average compared to 2025.

Electricity prices in the **Nordics** remained the lowest in Europe, falling by more than 20% y-o-y in H1 2025 to an average of about USD 40/MWh. This decline was primarily due to an increase in wind power generation in the region and higher hydropower output, which together boosted electricity supply.

A slight fall in demand also contributed to lower wholesale prices. Futures prices indicate a stable outlook for 2026, with average prices remaining close to current levels.

Fraction of negative hourly wholesale electricity prices in selected regions in the first six months of the year, 2019-2025



Notes: Southern California corresponds to area SP15 in the state's zonal regions, Central California to area ZP26 and Northern California to area NP15. In Spain, negative electricity prices on the day-ahead market were permitted in December 2023 following the implementation of updated rules on the operation of electricity markets. In Italy, negative prices were previously not allowed, but this changed in January 2025 with the implementation of the Testo Integrato del Dispacciamento Elettrico (TIDE) reform. For South Australia and Victoria, five-minute interval prices were converted to hourly averages to enable comparison.

Source: IEA (2025), Real-Time Electricity Tracker (data explorer).

In the **United States**, wholesale electricity prices rose by around 40% y-o-y in H1 2025, averaging around USD 48/MWh. However, this increase was from a low base, as prices in H1 2024 were the lowest for a first half of the year since 2020. Rising natural gas prices exerted upward pressure on US wholesale electricity prices, where gas-fired output makes about 40% of total electricity generation. Colder winter conditions and instances of extreme weather in several regions also contributed to higher prices by raising heating-related electricity usage. The Energy Information Administration's (EIA) Short-Term Energy Outlook price projections for 2026 indicate similar price levels to 2025.

In **Japan,** wholesale electricity prices were up by about 15% y-o-y in H1 2025, averaging USD 76/MWh. The rise in LNG prices increased generation costs, applying upward pressure on wholesale prices. Warmer than average temperatures in the spring and early summer heatwaves, combined with a cold winter, also contributed to higher electricity prices. Futures prices indicate a rise in wholesale electricity prices in 2026, to an average of USD 87/MWh.

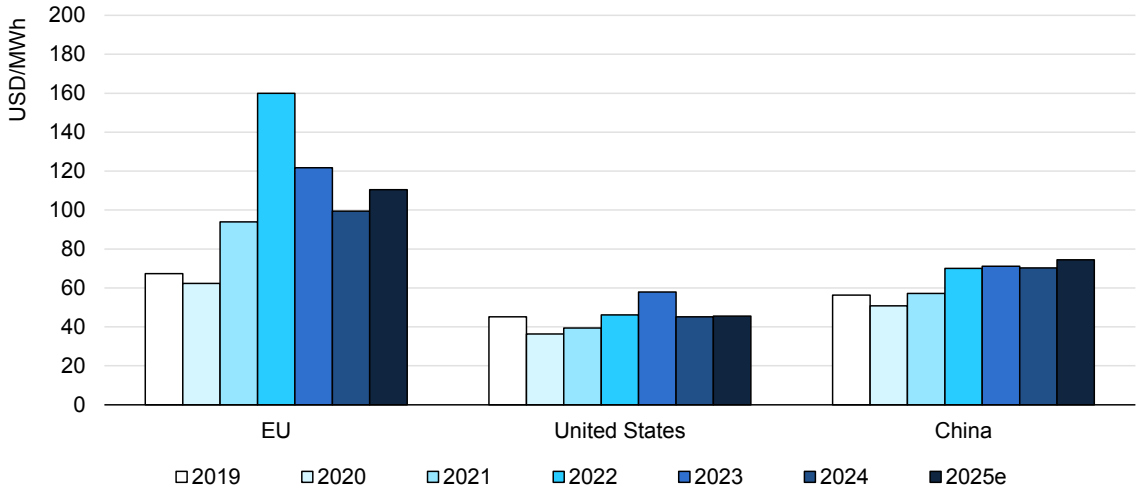
In the first half of 2025, **Australian** average wholesale electricity prices fell by 6% y-o-y to USD 68/MWh. This is despite periods of extreme weather, including

heatwaves in the southeast of the country. Two key factors that contributed to lower prices were a decline in the number of high-priced hours and an increase in variable renewable energy (VRE) generation. In Q1 2025, the number of 30-minute intervals in which the wholesale electricity price exceeded AUD 5 000/MWh fell to 11, down from 26 in Q1 2024. Grid-scale solar and wind set prices in 15% of intervals in Q1 2025, up from 10% of intervals in Q1 2024, contributing to a lower average wholesale electricity price. Battery output also rose, by 86%, as new storage capacity came online, helping to mitigate against high-priced events by displacing more expensive gas and coal generation during peak demand. Futures prices for 2026 are similar to the price levels observed in H1 2025.

In **India**, electricity prices fell by about 15% y-o-y in the first half of 2025, averaging USD 51/MWh. Despite this decline, prices remain above pre-2022 levels. A drop in seaborne thermal coal prices to a four-year low eased input costs for coal-fired generation. On the supply-side, increased availability from thermal and renewable capacity additions strengthened market liquidity and exerted downward pressure on prices. Robust output from low-emissions sources in May, combined with unseasonal rains that increased hydropower output, contributed to near-zero prices during several time periods on 25 May.

Electricity prices for energy-intensive industries continued to vary significantly across regions. After declining since their 2022 peak, they are expected to rise year-on-year in 2025 in the European Union, driven by higher wholesale price levels. The average EU price this year is expected to be roughly twice that in the United States and about 50% higher than in China. By comparison, in 2019, prices in the European Union were approximately 50% higher than in the United States and 20% higher than in China.

Estimated final electricity price for large industrial customers in energy-intensive industries, 2019-2025



Notes: Values for 2025 are preliminary. This analysis considers electricity prices of industries with greater than 150 GWh of annual electricity consumption for European countries, based on Eurostat data. Electricity price compensation included for countries that participate in EU-ETS. For the calculation of the maximum possible state aid for electricity price compensation in the European Union, the analysis assumes that the specific product has an electricity consumption benchmark of 0.8 and that the company in question receives the maximum possible state aid once this benchmark is incorporated into the maximum aid calculation. The final electricity price for the United States is based off the final electricity for industry in Texas. The final electricity price for China is based off the final electricity for industry in Inner Mongolia. The prices for the United States and China are indicative of the average reported prices, individual industries depending on their energy consumption levels and where they are located can face different prices.

General annex

Summary tables

Regional breakdown of net electricity demand, 2023-2026

TWh	2023	2024	2025	2026	Growth rate 2023-2024	Growth rate 2024-2025	Growth rate 2025-2026
Africa	732	759	800	838	3.7%	5.4%	4.7%
Americas	6 090	6 227	6 363	6 496	2.2%	2.2%	2.1%
of which United States	4 029	4 112	4 204	4 296	2.1%	2.3%	2.2%
Asia Pacific	13 554	14 396	15 013	15 764	6.2%	4.3%	5.0%
of which China	8 573	9 183	9 644	10 189	7.1%	5.0%	5.7%
Eurasia	1 228	1 268	1 295	1 315	3.3%	2.1%	1.5%
Europe	3 395	3 465	3 508	3 563	2.1%	1.2%	1.6%
of which European Union	2 430	2 470	2 496	2 533	1.6%	1.1%	1.5%
Middle East	1 241	1 285	1 328	1 372	3.5%	3.3%	3.3%
World	**26 240**	**27 400**	**28 307**	**29 347**	**4.4%**	**3.3%**	**3.7%**

Notes: Data for 2024 are preliminary; 2025-2026 are forecasts. Differences in totals are due to rounding. Summary tables include values for net electricity demand, excluding own use in the power sector. Any differences with previous editions in historical data and forecasts are due to this change in definition, in addition to normal updated revisions.

Breakdown of global electricity supply, 2023-2026

TWh	2023	2024	2025	2026	Growth rate 2023-2024	Growth rate 2024-2025	Growth rate 2025-2026
Nuclear	2 741	2 825	2 864	2 945	3.1%	1.4%	2.8%
Coal	10 651	10 790	10 721	10 578	1.3%	-0.6%	-1.3%
Gas	6 654	6 783	6 869	6 956	1.9%	1.3%	1.3%
Other non-renewables	905	881	852	800	-2.6%	-3.3%	-6.2%
Total renewables	8 950	9 871	10 805	11 912	10.3%	9.5%	10.2%

Notes: Data for 2024 are preliminary; 2025-2026 are forecasts. Differences in totals are due to rounding. Generation numbers refer to gross generation.

Global CO_2 emissions from power generation, 2023-2026

Mt CO_2	2023	2024	2025	2026	Growth rate 2023-2024	Growth rate 2024-2025	Growth rate 2025-2026
Total emissions	13 756	13 927	13 879	13 752	1.2%	-0.3%	-0.9%

Regional and country groupings

Africa – Algeria, Angola, Benin, Botswana, Cameroon, Congo, Democratic Republic of the Congo, Côte d'Ivoire, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Ghana, Kenya, Libya, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Senegal, South Africa, South Sudan, Sudan, United Republic of Tanzania, Togo, Tunisia, Zambia, Zimbabwe and other African countries and territories.[1]

Asia – Bangladesh, Brunei Darussalam, Cambodia, Chinese Taipei, India, Indonesia, Japan, Korea, Democratic People's Republic of Korea, Lao People's Democratic Republic, Malaysia, Mongolia, Myanmar, Nepal, Pakistan, People's Republic of China,[2] Philippines, Singapore, Sri Lanka, Thailand, Viet Nam and other Asian countries, territories and economies.[3]

Asia Pacific – Australia, Bangladesh, Brunei Darussalam, Cambodia, Chinese Taipei, India, Indonesia, Japan, Korea, Democratic People's Republic of Korea, Lao People's Democratic Republic, Malaysia, Mongolia, Myanmar, Nepal, New Zealand, Pakistan, People's Republic of China,[2] Philippines, Singapore, Sri Lanka, Thailand, Viet Nam and other Asian countries, territories and economies.[4]

Central and South America – Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Curaçao, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Nicaragua, Panama, Paraguay, Peru, Suriname, Trinidad and Tobago, Uruguay, Venezuela and other Latin American countries and territories.[5]

Eurasia – Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Russian Federation, Tajikistan, Turkmenistan and Uzbekistan.

Europe – Albania, Austria, Belgium, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus,[6,7] Czech Republic, Denmark, Estonia, Finland, France, Germany, Gibraltar, Greece, Hungary, Iceland, Ireland, Italy, Kosovo[8] Latvia, Lithuania, Luxembourg, Malta, Montenegro, Netherlands, North Macedonia, Norway, Poland, Portugal, Republic of Moldova, Romania, Serbia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Republic of Türkiye, Ukraine and the United Kingdom.

European Union – Austria, Belgium, Bulgaria, Croatia, Cyprus,[6,7] Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain and Sweden.

Middle East – Bahrain, Islamic Republic of Iran, Iraq, Israel[9], Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, the United Arab Emirates and Yemen.

Nordics – Denmark, Finland, Norway, Sweden

North Africa – Algeria, Egypt, Libya, Morocco and Tunisia.

North America – Canada, Mexico and the United States.

Southeast Asia – Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam. These countries are all members of the Association of Southeast Asian Nations (ASEAN).

Advanced economies – OECD member nations, plus Bulgaria, Croatia, Cyprus, Malta and Romania.

Emerging markets and developing economies – All other countries not included in the advanced economies regional grouping.

[1] Individual data are not available and are estimated in aggregate for: Burkina Faso, Burundi, Cape Verde, Central African Republic, Chad, Comoros, Djibouti, Gambia, Guinea, Guinea-Bissau, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Reunion, Rwanda, Sao Tome and Principe, Seychelles, Sierra Leone, Somalia, Eswatini and Uganda.
[2] Including Hong Kong.
[3] Individual data are not available and are estimated in aggregate for: Afghanistan, Bhutan, Macau (China), Maldives and Timor-Leste.
[4] Individual data are not available and are estimated in aggregate for: Afghanistan, Bhutan, Cook Islands, Fiji, French Polynesia, Kiribati, Macau (China), Maldives, New Caledonia, Palau, Papua New Guinea, Samoa, Solomon Islands, Timor-Leste, Tonga and Vanuatu.
[5] Individual data are not available and are estimated in aggregate for: Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, British Virgin Islands, Cayman Islands, Dominica, Falkland Islands (Malvinas), Grenada, Guyana, Montserrat, Saba, Saint Eustatius, Saint Kitts and Nevis, Saint Lucia, Saint Pierre and Miquelon, Saint Vincent and the Grenadines, Sint Maarten, and the Turks and Caicos Islands.
[6] Note by Türkiye: The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Türkiye recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of United Nations, Türkiye shall preserve its position concerning the "Cyprus issue".
[7] Note by all the European Union Member States of the OECD and the European Union: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Türkiye. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.
[8] The designation is without prejudice to positions on status and is in line with the United Nations Security Council Resolution 1244/99 and the Advisory Opinion of the International Court of Justice on Kosovo's declaration of Independence.
[9] The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD and/or the IEA is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Abbreviations and acronyms

AEMO	Australian Energy Market Operator
AI	artificial intelligence
CAGR	compound annual growth rates
EU	European Union
EU-ETS	European Union Emissions Trading System
EV	electric vehicle
GDP	gross domestic product
IEA	International Energy Agency
IMF	International Monetary Fund
PV	photovoltaic
USD	United States Dollar
VRE	variable renewable energy

Units of measure

g CO_2	gramme of carbon dioxide
g CO_2/kWh	gramme of carbon dioxide per kilowatt hours
GW	gigawatt
kW	kilowatt
MW	megawatt
MWh	megawatt-hour
Mt CO_2	million tonnes of carbon dioxide
GW	gigawatt
t CO_2	tonne of CO_2
TWh	terawatt-hour

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