

Global Electricity Mid-Year Insights

Global electricity demand growth was met entirely by renewable power in the first half of 2022, halting the rise in fossil fuels.





About

This report gives mid-year insights into the global electricity transition. It analyses electricity data from 75 countries representing 90% of global electricity demand and includes projections for changes in the remaining countries. It compares the first six months of 2022 (H1-2022) to the same period in 2021 (H1-2021) to show how the electricity transition has progressed.

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Languages

English, Chinese

Disclaimer

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Highlights

+389

Change in global
electricity demand (TWh)

+416

Change in renewable
generation (TWh)

+5

Change in fossil
generation (TWh)

Executive summary

Renewables met all global electricity demand growth

The world is in the middle of an energy crisis. With all the headlines, it might have been expected that coal and gas use would have increased in 2022. But that is not what happened, at least in the electricity sector. In fact, in the first half of 2022, renewables met all the growth in global electricity demand, halting the rise in fossil fuels.

01

Renewables met all growth in global electricity demand

Global electricity demand rose 3% in the first half of 2022 compared to the same period last year; this was in line with the historic average. **Wind and solar met 77% of this demand growth, and hydro more than met the remainder.** In China, the rise in wind and solar generation met 92% of its electricity demand rise; in the US it was 81%, while in India it was 23%.

02

Coal and gas generation remained almost unchanged

Because renewables growth met all the demand growth, fossil generation was almost unchanged. Coal declined by 0.7% and gas declined by 0.05%; these were offset by a slight rise in oil. Consequently, global CO₂ power sector

emissions were unchanged, despite the rise in electricity demand. Coal in the EU rose 15% only to cover a temporary shortfall in nuclear and hydro generation. Coal in India rose 10% because of a sharp rebound in electricity demand from the lows early last year when the Covid-19 pandemic struck hardest. These rises were offset against falls of 3% in China and 7% in the US. electricity generation in Indonesia in 2020 (the latest data available).

03

Wind and solar growth delivered tangible cost and climate benefits

The growth in wind and solar in the first half of 2022 prevented a 4% increase in fossil generation. This avoided \$40 billion USD in fuel costs and 230 Mt CO₂ in emissions. In China, the growth in wind and solar enabled fossil fuel power to fall 3%, rather than rise by 1%. In India, it slowed down the rise in fossil fuel power from 12% to 9%. In the US, it slowed down the rise in fossil fuel power from 7% to 1%. In the EU, it prevented a major rise in fossil fuel power – without wind and solar, fossil generation would have risen by 16% instead of 6%.

04

Power sector emissions may yet set a new record high in 2022

In July and August there was a rise in global coal and gas generation, leaving open the possibility that power sector CO₂ emissions in 2022 may yet rise, following [last year's all-time high](#). This happened because China's hydro surplus turned into deficit due to record droughts, and heatwaves struck across the world, pushing up electricity demand.

We are getting closer to a tipping point, where clean electricity – led by wind and solar – will meet all future electricity demand growth, and thus fossil fuel power generation peaks. Renewable generation growth has matched global electricity demand growth before; in 2015 and 2019. But when we are there, that is only the beginning. The electricity sector should be quickly reducing emissions. The fact that we're still at or close to record highs shows how much more quickly the electricity transition needs to happen.

Wind and solar are proving themselves as an effective solution as the world faces escalating climate impacts, energy insecurity and economic instability. They are bringing down costs, and improving security.

“Wind and solar are proving themselves during the energy crisis. The first step to ending the grip of expensive and polluting fossil fuels is to build enough clean power to meet the world’s growing appetite for electricity.”

“We can’t be sure if we’ve reached peak coal and gas in the power sector. Global power sector emissions are still pushing all-time highs when they need to be falling very quickly. And the same fossil fuels pushing us into a climate crisis are also causing the global energy crisis.”

“We have a solution: wind and solar are homegrown and cheap, and are already cutting both bills and emissions fast.”

Małgorzata Wiatros-Motyka

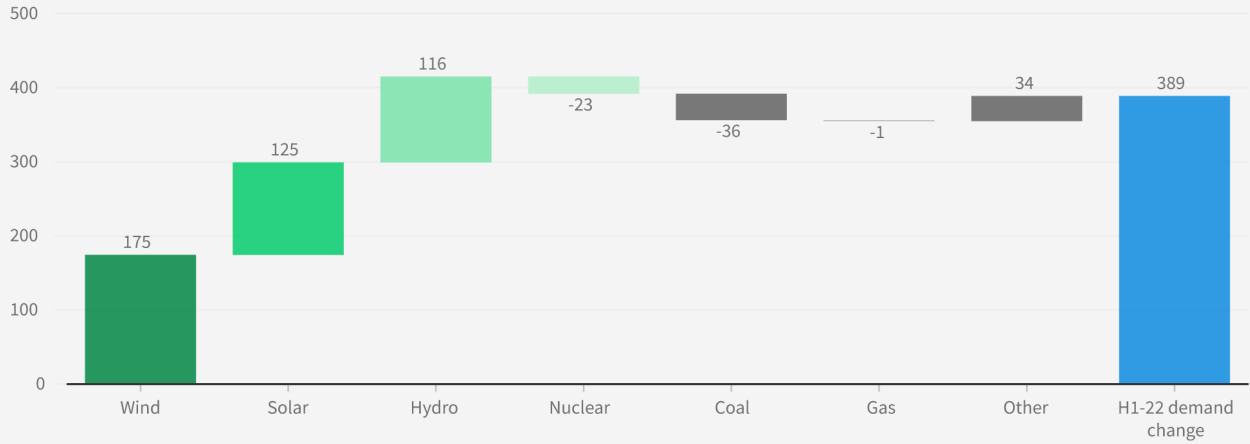
Senior Electricity Analyst, Ember



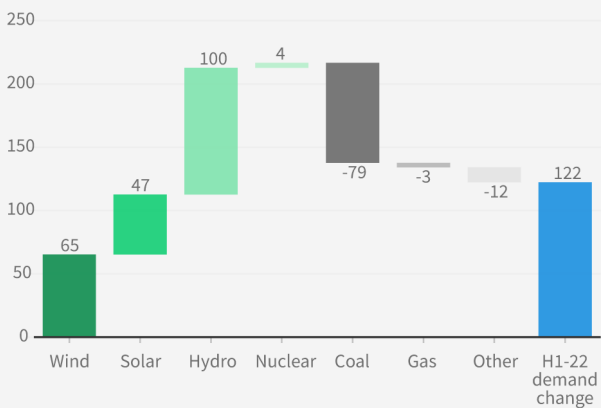
Renewables met growing electricity demand, halting coal and gas

Year on year changes in electricity generation from Jan to Jun 2022, in terawatt hours

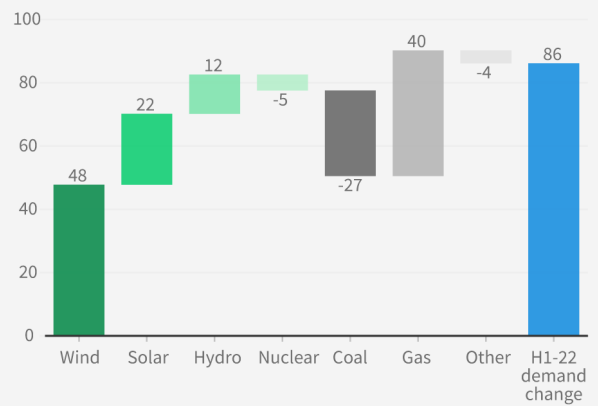
World



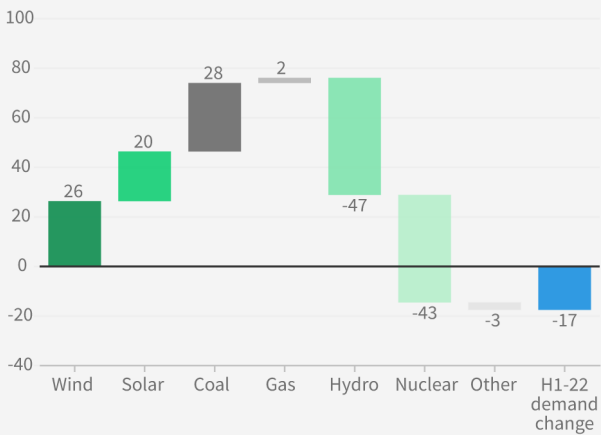
China



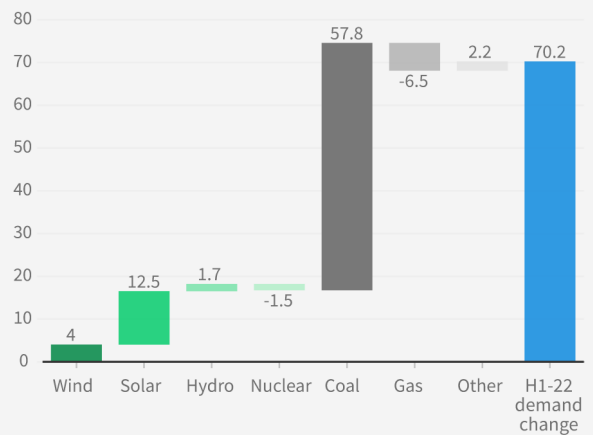
United States of America



European Union



India



Source: Ember's Global Electricity Mid-Year Insights

Chapter 1: Global analysis

Global electricity trends in the first half of 2022

Renewables, driven by wind and solar, met all the rise in global electricity demand. Therefore coal and gas generation were unchanged.

However, power sector emissions may yet set a new record high in 2022. It's uncertain if we have reached the point that the rise in clean power meets all the rise in electricity demand, therefore halting the rise in fossil fuels in the power sector.

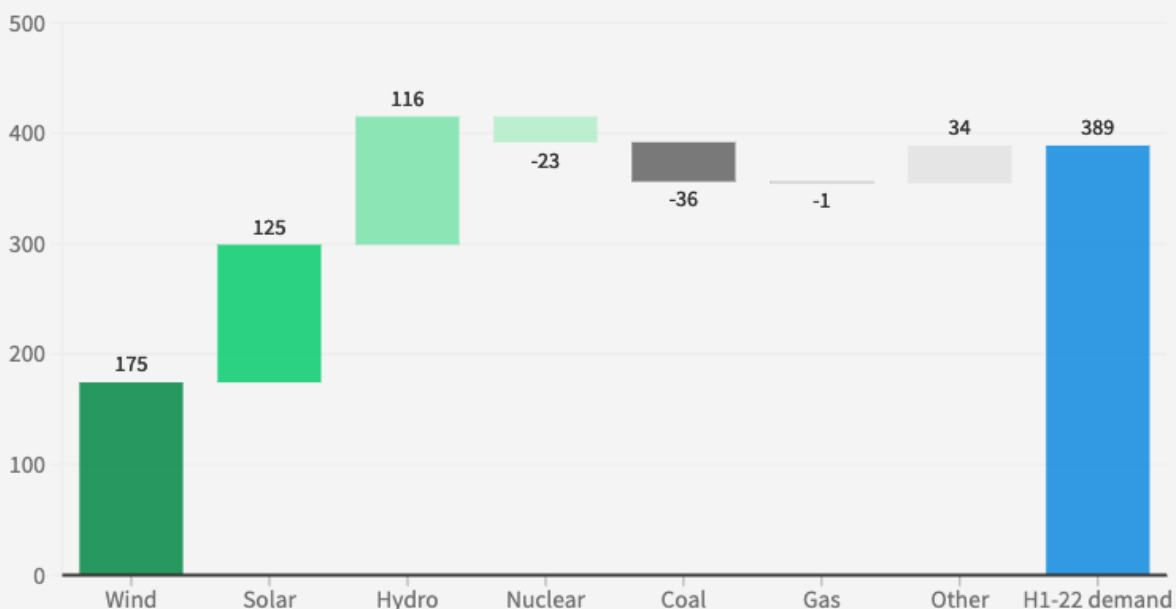
Renewables met growing electricity demand, halting coal and gas

Global electricity demand rose 3%, in line with the historic average. Global electricity demand increased by 389 TWh (+3%), in line with average historical demand growth for 2010–2021. Total global demand reached 13,393 TWh in the first half of 2022, up from 13,004 TWh in the same period last year.

Renewables growth (wind, solar, hydro) met all of the electricity demand growth. Global renewables generation increased by 416 TWh, slightly exceeding the growth in global electricity demand of 389 TWh. In total, renewables generated 28% of global electricity in the first half of 2022 (3,802 TWh), up from 26% (3,387 TWh) in the same period last year.

Renewables met growing electricity demand, halting coal and gas

Year on year change in electricity generation from Jan to Jun 2022, in terawatt hours



Source: Ember's Global Electricity Mid-Year Insights
Other includes renewables and fossil fuels not otherwise listed

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Wind and solar met 77% of this demand growth. Wind and solar are now being built at scale in countries where electricity demand is growing the fastest: in China, wind and solar generation met 92% of its electricity demand rise; in the US it was 81%, while in India it was 23%.

Wind generation rose by 175 TWh (19%) globally in the first half of 2022, while solar increased by 125 TWh (25%). In total, solar generated 5% of global electricity in the first half of 2022 (619 TWh), while wind generated 8% (1,102 TWh).

Most of the rise in generation can be attributed to the increase in installed capacity. However, the rise in generation is a little higher than we would expect due to capacity increases alone (solar capacity in 2021 grew by 19% and wind by 13%). Other contributing factors are weather conditions (for example especially low wind in Q1-2021 in China and the EU), the timing of capacity additions, and the rise in higher output offshore wind.

Hydro generation met the remaining rise in electricity demand. Hydro generation increased by 6% (+116 TWh), rising from 1,965 TWh in the first half of 2021 to 2,081 TWh in the same period this year. The growth in capacity was less than half of this. Therefore, the majority of the hydro generation rise – unlike for wind and solar – was due to favourable weather conditions. In particular, the poor hydro conditions seen in the first half of last year in China, Turkey and Brazil were not repeated this year.

Coal and gas generation were almost unchanged. Because increased electricity demand was met from renewables, there was no need for additional generation from fossil fuels. Globally fossil generation changed only by +4 TWh, from 7998 TWh in the first half of 2021 to 8002 TWh in the same period this year. Coal fell by 36 TWh (-0.7%), gas by 1 TWh (-0.05%), while other fossil fuels (mainly oil) increased by 42 TWh (+14%). Consequently, global CO₂ power sector emissions were unchanged, despite the rise in electricity demand.

Power sector emissions may yet set a new record high in 2022

Despite the halt in fossil generation in the first half of 2022, coal and gas generation increased in July and August, as shown in the graph below. This happened because China's hydro surplus early in 2022 turned into deficit by August as a severe drought hit the hydro-rich province of Sichuan, and heatwaves struck across the world, pushing up electricity demand. Nuclear generation is still down considerably in Europe, due to outages in France and German closures.

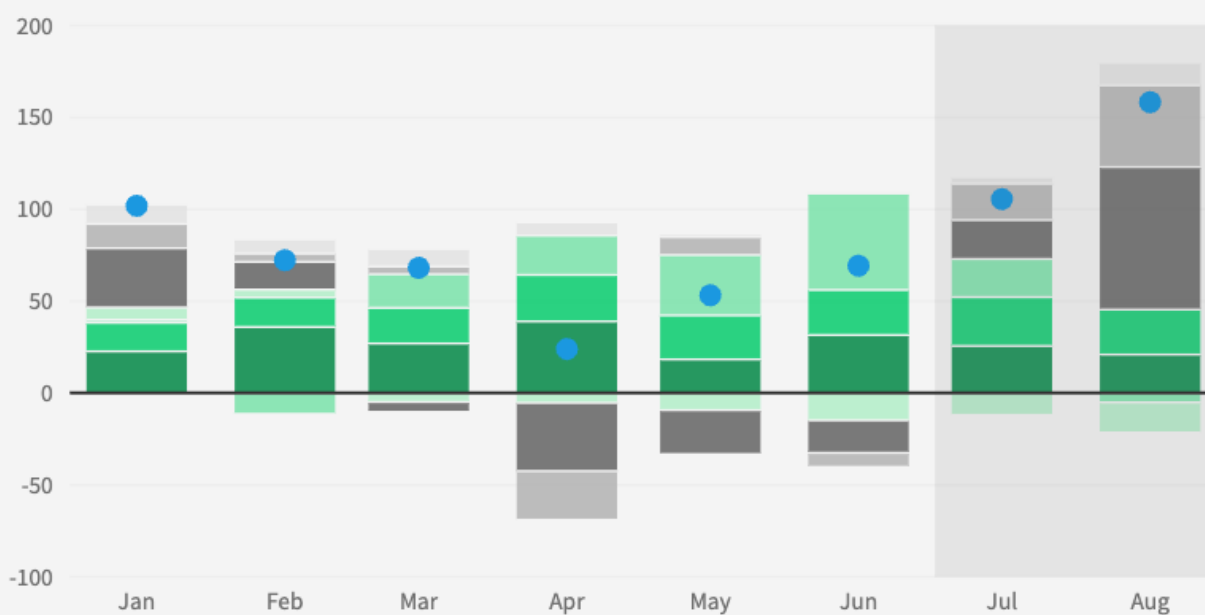
Our latest year-to-date estimates for January to August show a 1% (+63 TWh) rise in coal power and a 1.6% (+63 TWh) rise in gas power as well as a rise of oil generation of 14% (+57 TWh) compared to the same period last year. This rise in fossil

generation led to global power sector CO₂ emissions increasing by 1.7% (133 Mt) during January to August, compared to the same period last year. Consequently, it is hanging in the balance whether fossil generation – and total power sector CO₂ emissions – will rise to set a new record this year.

World

Monthly generation year-on-year change in terawatt hours

Electricity demand Wind Solar Hydro Nuclear Coal Gas Other



Source: Ember's Global Electricity Mid-Year Insights

Other includes bioenergy, other renewables and other fossil fuels.

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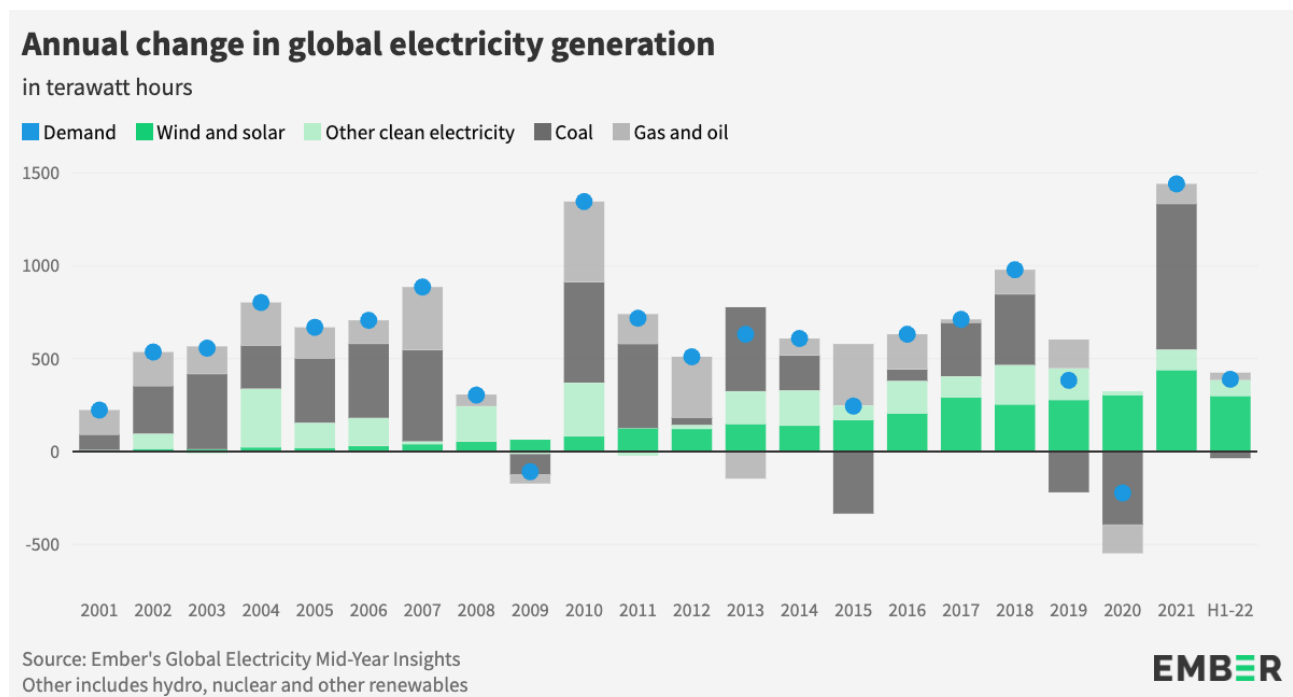
Are we close to a new tipping point?

Have we reached the point that the rise in clean power meets all the rise in electricity demand, therefore halting the rise in fossil fuels in the power sector?

This has happened twice before – in 2015 and 2019 (see graph below) – which were both years of below-average demand growth. The rises in July and August make it less likely it will happen in 2022, but it will certainly be close.

As wind and solar add more generation every year, that tipping point gets closer. However, electricity demand growth will also be increasing, as electrification of heating, transport and industry picks up this decade, meaning we will need even more clean electricity every year.

But for a 1.5 degree pathway, it's not enough to stop fossil generation rising. The IEA Net Zero report shows power sector emissions need to more than halve by 2030, and reach “net zero” by 2040, ten years ahead of the rest of the global economy.



Chapter 2: Country analysis

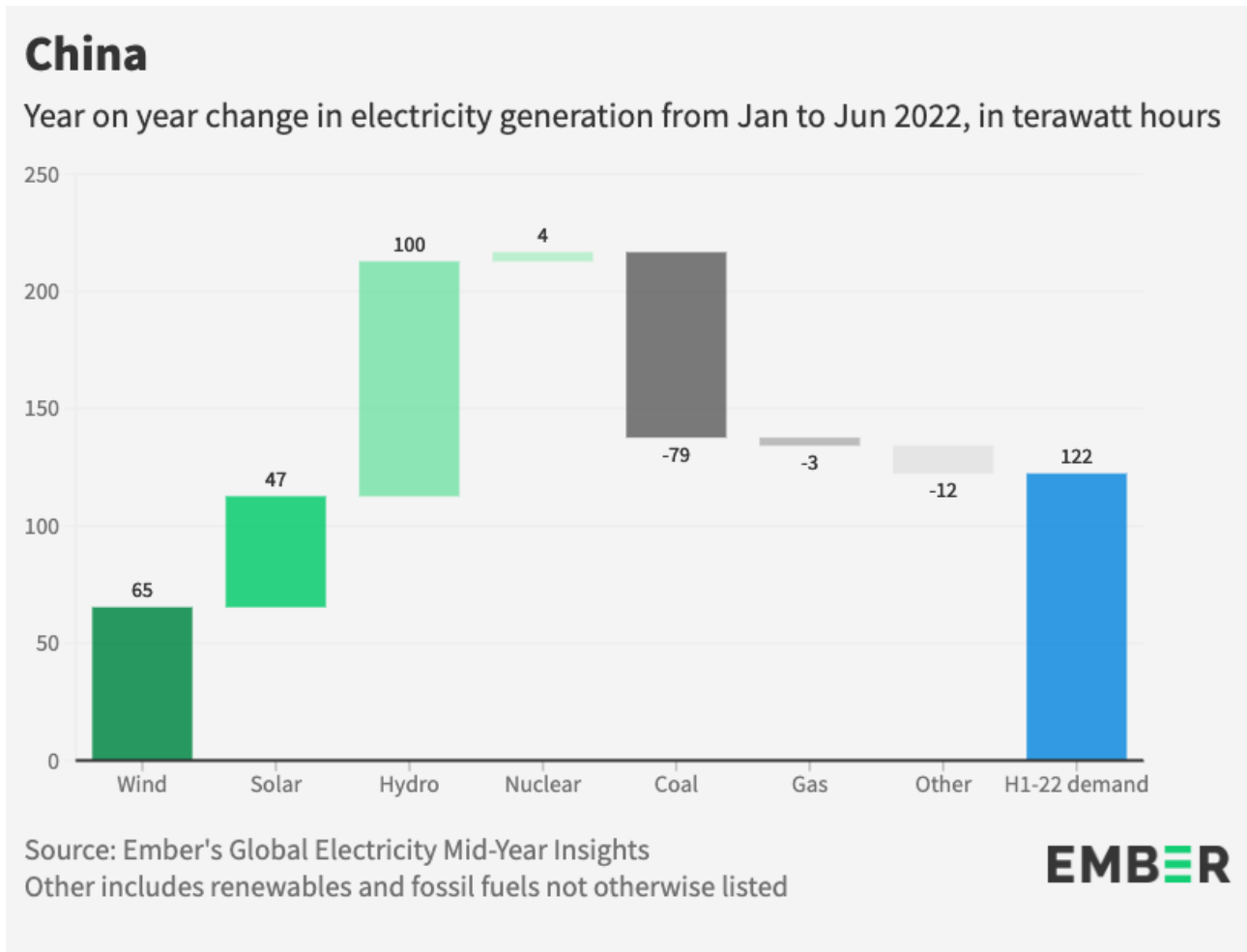
Mid-year insights by country

In China, the rise in wind and solar generation alone met 92% of its electricity demand rise; in the US it was 81%, while in India it was 23%.

China

Growth in renewables and muted demand helped China's coal fall in H1-2022

Wind and solar generation met 92% of China's electricity demand rise in the first half of 2022. However, this was against the backdrop of muted electricity demand growth. A large hydro rebound meant total renewables more-than covered the rise in electricity demand leading to a decline in coal generation. However, by the end of August, coal's fall in H1-2022 had been wiped out.

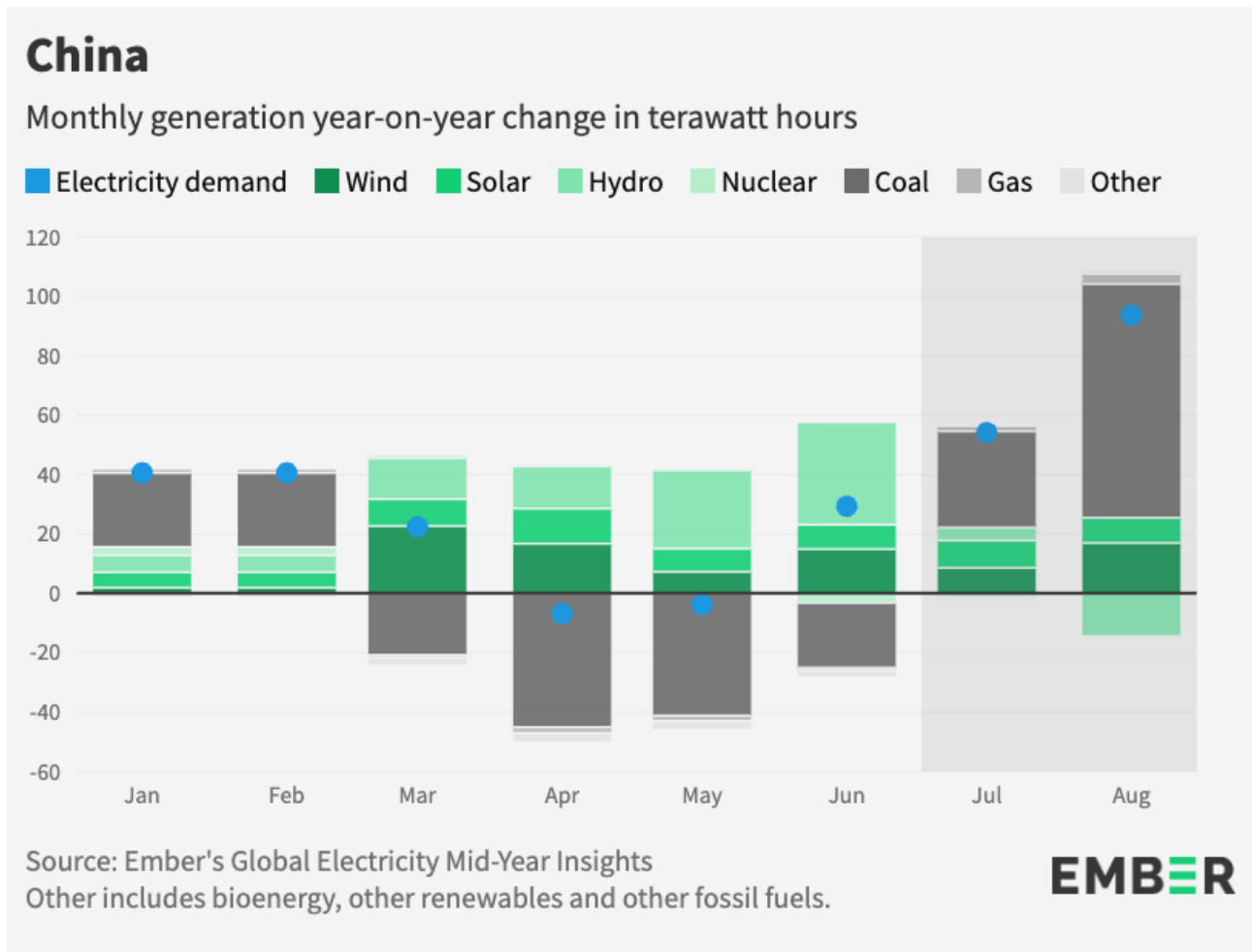


Wind and solar generation met 92% of China's electricity demand rise in the first half of 2022. Wind rose by 65 TWh, and solar rose by 47 TWh, meeting 92% of the 122 TWh rise in electricity demand. China's rise in wind generation was 37% of the total global increase of wind generation, and for solar it was 38%.

Electricity demand growth was muted. China's electricity demand grew by 3% in the first half of 2022 compared to the same period last year, and even went into reverse in April and May during the deepest lockdowns. This is slower than the average historical demand growth for 2010-21 of 7%. Had electricity demand grown in line with the trend, wind and solar would have covered a smaller amount of the rise in electricity demand.

A large hydro rebound meant total renewables more-than covered the rise in electricity demand leading to a decline in coal generation. Hydro rebounded from very poor conditions in early 2021. Hydro generation rose by 21%, compared to an estimated increase in capacity of about 4%.

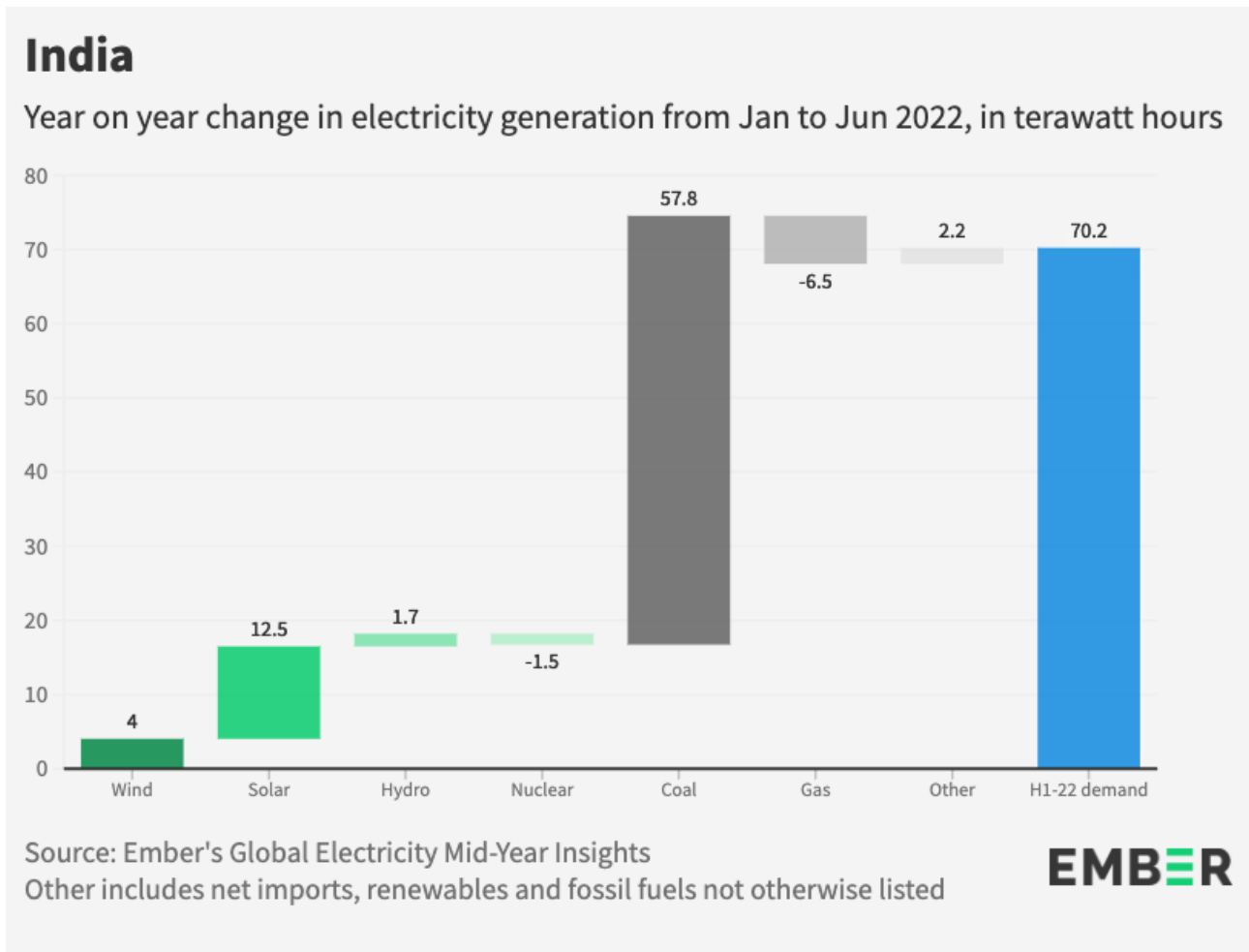
Coal's fall in H1-2022 had been wiped out by the end of August. The hydro situation turned from boom to bust, with extensive drought across the hydro region of Sichuan in August. Extensive heat waves also pushed up electricity demand; electricity demand in August was 12% higher than in August 2021. As a result, coal increased by 111 TWh in July and August compared to last year, cancelling out the 79 TWh fall in coal power seen during the first six months of the year.



India

India's coal power rose as renewables growth only partially met the rebound in electricity demand in H1-2022

In India, the growth in wind and solar generation met 23% of the rise in India's electricity demand in the first half of 2022. This was in context of a strong rebound in electricity demand from the pandemic lows in 2021. In July and August, electricity demand growth calmed.



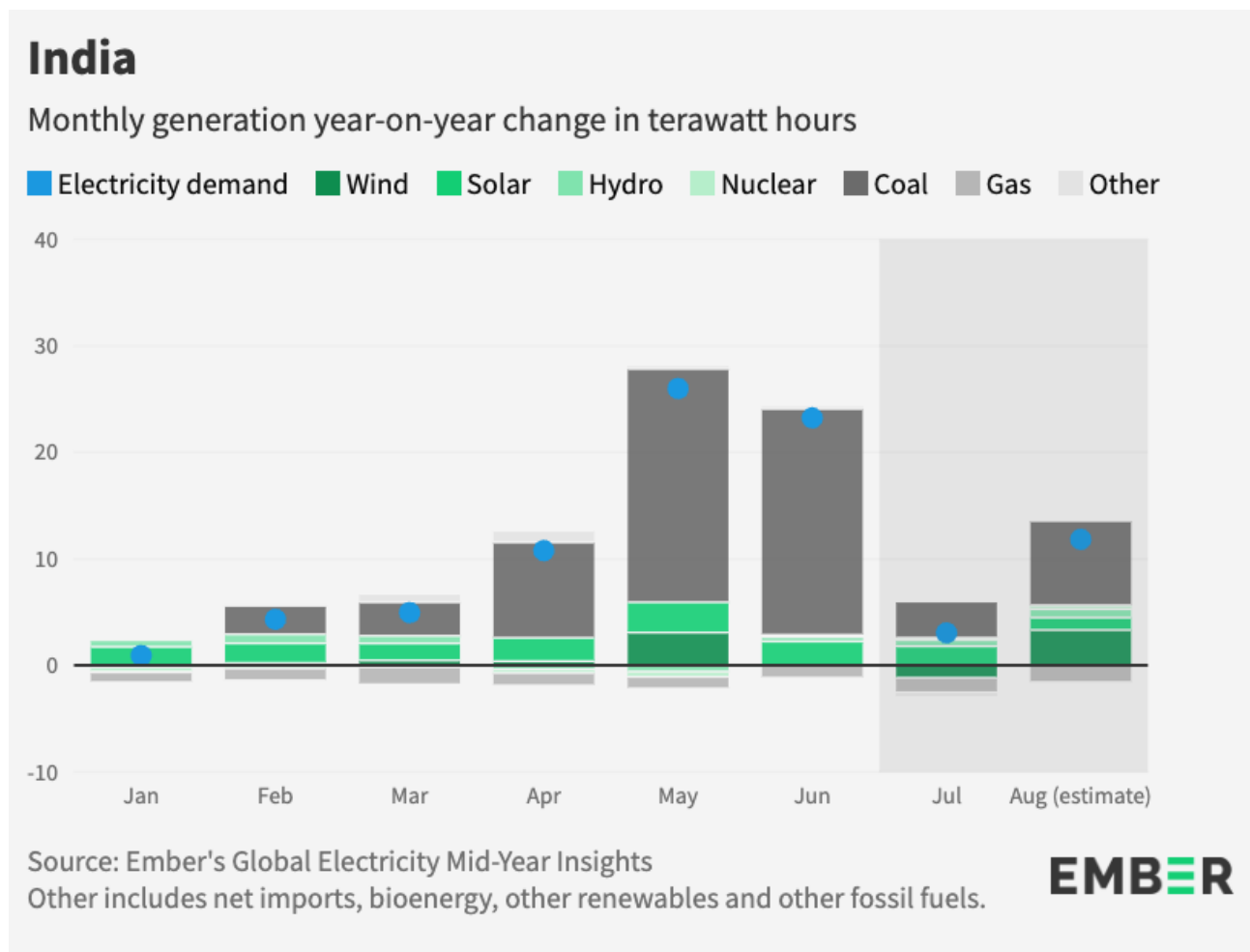
Wind and solar generation met 23% of the rise in India's electricity demand in the first half of 2022. Wind generation increased by 4 TWh (+13%) and solar by 12 TWh (+35%). Unlike China, the EU and the US, most of India's rise was in solar, rather than wind generation.

Electricity demand rebounded. India's electricity demand rebounded by a sizable 10%. This is higher than the average 2010–21 growth of 7%. It was mainly due to the country's economy rebounding from an intense pandemic period seen in Q2 of 2021, which saw very low electricity demand. Had electricity demand grown in line with the trend, wind and solar would have obviously covered a larger amount of the rise in electricity demand.

Coal generation rose rapidly, necessitated by a spike in electricity demand post-pandemic. India's coal generation rose by 10% in the first half of 2022 compared to the same period last year.

The role of gas in India's electricity mix has further diminished. Gas generation fell by 31% in the first half of 2022 compared to the same period last year. This meant gas generation was only 1.78% (14 TWh) of India's total electricity generation in the first half of 2022.

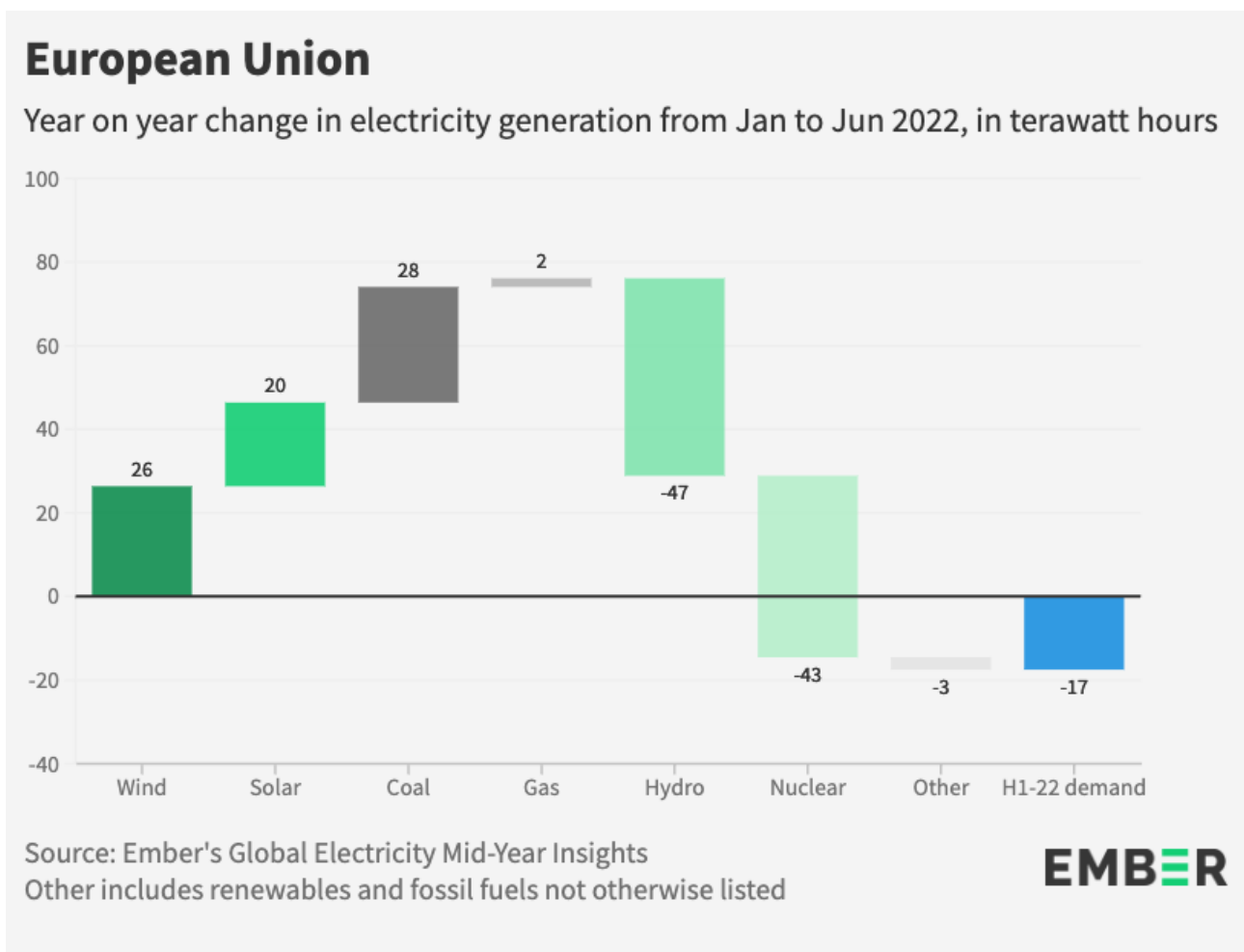
Electricity demand growth slowed down in July and August. This slowed down the rise in coal power.



European Union

Wind and solar rose in the EU but a temporary decline in hydro and nuclear led to a brief uptick in coal

In the EU, hydro and nuclear generation declined significantly. Wind and solar generation rose, enough to meet half of the nuclear and hydro shortfall. Coal generation was also needed to rise to cover the temporary shortfall.



In the EU, hydro and nuclear generation declined significantly (-91 TWh) in the first half of 2022, mostly due to temporary reasons. Hydro generation fell by 25% (-47 TWh) compared to the same period last year due to the worst [drought](#) in Europe in 500 years. This will likely bounce back next year if hydro conditions normalise.

Nuclear generation fell by 12% (-43 TWh) due to French outages and German plant closures. EDF [forecast](#) their nuclear generation will rise from 280–300 TWh in 2022 to 300–330 TWh in 2023 and 315–345 TWh by 2024.

Wind and solar generation rose by 45 TWh, enough to meet half of the nuclear and hydro shortfall. Wind generation rose by 14% (+26 TWh) and solar by 25% (+19 TWh).

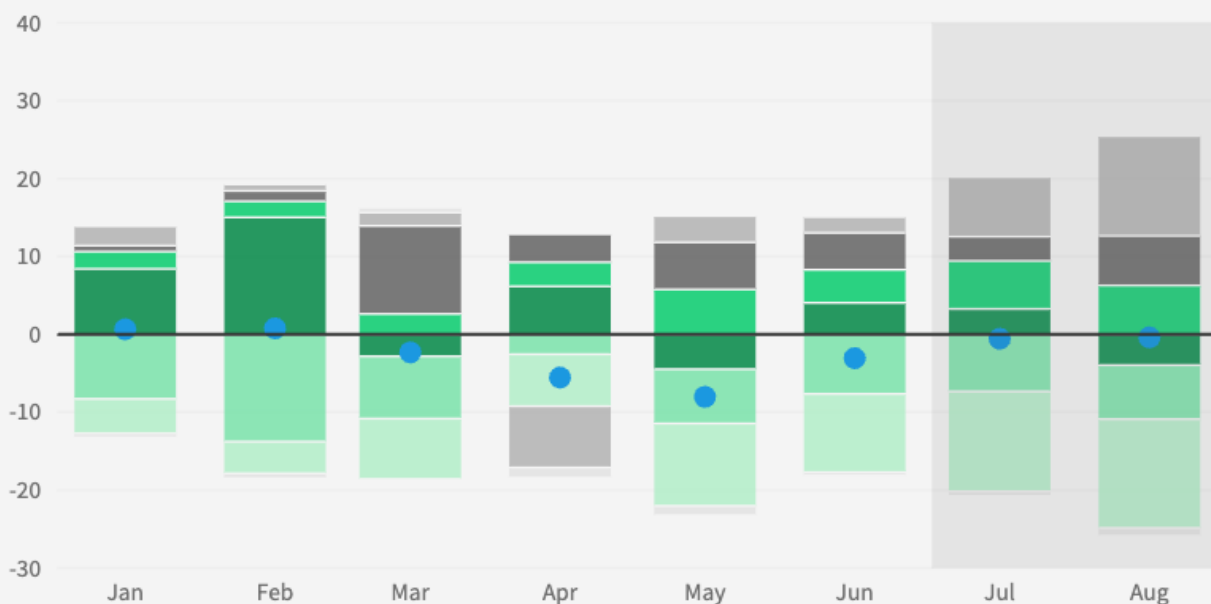
Coal generation needed to rise to cover the temporary shortfall. When the fall in hydro and nuclear is netted against a rise in wind and solar generation and a slight fall in demand, the remaining supply shortfall was 27 TWh. This was met by a 17% (+15 TWh) rise in hard coal generation and a 12% (+12 TWh) rise in lignite generation. Gas generation remained almost flat at +1% (+2 TWh). In the first half of 2022, coal still only provided 16% of the EU electricity mix; this represents a significant reduction from 2015 where coal made up a quarter of the EU's electricity production.

The same pattern has continued into July and August. French nuclear power set new lows in August, and the hydro situation is only just beginning to recover.

European Union

Monthly generation year-on-year change in terawatt hours

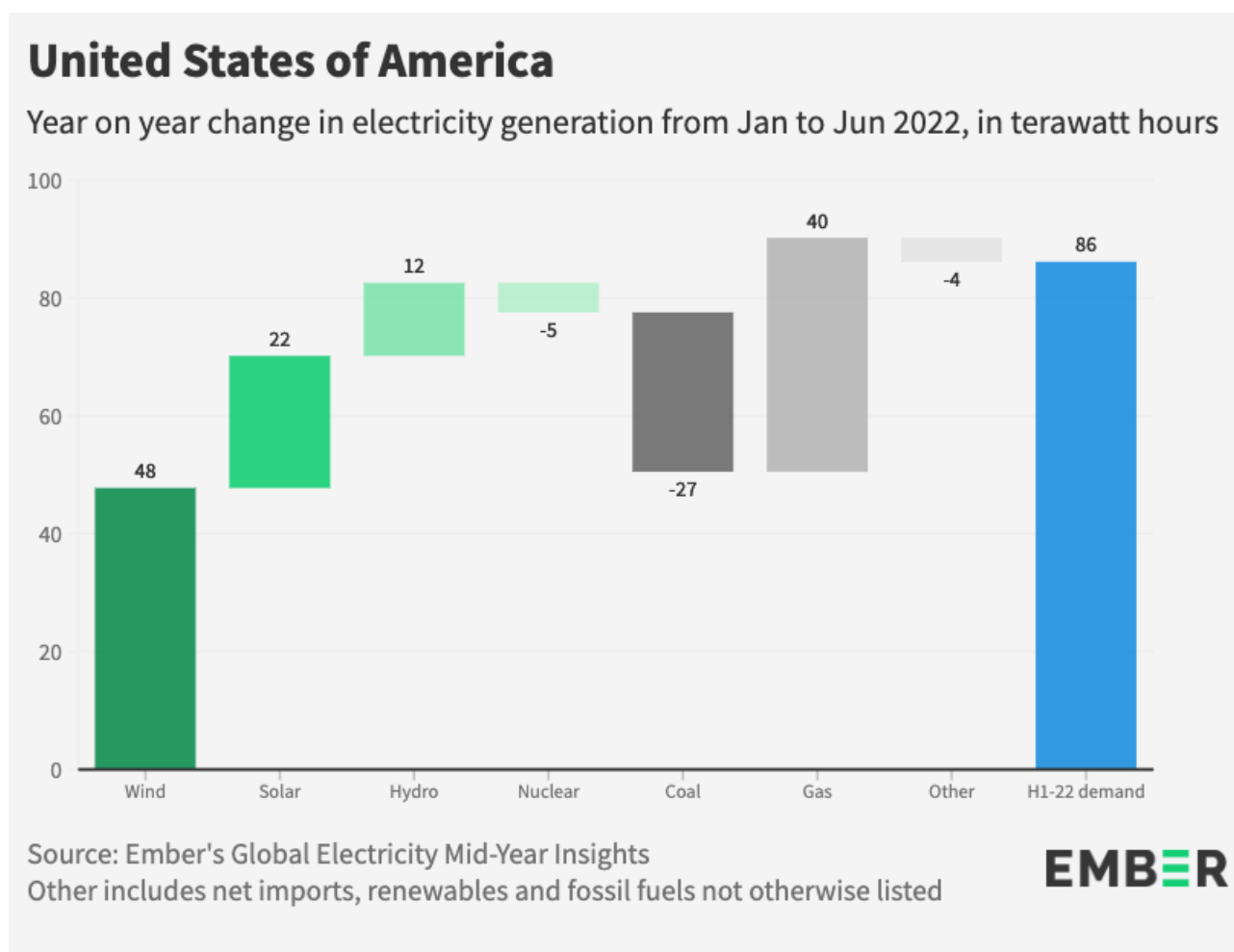
■ Electricity demand ■ Wind ■ Solar ■ Hydro ■ Nuclear ■ Coal ■ Gas ■ Other



Source: Ember's Global Electricity Mid-Year Insights
Other includes bioenergy, other renewables and other fossil fuels.

United States

Wind and solar grew to meet rising electricity demand, preventing a big rise in fossil generation



Wind and solar generation met 81% of the rise in the United States' electricity demand in the first half of 2022. Wind generation increased by 25% (+48 TWh) and solar by 28% (+22 TWh). The rest of the electricity demand was met by a small rise in hydro generation (+ 12 TWh), and a small rise in fossil generation (+13 TWh).

There was a spurt in electricity demand growth. The 4.2% increase in electricity demand seen in the first half of 2022, which resulted from an increase in economic activity, was much higher than the 11-year average increase of 0.5%.

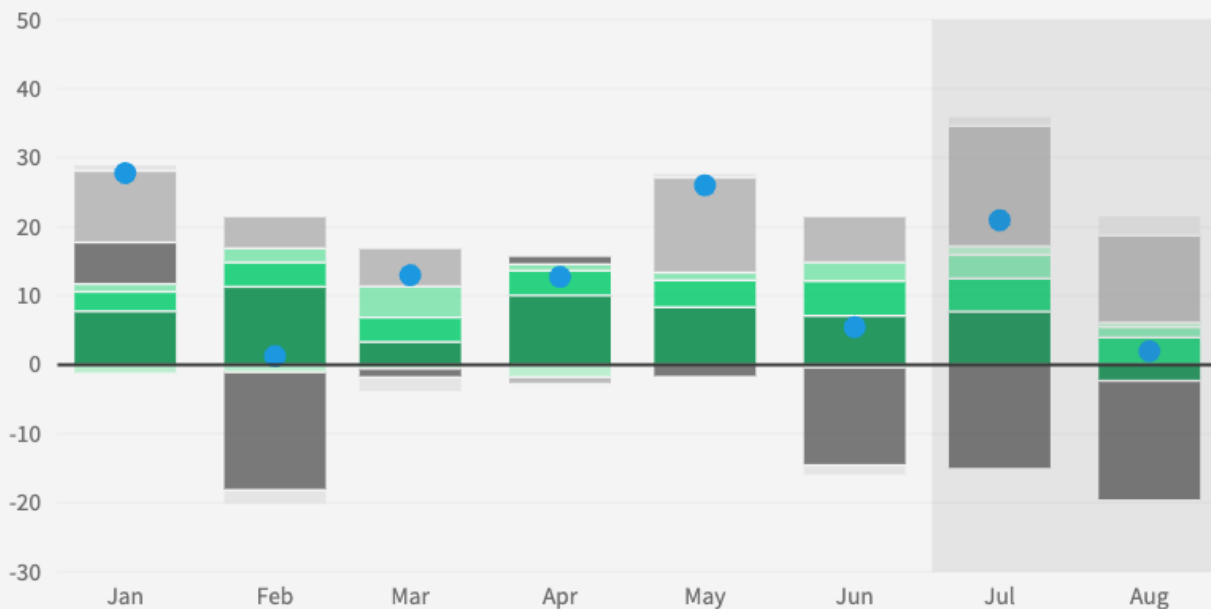
Fossil generation rose by 1% in the US – however, coal power still fell, as gas generation took market share from coal. Gas increased by 5.6% (+40 TWh) and coal fell by 7% (-27 TWh) in the first half of 2022 compared to the same period last year.

The switch from coal to gas continued into July and August. By the end of August, the year-to-date changes were coal down 9.2% and gas up 6.6%.

United States of America

Monthly generation year-on-year change in terawatt hours

Electricity demand Wind Solar Hydro Nuclear Coal Gas Other



Source: Ember's Global Electricity Mid-Year Insights

Other includes net imports, bioenergy, other renewables and other fossil fuels.

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Chapter 3: The “what if” scenario

Wind and solar are already changing the global power system

What if there was no rise in wind and solar in H1-2022? Instead of flat-lining, fossil power generation – and therefore global power sector CO₂ emissions – would have risen by around 4% and resulted in an increased fuel bill of \$40 billion USD.

The rise in wind and solar power stopped our need for more fossil fuel generation

Globally, wind and solar generation rose by 299 TWh. Had they not risen, this generation would primarily have been met with coal and gas. That would have pushed up total global fossil generation by 4% and incurred \$40 billion USD in fuel cost alone and 203 Mt CO₂ emissions in the first half of 2022.

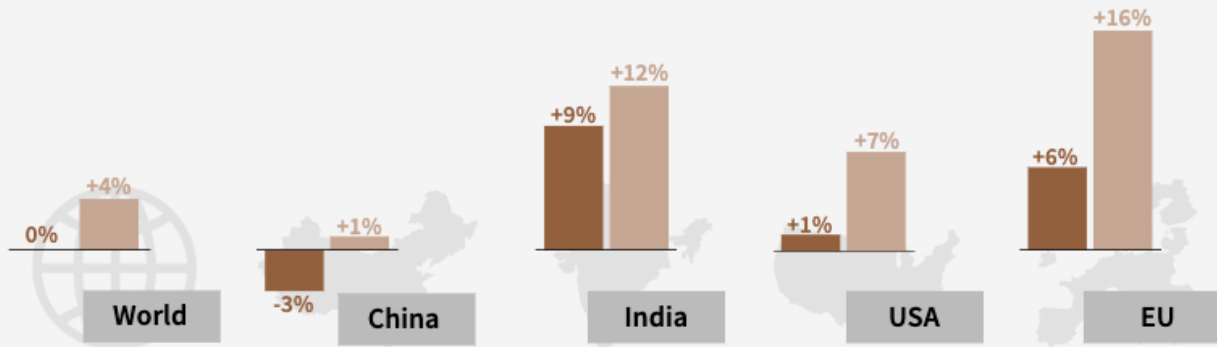
We can also apply this basic “what if” logic to countries. This shows that wind and solar had the following impacts:

- China: Enabled fossil fuel power to fall 3%, rather than rise by 1%
- India: Slowed down the rise in fossil fuel power from 12% to 9%
- US: Slowed down the rise in fossil fuel power from 7% to just 1%
- EU: Prevented a major rise in fossil fuel power – without wind and solar, fossil generation would have risen by 16% instead of 6%.

What if wind and solar generation hadn't risen?

Year on year change in first half of 2022

■ % actual change in fossil generation
■ % change in fossil generation IF wind and solar hadn't risen



Source: Ember's Global Electricity Mid-Year Insights

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Calculating the cost saving

Because we know how much wind and solar reduce the need for fossil fuels, we can also estimate a monetary value of the savings in fuel costs.

We assume \$240/tonne of coal. This is the average Australia export [price](#) for the first half of 2022. At 40% coal power plant efficiency, and no transport or carbon costs, that calculates to \$96 per MWh.

We assume \$22/MBtu gas average price. This is the Q1/Q2 straight average price for TTF, Asia spot and Henry Hub prices from [IEA](#). At 50% gas power plant efficiency, and no transport or carbon costs, that calculates to \$151 per MWh.

We assume a split of a third gas generation and two-thirds coal generation, roughly in line with the overall global electricity mix, giving a weighted average price of \$133/MWh.

So if the 299 TWh generated by wind and solar generation was instead generated by fossil fuel generation, that would have incurred \$40 billion USD in fuel cost alone in the first half of 2022.

Conclusion

A pathway out of multiple crises

Wind and solar are proving themselves as an effective solution as the world faces escalating climate impacts, energy insecurity and economic instability.

Bringing down costs, and improving security

Our analysis shows in the first half of 2022, for the year-on-year increase in wind and solar alone, countries saved paying \$40 billion USD on coal and gas. For many countries, this meant improving national security, by reducing their import bill by billions of dollars, much of which would have been paid to countries that are fuelling global instability.

As coal prices hit [new records](#), and gas is still several times higher than pre-crisis, it's clear high fossil prices will not fade quickly. Even before the current crisis, wind and solar were already cheaper than fossil generation in many countries. TransitionZero [tracks](#) the difference between coal and gas prices, compared to renewable prices, and renewables generation has never been cheaper.

Bringing down emissions

The year-on-year growth in wind and solar alone prevented global power sector emissions rising by 4% in 2022. That's 230 million tonnes of CO₂ saved in the first half of this year, equivalent to more than twice Germany's power sector emissions of 104 Mt in the same period.

A tipping point?

Renewable generation growth has matched global electricity demand growth before; in 2015 and 2019. We are getting closer to a tipping point, where clean electricity – led by wind and solar – will meet all future electricity demand growth, and thus fossil fuel power generation peaks.

But we're not quite there yet

It's not certain that for 2022 in total the rise in renewables will cover all of the rise in electricity demand. But as wind and solar add more generation every year, that tipping point gets closer.

And when we are there, that is only the beginning. The electricity sector should be quickly reducing emissions. The fact that we're still at or close to record highs shows how much more quickly the electricity transition needs to happen.

Supporting materials

Methodology

The data for this report is based on Ember's yearly and monthly electricity dataset. You can find the full methodology for underlying emissions, generation and capacity data [here](#). Yearly and monthly electricity data is available for download in [Ember's data catalogue](#).

Acknowledgements

Front cover image

The first Chinese wind turbine, Hong Kong, China

Image by: [Agencja Fotograficzna Caro](#) / Alamy Stock Photo



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