Global Electricity Mid-Year Insights 2025

Solar and wind outpaced demand growth in the first half of 2025, as renewables overtook coal's share in the global electricity mix.

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About

This report analyses changes in global electricity generation from January to June 2025 compared with the same period last year to measure the progress of the global clean energy transition.

The report draws on monthly electricity data from 88 countries representing 93% of global electricity demand and includes estimated changes in the remaining generation. It also dives deeper into the top four CO2-emitting economies, which together account for 63% of the world's electricity generation and 64% of global CO2 emissions from the power sector.

Key highlights

109%

Solar and wind growth exceeded global demand growth in the first half of 2025

83%

Solar generation growth alone met 83% of the global rise in demand in the first half of 2025

-0.6%

Coal generation fell by 0.6% in the first half of 2025

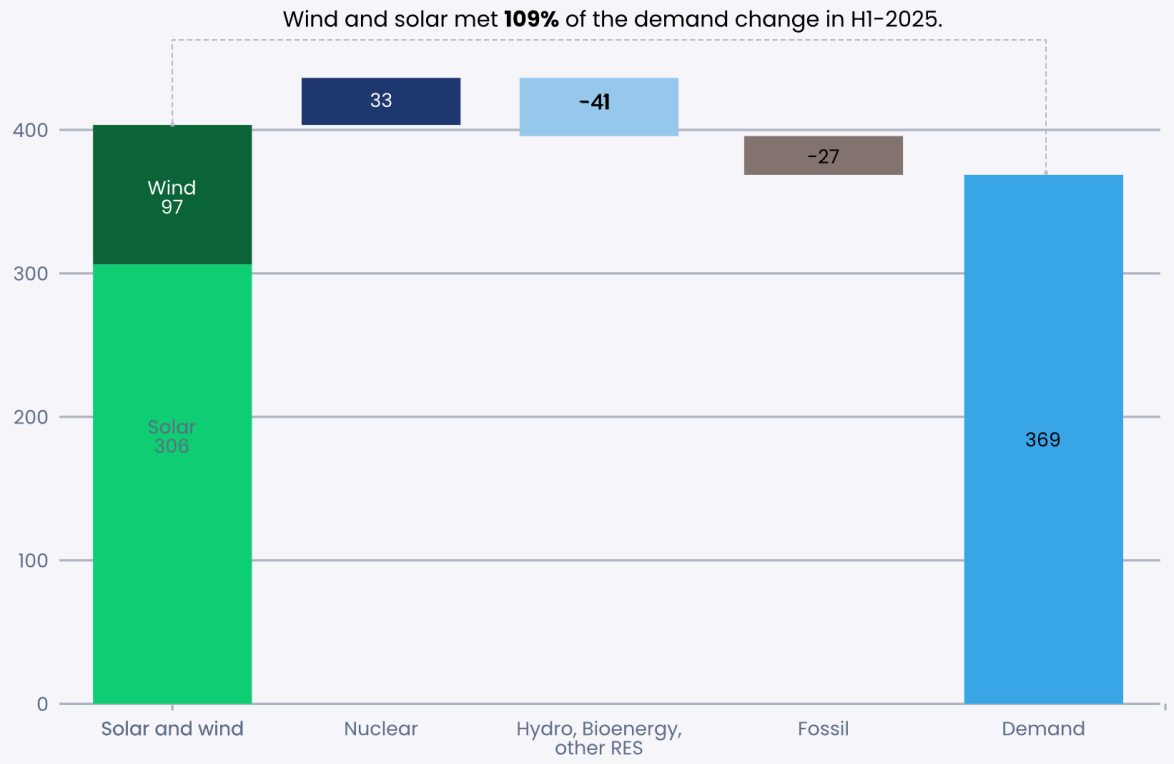
Solar and wind outpaced demand growth as renewables overtook coal in the first half of 2025

The increase in solar and wind power outpaced global electricity demand growth in the first half of 2025. Solar alone met 83% of the rise, with many countries setting new records. Fossil fuels remained mostly flat, with a slight decline. Fossil generation fell in China and India, but grew in the EU and the US.

As the world's energy needs increase and electricity makes up a growing share of final energy consumption, spectacular solar growth, alongside increased wind generation, met and exceeded all new demand. This led to renewables overtaking coal's share in the global mix and prevented further increases in CO2 emissions from the power sector.

Growth in solar and wind generation outpaced the rise in global electricity demand in H1-2025

Change in electricity generation: H1-2025 v H1-2024 (TWh)



Source: Monthly electricity data, Ember

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01 Solar and wind outpaced demand growth in the first half of 2025

Global electricity demand grew by 2.6% (+369 TWh) in the first half of 2025. This increase was more than met by increases in solar (+306 TWh, +31%) and wind (+97 TWh, +7.7%) generation, with solar alone covering 83% of the rise. Hydro fell significantly while bioenergy output dipped slightly, and nuclear rose modestly, while overall fossil generation fell marginally (-0.3%).

02 Solar saw record growth

Solar grew by a record 306 TWh (31%) in the first half of 2025. This increased solar's share in the global electricity mix from 6.9% to 8.8%. China accounted for 55% of global solar generation growth, followed by the US (14%), the EU (12%), India (5.6%) and Brazil (3.2%), while the rest of the world contributed just 9%. Four countries generated over 25% of their electricity from solar, and at least 29 countries surpassed 10%, up from 22 countries in the same period last year and only 11 countries in H1-2021.

03 Renewables overtook coal

A strong rise in solar, and to a lesser extent wind, led to renewables overtaking coal generation for the first time on record in the first half of 2025. Renewables grew by 363 TWh (+7.7%) to reach 5,072 TWh, while coal generation fell by 31 TWh to 4,896 TWh. As a result, renewables' share of global electricity rose to 34.3% (from 32.7%), while coal's share fell to 33.1% (from 34.2%).

04 Coal fell in both China and India — temporarily in India, but more structurally in China

Global fossil fuel generation fell slightly in the first half of 2025, down 27 TWh from the same period last year. Among major economies, fossil fuel generation decreased in China and India, where clean generation outpaced demand growth. By contrast, in the US, clean sources did not keep pace with demand rise, so fossil generation increased. In the EU, both coal and gas inched up to offset lower wind, hydro and bioenergy output.

05 Power sector emissions plateaued

Despite global electricity demand rising by 2.6%, emissions fell slightly by 12 MtCO2 in the first half of 2025. Declines in China (-46 MtCO2) and India (-24 MtCO2) reflected clean generation growth outpacing demand. By contrast, emissions increased in the EU (+13 MtCO2) and the US (+33 MtCO2) compared with the same period last year.

We are seeing the first signs of a crucial turning point. Solar and wind are now growing fast enough to meet the world's growing appetite for electricity. This marks the beginning of a shift where clean power is keeping pace with demand growth. As costs of technologies continue to fall, now is the perfect moment to embrace the economic, social and health benefits that come with increased solar, wind and batteries.

Małgorzata Wiatros-Motyka
Senior Electricity Analyst, Ember

This analysis confirms what we are witnessing on the ground: solar and wind are no longer marginal technologies—they are driving the global power system forward. The fact that renewables have overtaken coal for the first time marks a historic shift. But to lock in this progress, governments and industry must accelerate investment in solar, wind, and battery storage, ensuring that clean, affordable, and reliable electricity reaches communities everywhere.

Sonia Dunlop
CEO, Global Solar Council

Global electricity trends in the first half of 2025

Solar and wind met and exceeded all demand growth in the first half of 2025, leading to renewables overtaking coal for the first time and fossil generation falling slightly.

The first half of 2025 saw positive progress in the global electricity transition, despite increasingly unstable weather, geopolitical turmoil and economic uncertainty. However, much more remains to be done to accelerate the transition and unlock the full economic, health, social and environmental benefits.

1.1 Solar and wind met and exceeded demand growth

Solar growth was spectacular in the first half of 2025, while wind grew more moderately. Together, they met and exceeded the increase in electricity demand.

1.1.1 Global demand increased at an average pace

Global demand rose by 369 TWh (+2.6%) in H1-2025, compared with 731 TWh (+5.3%) in the same period last year. The smaller increase was due to a few factors, including a more measured pace of industrial growth in China and India, but also fewer heatwaves in May and June in India.

In China, demand grew by 198 TWh (+4.2%), compared with a much stronger increase of 326 TWh (+7.5%) in the same period last year.

In India, demand growth was particularly low at 12 TWh (+1.3%), compared with +75 TWh (+9%) last year when heatwaves drove higher demand. Ember estimates that if weather during May and June 2025 had matched last year's heatwave conditions, demand growth in India would have been closer to +3%.

Despite the smaller rise, the global demand increase in H1-2025 was close to the 10-year annual average of 2.7% for 2015-2024.

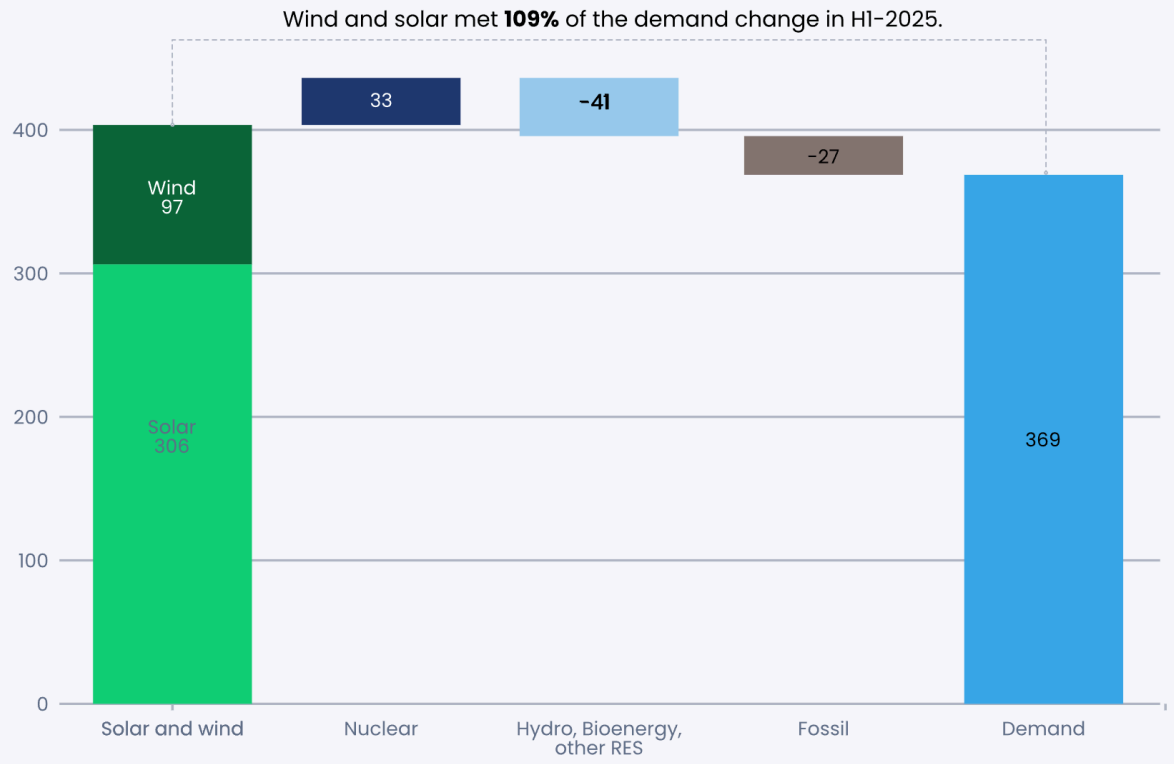
The world's four largest polluters accounted for 81% of the global demand rise in the first half of 2025: China 54% (198 TWh), the US 21% (76 TWh), India 3.3% (12 TWh) and the EU 2.4% (9 TWh).

1.1.2 Solar and wind outpaced demand growth

Solar and wind generation outpaced the entire growth in electricity demand in the first half of this year. Solar alone met 83% of the increase, setting new records for both growth and generation. Solar's share of electricity generation rose to 8.8%, up from 6.9% in the first half of 2024.

Growth in solar and wind generation outpaced the rise in global electricity demand in H1-2025

Change in electricity generation: H1-2025 v H1-2024 (TWh)



Source: Monthly electricity data, Ember

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Among other low-carbon sources, nuclear generation rose by 33 TWh (+2.5%), and other renewables increased by 3.6 TWh (+4.7%). Meanwhile, hydro fell by 42 TWh (-2%), and bioenergy also declined by 2.7 TWh (-1%).

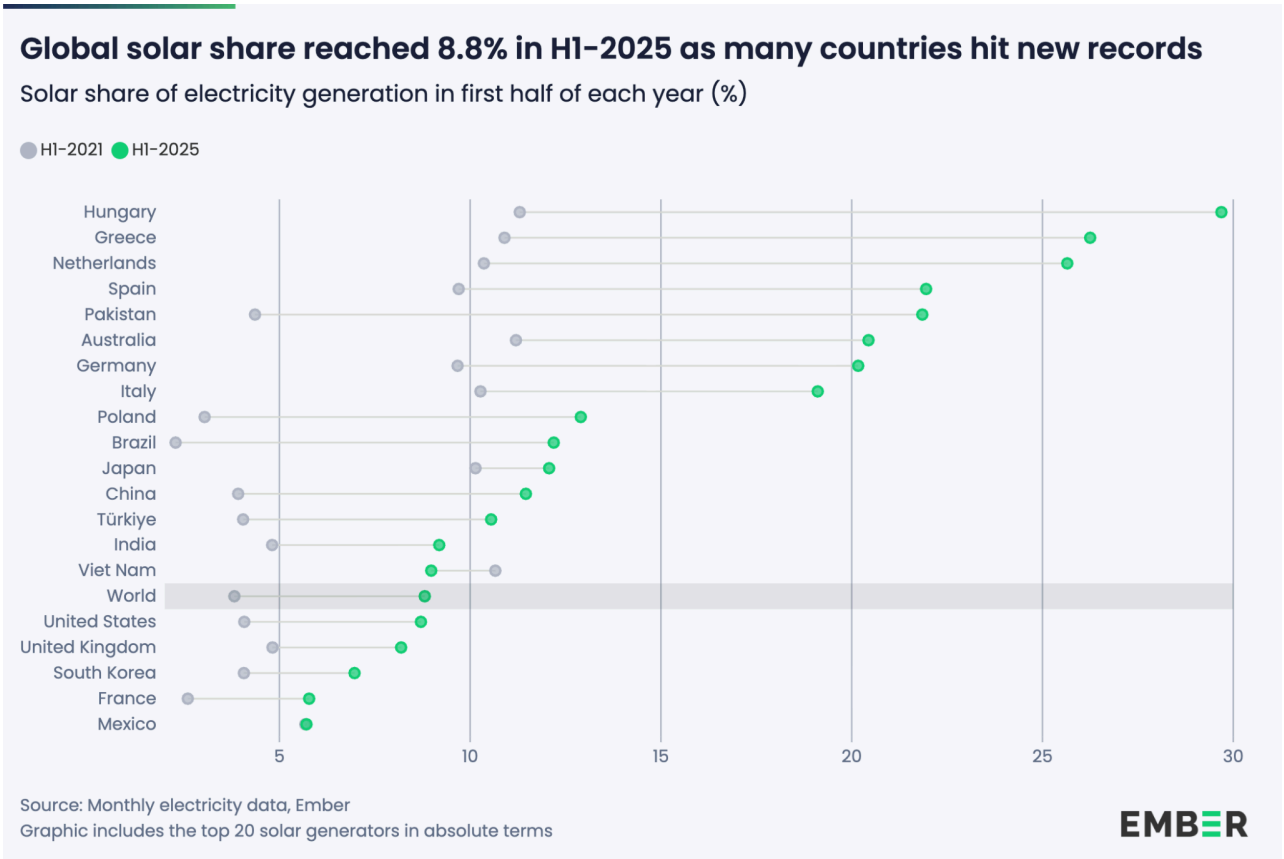
Total fossil generation declined by 27 TWh (-0.3%) as coal fell by 31 TWh (-0.6%) and gas by 6.3 TWh (-0.2%), offsetting a small rise in other fossil fuels (+10 TWh, +2.5%).

1.2 Solar generation grew faster than ever, breaking a new record in the first half of 2025

Solar generation grew by 306 TWh (+31%) in the first half of 2025, its fastest absolute growth on record. If this pace continues, solar is on track to remain the fastest-growing source of electricity for the 21st consecutive year and to outpace wind growth in absolute terms for the fourth year in a row.

1.2.1 New solar records across the world

Solar's global share was 8.8% in the first half of 2025, more than doubling in the last four years, from 3.8% in 2021. In many countries, solar now makes up a considerably higher share of the electricity mix.



Several economies set new records. Among the top 20 largest solar generators in absolute terms, seven countries — Hungary, Greece, the Netherlands, Pakistan, Spain, Australia and Germany — generated 20% or more of their electricity from solar in the first six months of 2025.

Hungary led with nearly 30% share of solar generation, ahead of Greece and the Netherlands, which both surpassed 25%, up from just over 10% only four years ago (in the first half of 2021). Meanwhile, based on Ember's estimate, Pakistan saw the largest increase in share, from 4.4% in H1-2021 to 21.9% in H1-2025. The increase was driven by the rapid adoption of rooftop solar by households and businesses in response to high electricity prices, as reported previously by Ember.

Based on available monthly data, at least 29 countries generated over 10% of their electricity from solar from January to June 2025, up from 22 countries in the same period of 2024 and only 11 countries in the first half of 2021.

China remained the leader in absolute growth terms for the third consecutive year, accounting for 55% (168 TWh) of the global increase in solar in the first half of 2025. The US accounted for 14% (44 TWh), the EU 12% (37 TWh) and India 6% (17 TWh). In contrast, solar generation fell marginally in Japan by 1.4 TWh (-0.4%), partly due to record-high curtailment. Solar also declined slightly in Vietnam (-0.5 TWh, -1.7%).

1.2.2 Sunnier conditions in H1-2025 slightly improved solar output

Weather conditions had a net-positive effect on solar power output in the first half of 2025. An analysis of solar radiation in 25 countries, covering 91% of global solar generation, shows that conditions alone improved output by 4% compared to the first half of 2024.

European countries were among those benefiting most, with Belgium (+26%), the Netherlands (+21%), the UK (+20%), Germany (+15%) and France (+10%) seeing the larger impacts. However, at a global level, capacity additions remain by far the dominant driver of the increase in solar generation.

1.2.3 Record capacity additions in the first half of 2025 point to a continued rise in solar generation

Solar capacity additions also grew at a record pace, reaching a new high of 380 GW in the first six months of 2025 - 64% more than the 232 GW added in the same period last year. A record surge in May, driven by accelerated installations in China ahead of new pricing rules on 1 June 2025, was a key contributor. Overall, China accounted for 67% of total solar capacity additions in H1-2025.

Global solar installations were 64% higher in the first half of 2025 than in the same time last year

Global solar capacity additions, cumulative by year (GW)

Source: Monthly wind and solar capacity, Ember; Ember calculations
Capacity installations for countries not covered in capacity data were estimated from solar export data; Capacity is in GW(DC). Data from countries reporting in GW(AC) was scaled in the calculation of global values.

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Record-high capacity additions in H1-2025 are a clear sign that the rapid growth of solar generation will continue beyond the first half of the year and into next year.

1.3 Slower wind growth means solar is close to overtaking wind

Wind generation grew by 7.7%, compared to solar's 31%. This means solar is close to overtaking wind, with solar generation at 1,303 TWh and wind at 1,365 TWh in the first half of 2025.

Global wind generation increased by 97 TWh (+7.7%) in the first half of 2025, compared to the same period last year when it increased by 106 TWh (+9.1%). This increase led to wind's share in the global electricity mix rising to 9.2% in H1-2025, up from 8.8% in the same period last year.

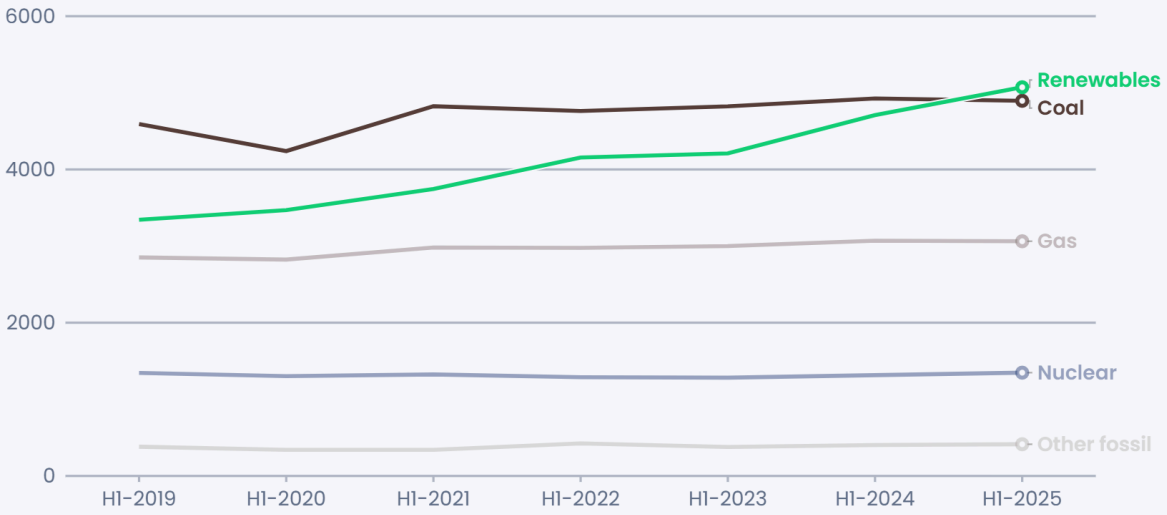
Wind generation fell in the EU due to unfavourable weather conditions, especially from January to April. In the US, it also declined in February, April, May and June, but overall grew in H1-2025.

1.4 Renewables overtake coal as fossil fuels fall slightly

Renewables overtook coal in the electricity mix for the first time on record, rising by 363 TWh (+7.7%) to 5,072 TWh in the first half of 2025. Their share increased to 34.3%, up from 32.7% in the same period last year. Coal fell by 31 TWh (-0.6%) to 4,896 TWh, with its share dropping to 33.1%, down from 34.2%.

Renewables produced more electricity than coal for the first time on record in the first half of 2025

Global generation, Jan-Jun of each year (TWh)



Source: Monthly electricity data, Ember
Renewables include wind, solar, hydro, bioenergy and other renewables, such as geothermal

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At the same time, global gas generation also fell (-6.3 TWh, -0.2%), just maintaining its share of 23% in the global electricity mix. Falls in coal and gas offset a small rise in other fossil fuels (+10 TWh, +2.5%) leading to overall fossil fuel generation falling by 27 TWh (-0.3%).

Coal use and emissions fell in China and India, as wind and solar met all the growth in electricity demand. In the EU, gas and, to a small extent, coal increased their generation to offset falls in hydro, bioenergy and wind generation.

Meanwhile, in the US, coal rose but gas fell due to gas-to-coal switching and because renewable generation did not rise enough to meet demand growth. Detailed changes in the power mixes of those economies are described in Chapter 2.

1.5 Hydro fell slightly

Hydro generation decreased by 42 TWh (-2%) in the first half of 2025, compared to the same period last year. This led to yet another fall in hydro's share of the global electricity mix, as it stood at 13.9% in H1-2025, down from 14.6% in the same period last year and from 16.3% in H1-2020.

Hydro generation decreased in a number of economies, with the top five being the EU, China, Russia, Türkiye and Brazil. In the EU (-33 TWh, -17%), hydro was down every month in the first half of the year, with dry conditions increasing towards the summer months.

In China, hydro fell (-11 TWh, -1.9%) after a good generation year in 2024, with drier weather in May and June leading to an overall fall in output. Hydro also fell in Russia (-13 TWh, -12%), Türkiye (-12 TWh, -25%) and Brazil (-10 TWh, -4.4 %), mainly due to droughts.

In contrast, hydro generation increased in Canada (+11 TWh, +6.3%), India (+9.6 TWh, +17%), Viet Nam (+7.9 TWh, +27%), Colombia (+6.3 TWh, +24%), the US (+5.0 TWh, +4.1%) and Norway (+4.2 TWh, +6.1%). It also rose in some other economies, but to a lesser extent.

1.6 Nuclear rose moderately

Nuclear generation globally rose by 33 TWh (+2.5%), maintaining its share of 9.1% in the global electricity mix in H1-2025. The rise came mainly from Asia, with increases in China (+24 TWh, +11%), South Korea (+7.9 TWh, +8.7%), Japan (+5.7 TWh, +14%) and India (+3.5 TWh, +14%). Outside Asia, nuclear generation also rose significantly in Canada (+5.2 TWh, +13%) and France (+4.4 TWh, +2.5%).

In contrast, nuclear power fell in economies such as Taiwan (-5.3 TWh, -62%), the US (-5.2 TWh, -1.4%), Belarus (-2.6 TWh, -28%), Belgium (-2.4 TWh, -16%), Argentina (-1.4 TWh, -21%) and Brazil (-1.2 TWh, -15%).

Further growth is expected as several economies plan to deploy new reactors or extend the operational life of existing ones.

1.7 Global CO2 emissions plateau

Global CO2 emissions from the power sector fell marginally by 12 MtCO2 (-0.2%) to 6,963 MtCO2 in the first half of 2025. The decline was possible because solar and wind power exceeded demand growth and led to a slight fall in fossil fuel use. Without solar and wind growth, emissions would have risen by an estimated 236 MtCO2 (+3.9%) globally, which is equivalent to almost all emissions (251 MtCO2) from Africa in H1-2025.

At the country level, there was significant variation. Among the four economies that account for the majority of global emissions (64%), emissions fell in China (-46 MtCO2, -1.7%) and India (-24 MtCO2, -3.6%), as clean electricity outpaced growth in demand in those countries.

In contrast, emissions rose in the EU (+13 MtCO2, +4.8%), where strong growth in solar was outweighed by shortfalls in wind, hydro and bioenergy, leading to higher gas and coal generation. Emissions also rose in the US (+33 MtCO2, +4.3%), as clean electricity growth was smaller than demand growth, leading to an increase in coal generation, which was exacerbated by gas-to-coal switching.

Mid-year insights by economy

Just four economies — China, India, the EU and the US — constituted nearly two-thirds of global electricity demand and power sector CO2 emissions in H1-2025. Fossil fuel generation fell in China and India but rose in the EU and the US, with China leading clean energy growth.

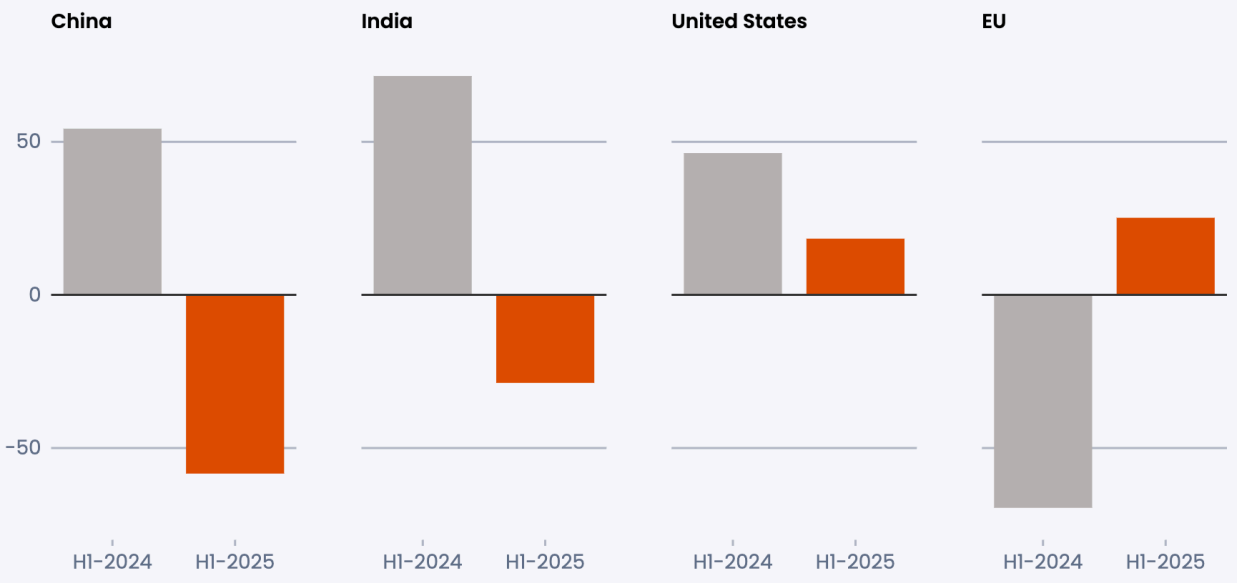
China, India, the EU and the US accounted for 63% of global electricity demand and 64% of CO2 emissions in the first half of 2025. Development in these countries therefore has a major influence on the global power sector.

In H1-2025, fossil fuel generation and related emissions fell in China and India - a reversal of trends seen in the first half of 2024, as clean sources in both countries grew faster than electricity demand.

Meanwhile, fossil generation and emissions rose in the US as clean generation did not keep pace with demand growth. In the EU, solar grew strongly, but falls in wind, hydro and bioenergy led to an increase in gas generation, and to a lesser extent coal, causing a slight rise in emissions.

Fossil fell year-on-year in China and India, while the US and EU's rose in H1-2025

Year-on-year change in fossil generation, Jan-June (TWh)



Source: Ember

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China remained the clear frontrunner in clean energy growth, accounting for 55% of the global rise in solar generation and 82% of the rise in wind generation.

The following sections examine developments in these four major economies, whose trajectories are crucial for global electricity demand, generation and emissions.

2.1 China

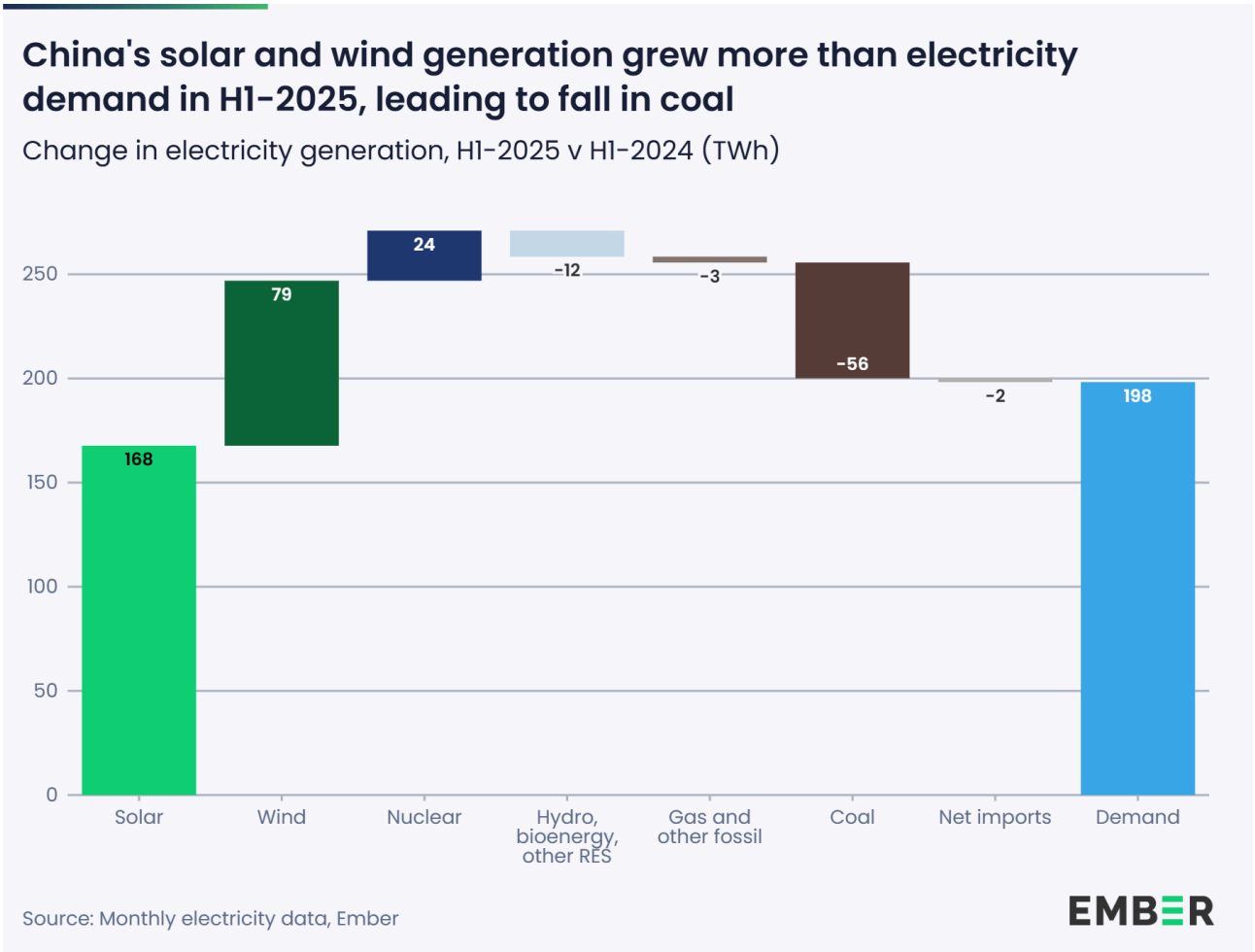
China met all its demand growth with clean electricity generation in the first half of 2025. This led to a fall in its fossil fuel generation and emissions. China also accounted for most of the global growth in low-carbon electricity: 55% of solar, 82% of wind and 73% of nuclear.

2.1.1 China drives global solar and wind growth

China's progress in energy transition has been impressive, as shown in Ember's China Energy Transition Review 2025. In H1-2025, China's electricity demand rose by 198 TWh (+4.2%), lower than the 326 TWh (+7.5%) increase in the same period in 2024. This moderation was partly due to a more measured pace of industrial demand growth. The increase in demand was outpaced by solar, wind and nuclear generation.

Solar output grew by 168 TWh (+43%) compared to the same period last year, well above the global average of 31% for this period, and accounted for 85% of the increase in China's electricity growth and 55% of global growth in solar. Solar's share of China's power mix rose to 11.5%, up from 8.4% in H1-2024.

Wind generation increased by 79 TWh (+16%), more than double the global average of 7.7%, accounting for 40% of China's electricity generation growth and 82% of global growth. Wind's share of the country's power mix grew from 11% to 12%.



Among low-carbon sources, nuclear generation grew by 24 TWh (+11%), contributing 73% to global nuclear growth. Meanwhile, hydro declined by 11 TWh (-1.9%).

2.1.2 Fossil fuels fall as solar and wind surge

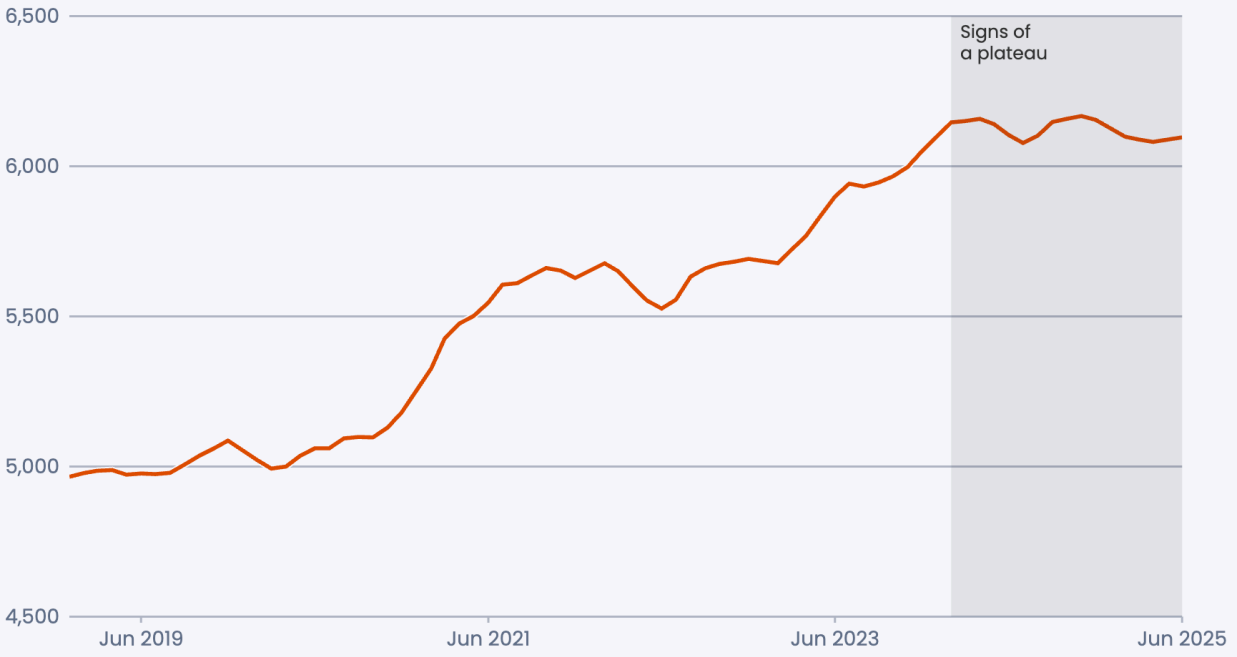
Growth in clean electricity, particularly solar and wind, drove down coal and gas use in the first half of 2025. Coal generation fell by 56 TWh (-2%), reducing its share from 59% to 56%, while gas generation dropped by 2.7 TWh (-2%)

compared to the same period last year. Other fossil fuels fell by 0.1 TWh (-1.8%). As a result, China's power sector emissions fell by 46 MtCO2 (-1.7%).

Looking at the past 12 months, fossil generation shows signs of plateauing. However, it remains unclear when fossil fuels will definitely peak in China, partly because weather can play a significant role in year-to-year variations in demand and generation.

China's electricity generation from fossil fuels is beginning to plateau

12-month rolling sum of fossil generation (TWh)



Source: Monthly electricity data, Ember

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2.2 United States

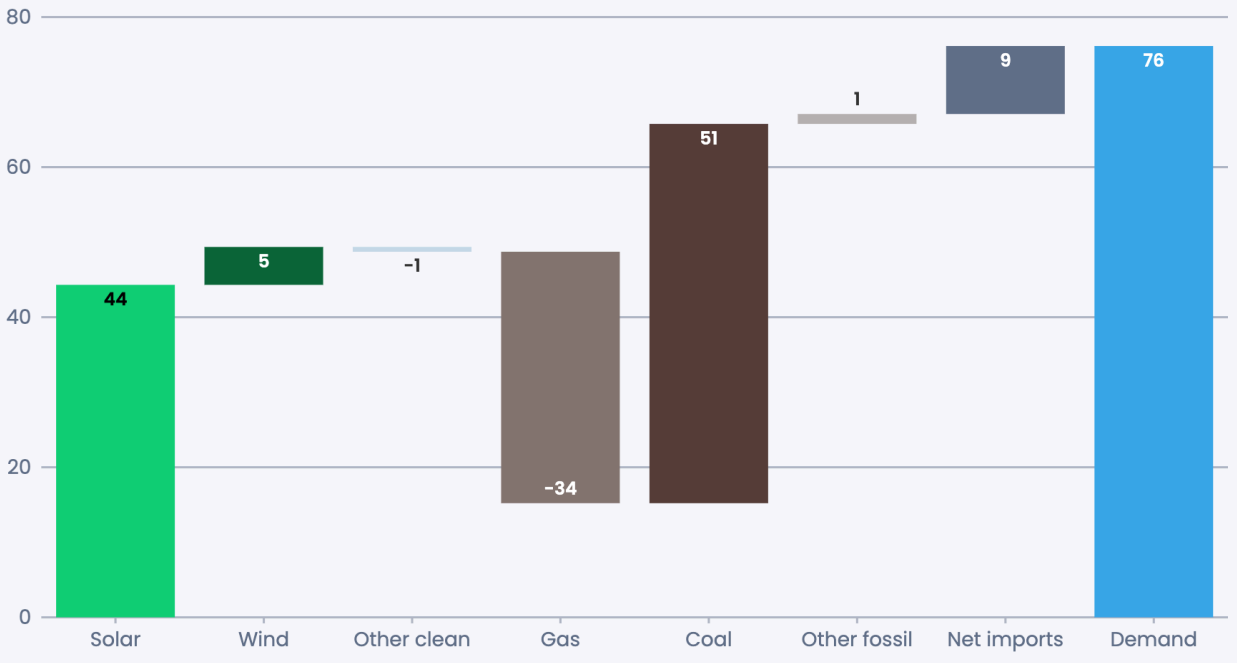
The United States, the world's largest economy, accounted for 15% (2,190 TWh) of global electricity demand and 12% of global power sector CO2 emissions in the first half of 2025. Unlike China, solar and wind in the US grew less than electricity demand, meeting only 65% of the increase. Coal generation rose to fill the gap and also partly replaced gas, driving an increase in emissions.

2.2.1 Renewables not keeping pace with strong demand growth

Globally, renewables growth met all the increase in electricity demand. That certainly wasn't the case in the US.

US coal generation increased in H1-2025 to displace gas and meet a shortfall in clean power growth

Change in electricity generation, H1-2025 v H1-2024 (TWh)



Source: Monthly electricity data, Ember
Other clean includes nuclear, hydro, bioenergy and other renewables.

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Electricity demand in the US grew by 76 TWh (+3.6%) in H1-2025, compared with an increase of 93 TWh (+4.6%) in the same period last year, when demand was partly boosted by heatwaves. The H1-2025 increase contrasts with flat changes in electricity demand from the mid-2000s to the early 2020s.

Demand is expected to rise further due to growing consumption in the commercial sector, including data centers, and the industrial sector, including manufacturing, according to analysis by the US Energy Information Administration (EIA).

Solar generation rose by 44 TWh (+30%), meeting 58% of demand growth and raising its share of the electricity mix to 8.7%, up from 6.9% a year earlier.

Wind output increased by 5 TWh (+2%), well below the 19 TWh (+8.1%) growth recorded in H1-2024. Despite the increase, its share of the mix fell from 11.7% to 11.5%, as a result of faster demand growth. The slowdown was mainly due to unfavourable wind conditions in February, April, May and June.

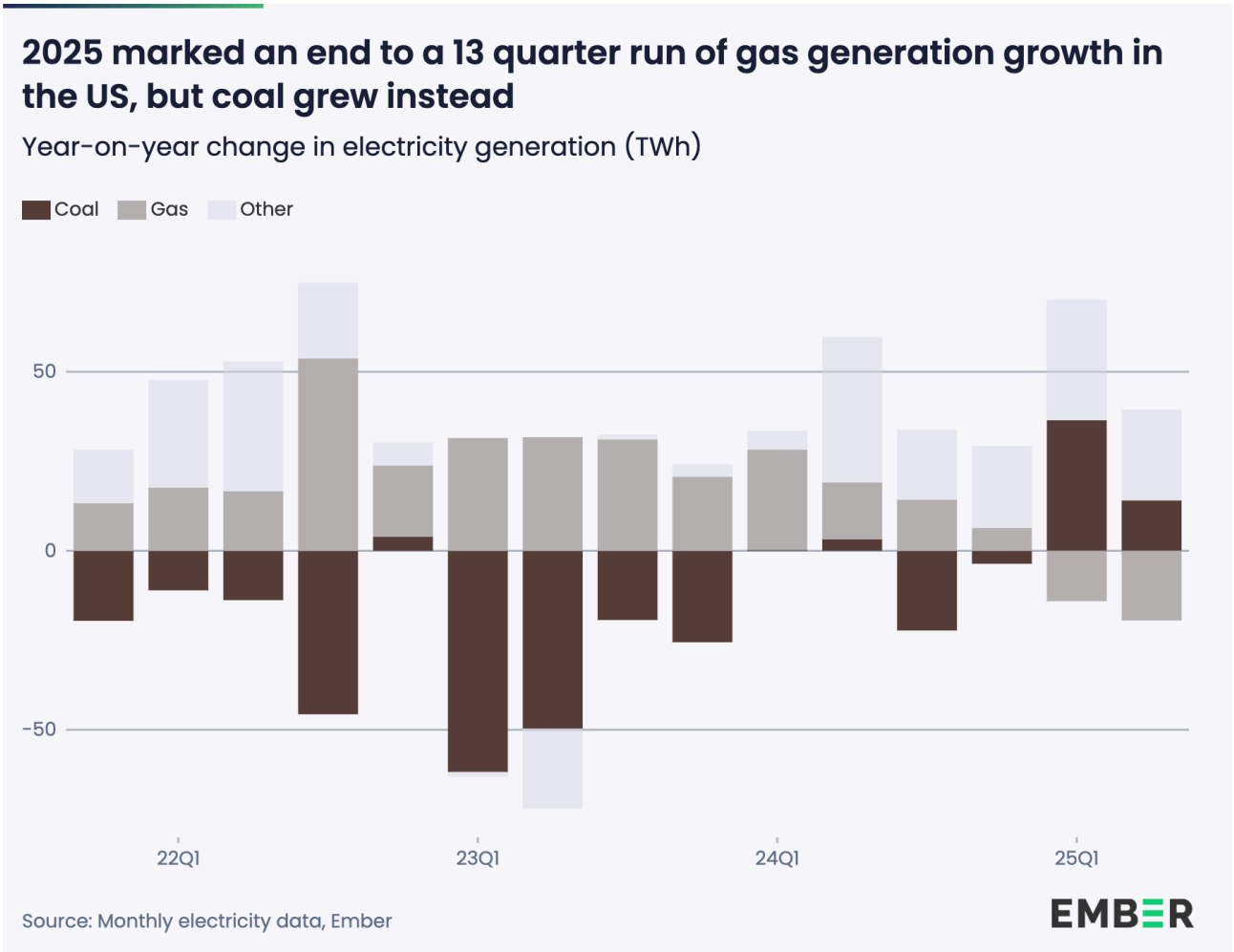
Hydro rose by 5 TWh (+4.1%), compared with just 1 TWh (+0.8%) increase last year. In contrast, nuclear output fell by 5.2 TWh (-1.4%).

Overall, strong demand growth increased fossil fuel generation by 18 TWh (+1.6%) and pushed power sector emissions up by 33 MtCO2 (+4.3%).

2.2.2 Much more coal, but less gas

A reversal of previous years' trend saw gas generation falling in H1-2025, declining in both Q1 and Q2, and partly replaced by coal. Gas generation declined by 34 TWh (-3.9%) compared with a 44 TWh (+5.4%) increase last year, reducing its share of the mix to 37.9% from 40.6%.

Coal generation rose by 51 TWh (+17%), compared with a modest 3.5 TWh (+1.2%) increase in H1-2024, lifting its share to 16.2%, up from 14.4%. This gas-to-coal switch was partly driven by higher gas prices.



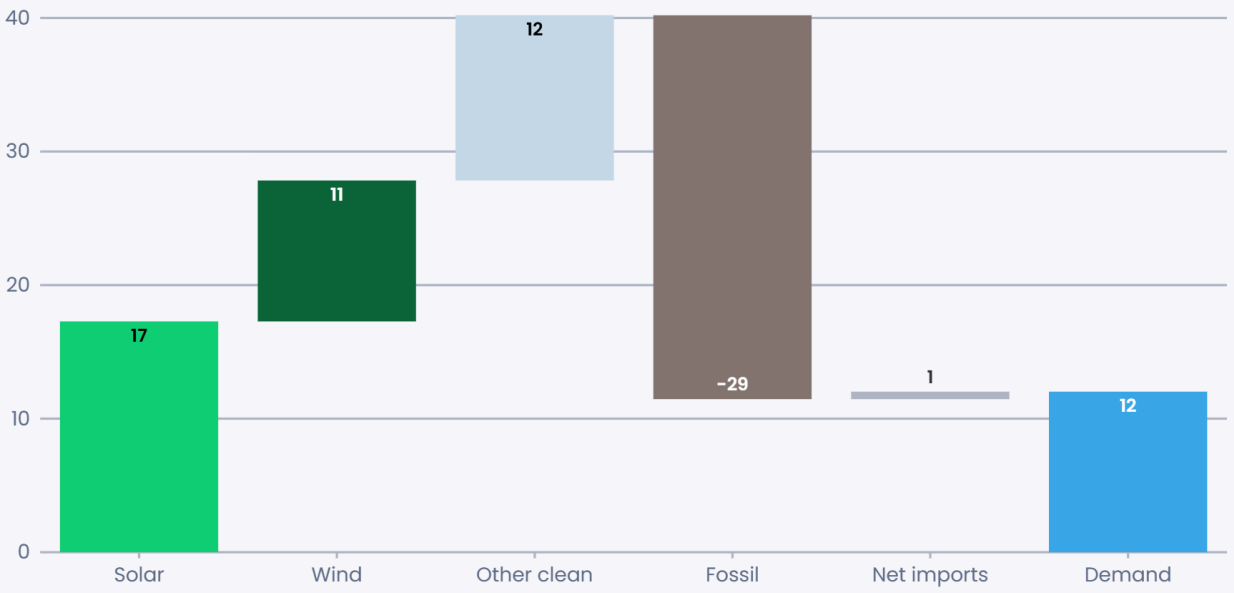
2.3 India

India accounted for 6.2% of global electricity demand and 9.1% of global CO2 emissions in the first half of 2025. At the same time, growth in clean sources was

more than three times bigger than demand growth, with record solar and wind installations pushing coal generation and emissions down. Fewer heatwaves also contributed to lower electricity demand.

India's clean electricity growth drove down fossil generation in H1-2025

Change in electricity generation, H1-2025 v H1-2024 (TWh)



Source: Monthly electricity data, Ember
Other clean includes hydro, nuclear, bioenergy and other renewables.

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2.3.1 Clean sources outpaced electricity demand amid fewer heatwaves

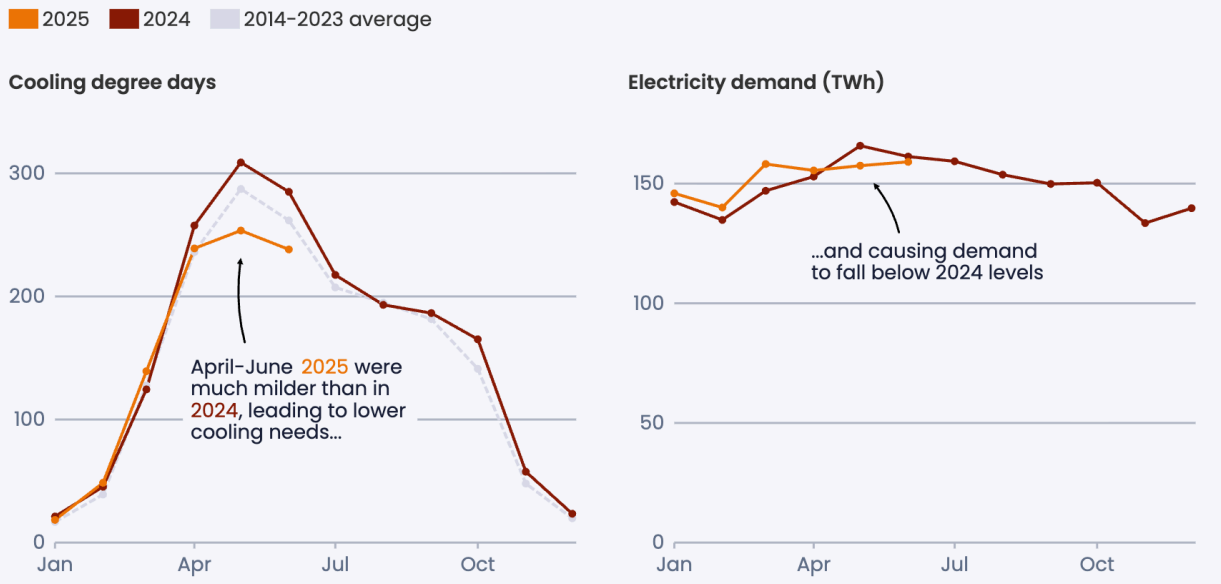
Electricity demand increased by just 12 TWh (+1.3%) in H1-2025, compared with a rise of 75 TWh (+9%) in the same period last year. This was the lowest absolute growth since the COVID-19 pandemic. This slowdown reflected more measured

industrial growth, as well as milder weather that reduced cooling demand. Air conditioning is estimated to account for about 50 GW, or 20% of India's maximum power load, hence having a significant impact on demand.

Ember estimates that if temperatures had been similar to H1-2024, particularly in April, May and June, demand would have increased by about 3.5% (+32 TWh). Even in that scenario, clean sources, led by solar and wind, would have exceeded demand growth, rising by 40 TWh (+20%) in H1-2025 and pushing coal generation down. Demand growth is expected to rebound in the second half of the year, likely driving higher coal generation.

Milder temperatures in India's early summer caused electricity demand to slow

'Cooling degree days' measure by how much daily temperatures exceed 22°C. The higher the number, the more electricity people need for cooling.



Source: Monthly electricity data, Ember; Ember analysis of ERA5 temperature data
Cooling degree days are population-weighted to better reflect temperatures in demand centres

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2.3.2 Solar and wind rose at a record pace

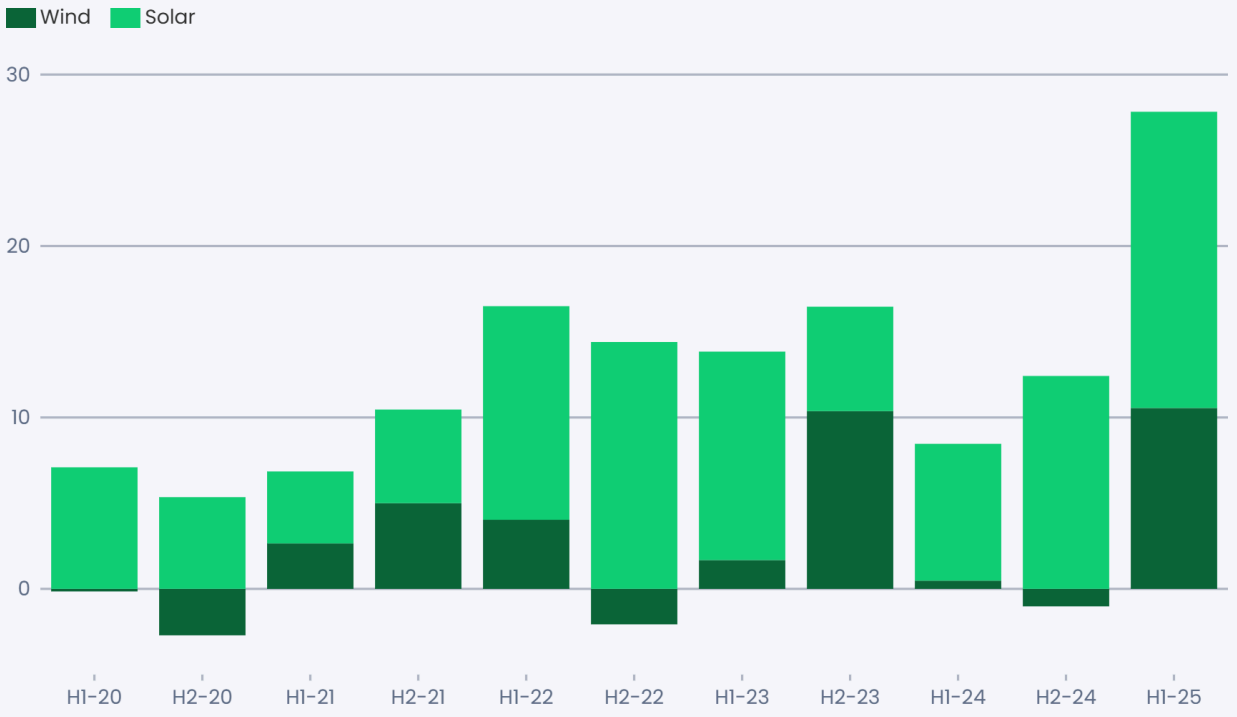
Solar and wind both grew at a record pace in the first half of 2025. Solar was a standout, with generation rising by a record of 17 TWh (+25%) compared to 8 TWh (+13%) in the same period last year. This growth lifted its share of the electricity mix to 9.2%, up from 7.4% in H1-2024.

Wind generation also increased strongly, by a record addition of 11 TWh (+29%), against just 0.5 TWh (+1.3%) last year. Its share of the mix rose to 5.1% from 4%.

The rise in solar generation was on its own bigger than the growth in demand, while the rises in both wind and hydro were both virtually equivalent to demand growth.

India recorded its largest ever increase in both wind and solar power during the first half of 2025

Year-on-year change in electricity generation (TWh)



Source: Monthly electricity data, Ember

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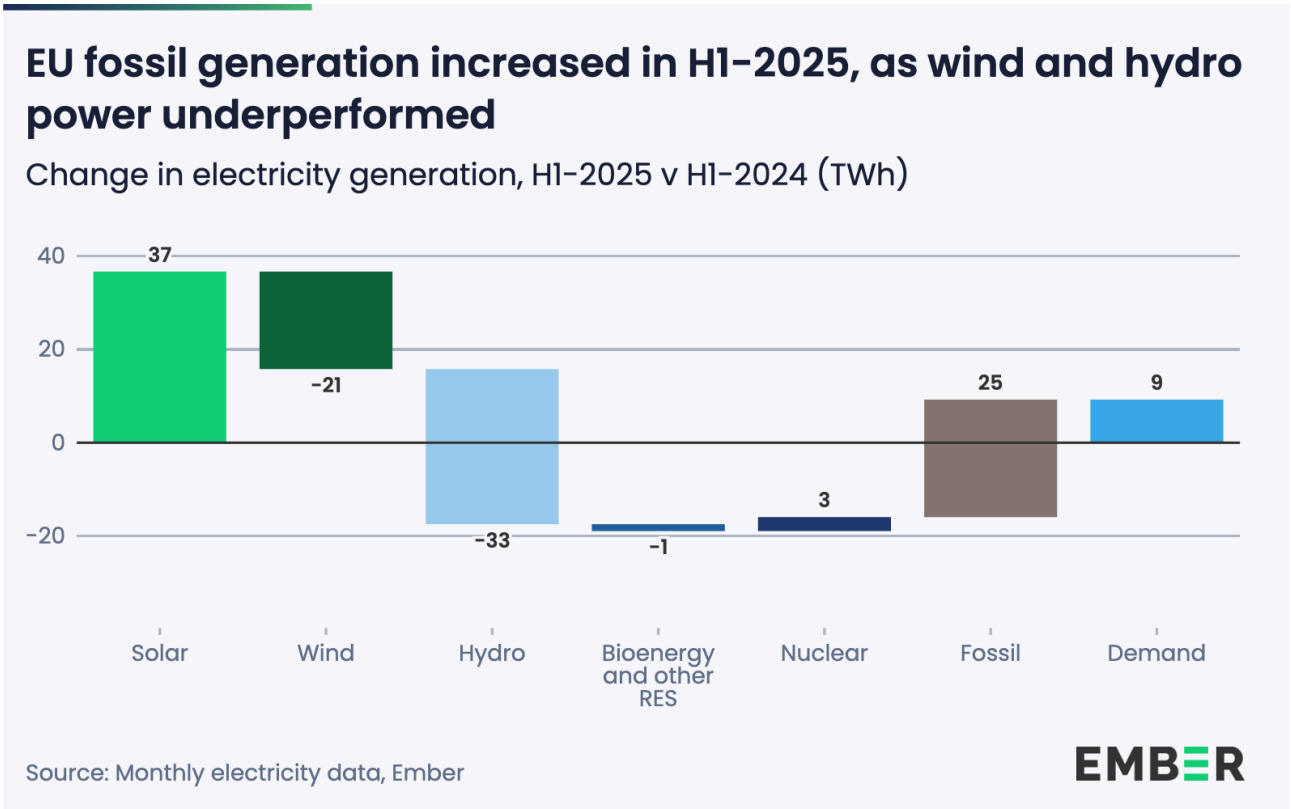
Other low-carbon sources also grew. Nuclear generation rose by 3.5 TWh (+14%) compared to 2.6 TWh (+12%) recorded last year. Hydro rebounded with an increase of 9.6 TWh (+17%), a sharp turnaround from the 4.9 TWh (-7.8%) decline in H1 2024.

The expansion of clean energy reduced fossil fuel use. Coal generation fell by 22 TWh (-3.1%), while gas generation declined by 7.1 TWh (-34%). As a result, power sector emissions fell by 24 MtCO2 (-3.6%) compared with the same period last year.

2.4 European Union

The EU generated 8.8% (1,303 TWh) of global electricity and 4% (293 MtCO2) of the world's power sector emissions in the first half of 2025. Although solar grew more than demand, poor conditions for wind and hydro caused their output to fall, resulting in higher gas generation and emissions.



2.4.1 Demand growth remains low

Electricity demand increased slightly by 9 TWh (+0.7%) in H1-2025, following a similarly low increase of 14 TWh (+1.1%) in the same period last year. This marks the second consecutive year of modest demand growth, after two years of decline when high electricity prices and the COVID-19 pandemic suppressed industrial activity. Demand is expected to continue rising moderately, as the industrial sector has yet to fully recover.

2.4.2 Despite strong solar growth, wind and hydro fell, leading to rising fossil generation

Solar generation grew by 37 TWh (+24%) in H1-2025, compared with a 26 TWh (+21%) rise recorded in H1 last year. This lifted solar's share of the electricity mix to 14%, up from 12%. In June, solar was the single largest source of electricity, accounting for 22% of the bloc's electricity mix, as Ember reported.

By contrast, wind generation fell by 21 TWh (-8.5%), compared with the 21 TWh (+9.3%) gain seen in H1-2024. Poor wind conditions between January and April reduced its share of the electricity mix to 17%, down from 19% last year.

Hydro generation also fell by 33 TWh (-17%), compared with a 34 TWh (+21%) increase in H1-2024. In the first half of 2025, droughts and heatwaves pushed hydro's share down to 12%, from 15%. Bioenergy output dropped by 1.7 TWh (-3.2%), following a smaller decline of 0.8 TWh (-1.5%) last year.

Nuclear grew by 3 TWh (+1%), slightly lifting its share from 23.4% to 23.5% of the electricity mix. This was below the 9 TWh (+3%) growth recorded in H1-2024, following two years of decline.

Falling hydro and wind output drove higher fossil fuel generation. Gas-fired generation increased by 25 TWh (+14%), compared with a 29 TWh (–14%) decline

in H1 last year, raising its share of the mix to 16%, from 14% in H1-2024. Coal maintained its share of 9.7% in the mix, growing by 1.4 TWh (+1.1%), in contrast to last year when it fell by 39 TWh (-24%). Other fossil fuels fell by 1.1 TWh (-3%), similar to last year's 1.9 TWh (5.2%) decline, slightly reducing their share of the electricity mix, from 2.7% to 2.6%.

As a result, the EU's power sector emissions increased by 13 MtCO2 (+4.8%) in the first half of 2025.

Solar and wind surge signals a turning point

Rapid solar and wind growth in the first half of 2025 signals that fossil fuel demand is nearing its peak. Accelerating clean energy deployment is now essential to stay on track for net-zero.

Solar generation in H1-2025 surged 31% year-on-year, expanding its share of the global electricity mix from 6.9% to 8.8%. Record growth in many countries meant solar and wind together met and exceeded new electricity demand growth, signalling that global power sector fossil fuel demand is nearing its peak. This is a pivotal moment to be ambitious and accelerate the transition.

Falling prices of solar and wind give governments an increasing opportunity to set more ambitious targets and policies to speed deployment. Doing so would maximise the economic, social, health and environmental benefits of clean power, in addition to reducing carbon emissions and keeping climate change targets within reach.

Half of the world is past a peak in fossil generation, and the tools to accelerate the transition are available. However, some emerging economies still face higher costs of capital and other capacity constraints. Support from mature economies, particularly those with historic emissions, is crucial to overcoming these barriers and keeping the pathway to net-zero within reach.

Methodology

General methodology

Electricity generation data for countries, regions and the world is based on Ember's Monthly Electricity data. Data is gathered for 88 countries from over 70 sources, including national transmission system operators, statistical agencies and data aggregators such as ENTSO-E.

In some cases, published data was not available for the full reported timeframe; here, we have estimated recent months using Ember's own generation forecasting model. Regional and world data is largely based on actual reported data, with Ember's monthly data covering countries representing more than 90% of global electricity demand. Other countries are estimated.

A full methodology on data sources and methods is available here.

Note on electricity source classification

Bioenergy has typically been assumed (by the IPCC, the IEA and many others) to be a renewable energy source, as forest and energy crops can be regrown and replenished, unlike fossil fuels. It is included in many governmental climate targets, including EU renewable energy legislation.

Ember therefore includes it in “renewables” to allow easy comparison with legislated targets. However, we recognise that the IPCC-reported lifecycle carbon intensity of bioenergy is significantly higher than other renewables and nuclear, and this is incorporated into our power sector emissions estimate.

More information about Ember’s classification of electricity sources can be found in the full methodology for Ember’s Monthly Electricity Data under “Fuel Types”.

Emissions

References to CO2 emissions in this report are using CO2-equivalent emissions, which include other greenhouse gases such as methane (CH4). Power sector emissions are based on the methodology from Ember’s Electricity Data, which can be found here.

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Contributors

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Cover photo

Aerial shot of wind, solar and battery storage in China – hrui / Getty images