

Analysis of the 25 largest power sector emitters in 2023

This Annex provides a summary analysis of the current electricity transition status in a further twenty-five countries and regions that are among the world biggest absolute CO₂ emitters, alongside the top six set out in Chapter 5 – Major Countries and Regions.

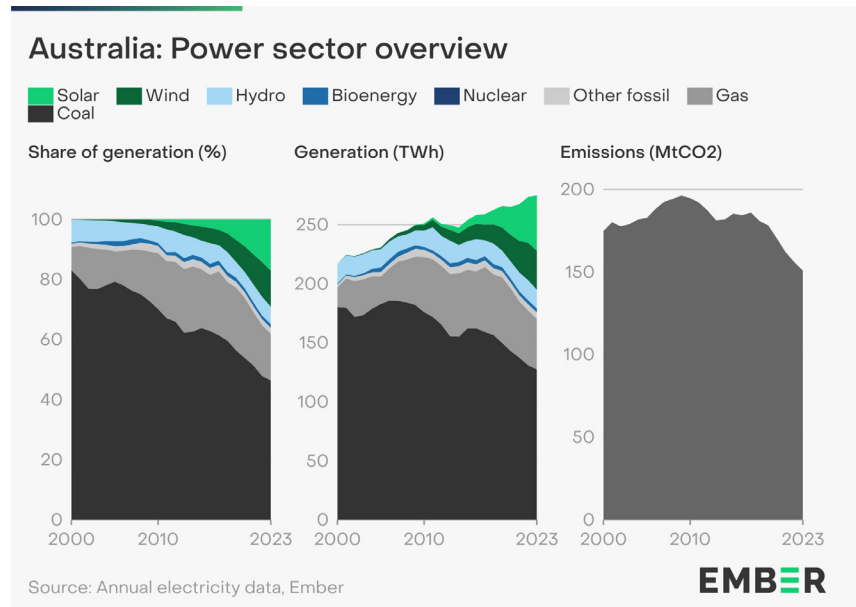
The countries are presented in alphabetical order, with their global ranking included, which is based on the amount of carbon dioxide emissions produced from the electricity sector of the given country or region in 2023, or the previous year if no data is available.

Australia

Australia's wind and solar increase has helped to drive down power sector emissions, but coal remains a major polluter

Australia relied on fossil fuels for 64% of its electricity in 2023, ranking as the G20's [top coal emitter](#) on a per capita basis.

Despite Australia's power sector emissions peaking in 2009, with its share of coal dropping from 73% to 46% and wind and solar growing from 3% to 29%, coal continues to dominate the electricity mix. Australian coal mines also [emit massive amounts](#) of the potent greenhouse gas methane.



Solar leads Australia's clean electricity at 17% of the mix, placing the country in 5th position globally for the largest share of solar. However, although its 29% share of wind and solar is well above the [global](#) average (13%), it lags behind major European economies such as Germany (39%) and the UK (33%).

Australia aims for [82% renewable electricity by 2030](#), while the IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030.

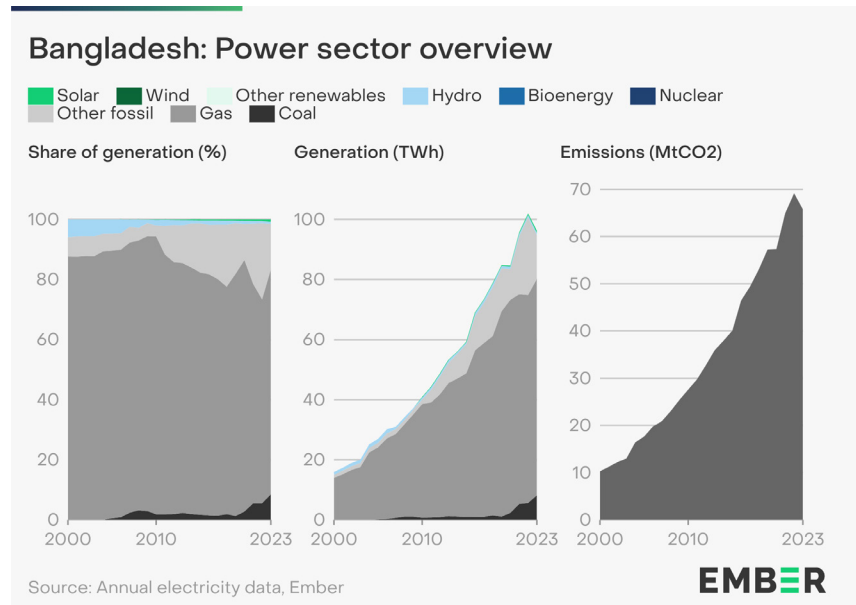
Bangladesh

Bangladesh has mostly met growing demand for electricity with fossil gas, but solar can help reduce reliance on costly imports

Bangladesh relied on fossil fuels for 98% of its electricity in 2023. However, its emissions per capita were below the global average due to low electricity demand.

Bangladesh generates less than 1% of its electricity from hydro and less than 1% from solar and wind – far below the [global](#) average (13%).

Bangladesh's power sector emissions grew over the last two decades as increased demand was met almost entirely by fossil fuels.



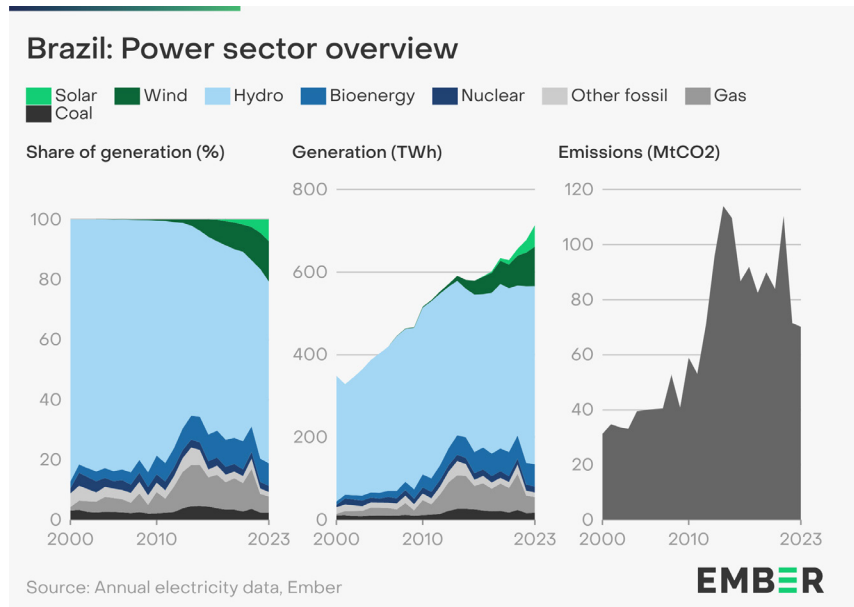
Bangladesh aims for 16% renewable generation by 2030, while the IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030. Ember's analysis shows that an ambitious plan to build [solar could help reduce fossil fuel import costs](#) significantly.

Brazil

Wind and solar will help Brazil manage the impact of climate variability on hydro and rising demand

Brazil generated 91% of its electricity from clean sources in 2023, with hydro dominating the mix at 60%. Its share of wind and solar (21%) is above the [global](#) average (13%) and its neighbour [Argentina](#) (12%), but below Chile (32%).

Brazil relied on fossil fuels for just 9% of its electricity in 2023. Its per capita emissions were well below the global average. In 2023, it had the second lowest carbon intensity of electricity generation in the G20.



Brazil's power sector emissions have fluctuated significantly over the last two decades as weather conditions swung between rainfall and drought, affecting hydro output. A combination of rainy weather and strong growth in wind and solar delivered [record-low fossil power](#) in February of 2023.

Brazil has already surpassed its target of reaching [84% renewable electricity by 2030](#). The IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030.

Canada

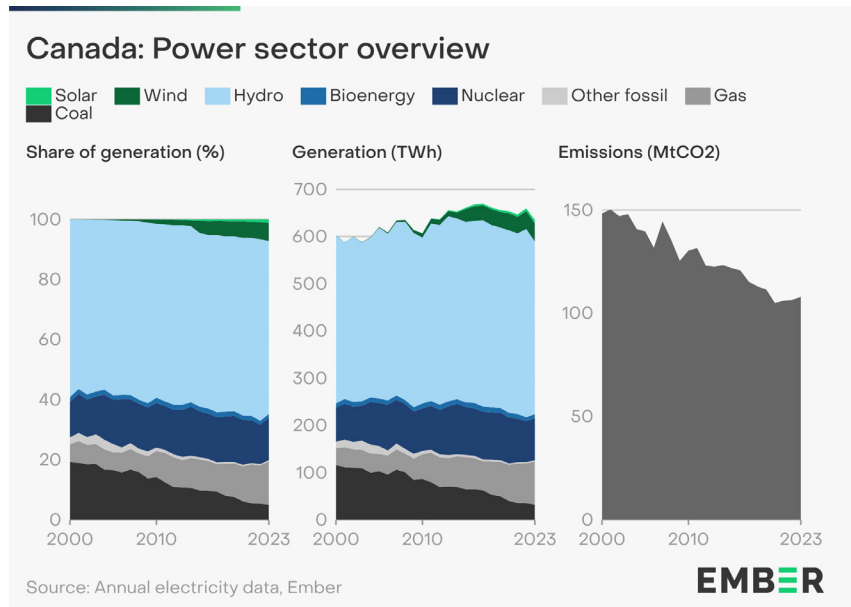
Hydro leads Canada's clean energy, with greater ambition for wind and solar needed to displace remaining fossil fuels

In 2023, Canada relied on fossil fuels for 20% of its electricity. Its emissions per capita were above the global average.

Hydro dominates Canada's electricity mix, making up 58% of generation in 2023. However, wind and solar lagged behind at 7%, below the [global average](#) (13%) and [the United States](#) (16%).

Canada's power sector emissions fell over the last two decades, having peaked in 2001, due to a steady fall in coal generation, which is now just 5% of the electricity mix.

Canada aims for [72% renewable energy by 2030](#), while the IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030.



Egypt

Egypt's vast untapped solar potential can help overcome its fossil gas dependency and cut its rising power sector emissions

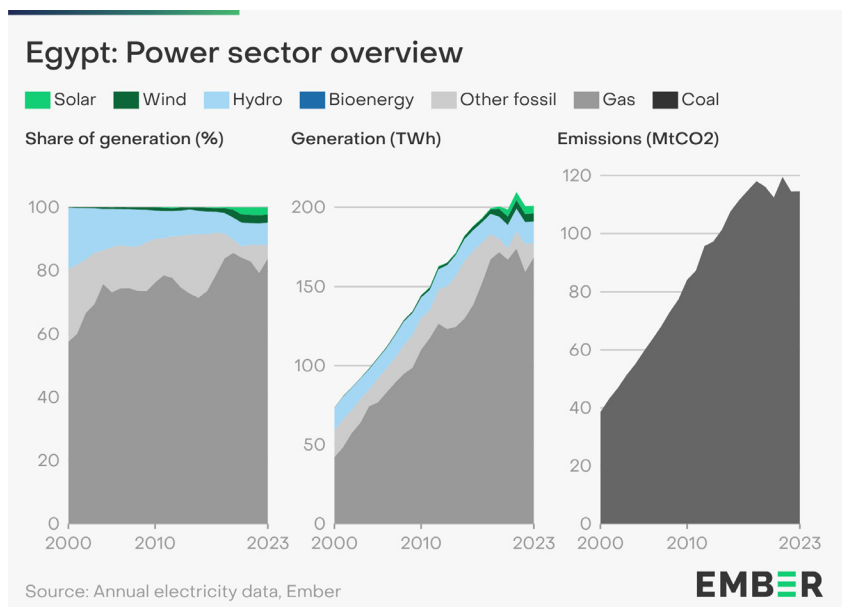
Egypt relied on fossil fuels for 88% of its electricity in 2023. Its per capita emissions are lower than the global average.

Egypt's largest clean electricity source is hydro (7%). Wind and solar are starting to grow, comprising 5% of the country's electricity in 2023, up from just 1% in 2015. However, this figure is still below both the [global average](#) (13%) and the regional average for [Africa](#) (6%).

Egypt is Africa's largest fossil gas generating country, responsible for 45% of the continent's gas generation in 2022.

Over the last two decades, Egypt's electricity demand has more than doubled, and so have its power sector emissions. Rising demand was predominantly met by fossil gas generation which constitutes 84% of Egypt's electricity mix.

Egypt aims for [42% renewable electricity by 2030](#), while the IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030.



Germany

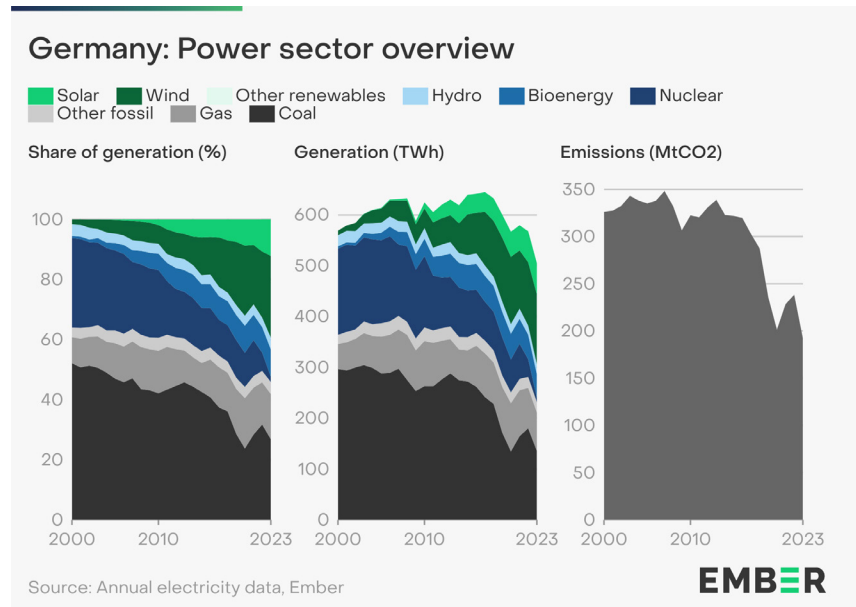
Wind power overtook coal to become Germany's largest source of electricity in 2023

Germany relied on fossil fuels for 46% of its electricity in 2023. Its per capita emissions were above the global average.

Germany's largest source of electricity is wind (27.2%), which overtook coal (26.8%) in 2023. Its share of wind and solar (39%) is three times the [global](#) average (13%) and similar to [Spain](#) (40%) and the Netherlands (41%).

Germany's power sector emissions peaked in 2007 and have fallen significantly since then as coal-fired electricity generation more than halved. In 2000, coal generated 52% of the country's electricity, but by 2023 this had fallen to 26.8%.

Germany aims for 75% [renewable electricity by 2030](#), while the IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030.



Indonesia

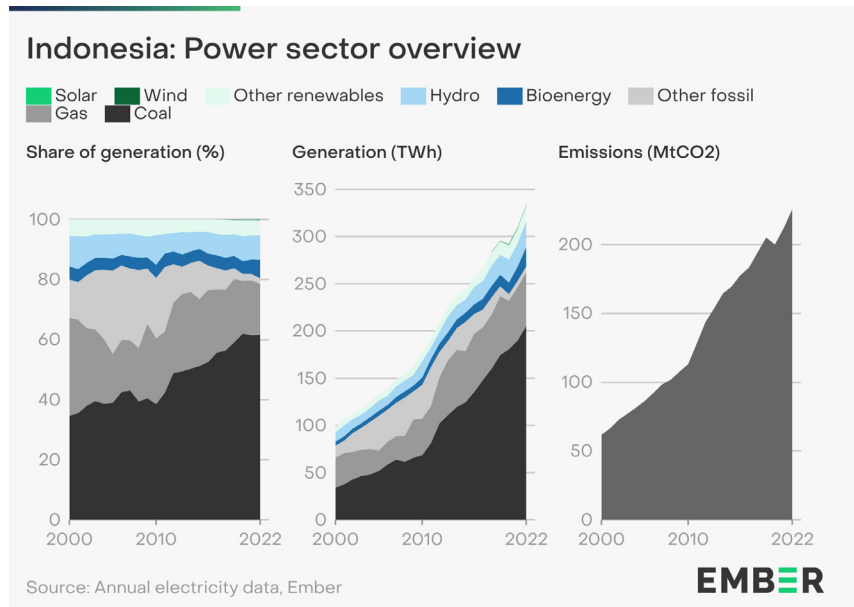
Indonesia remains reliant on fossil fuels, while its neighbours have begun their transition to clean, cheap electricity

In 2022, Indonesia relied on fossil fuels for 80% of its electricity. Its emissions per capita were below the global average.

Indonesia's largest source of clean electricity is hydro (8%). Its share of wind and solar (0.2%) is below the global average (13%) and its neighbours [the Philippines](#) (4% in 2023) and [Thailand](#) (5% in 2023).

Indonesia's power sector emissions grew in the last two decades as electricity demand more than tripled and was met almost entirely with electricity generated by coal and gas.

Indonesia's Just Energy Transition Partnership (JET-P) draft plan proposes it will reach at least [44% renewables in its power generation by 2030](#). This is below the [global target of 60% renewable electricity](#) set out in the IEA Net Zero Emissions scenario and overlooks the country's largely untapped [renewables potential](#).



Iran (Islamic Republic of Iran)

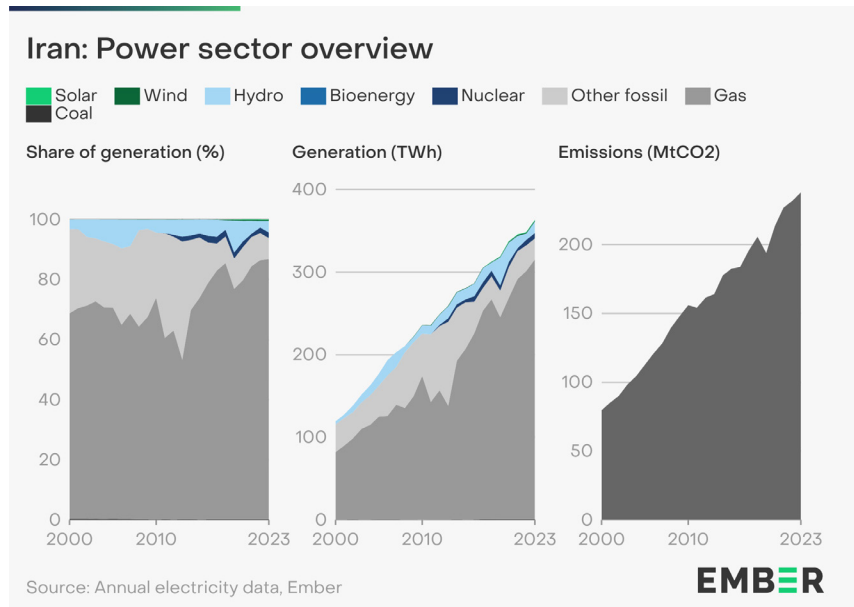
Iran's vast untapped solar potential can help overcome its fossil gas dependency and slow its rising power sector emissions

In 2023, Iran relied on fossil fuels for 94% of its electricity generation. Its per capita emissions were above the global average.

Hydro is Iran's largest source of clean electricity at 4%. However, the share of wind and solar in total electricity generation is only 0.6%. The [global](#) average for wind and solar share is at 13% and its neighbour [Türkiye](#) at (16%).

Iran's power sector emissions have almost tripled in the last two decades, as rising demand for electricity was predominantly met by an increase in fossil gas. The country generated 87% of its electricity from fossil gas in 2023.

The Iranian government has [plans to expand](#) renewables capacity to take advantage of the country's huge untapped solar potential and reduce reliance on fossil gas in the power sector amid domestic gas shortages. The IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030.

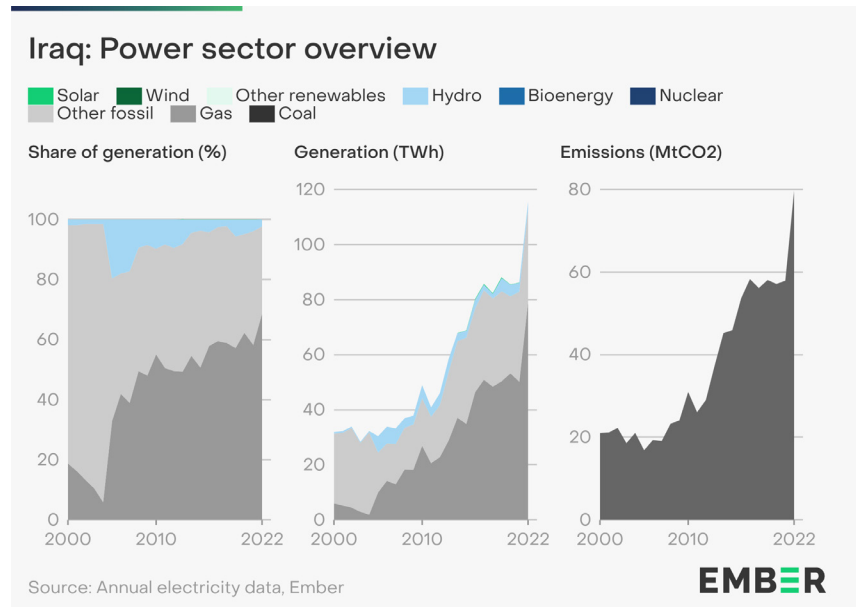


Iraq

Iraq's power sector emissions have nearly quadrupled over the last two decades as gas grew to meet rising demand

In 2022, Iraq relied on fossil fuels for 98% of its electricity generation. Its emissions per capita were slightly above the global average. Gas generation increased 105% year-on-year, as a [new gas power plant](#) came online.

Iraq generates less than 3% of its electricity from hydro, and less than 1% from solar and wind. Its share of wind and solar is far below the [global](#) average (13% in 2023) and its neighbour [Türkiye](#) (16% in 2023).



Iraq's power sector emissions nearly quadrupled over the last two decades, as increased demand for electricity was met almost entirely by gas. The share of hydro generation has also decreased since 2020, when it was 5%, with [droughts](#) leading to lower hydro output which was replaced by fossil generation.

Iraq has not yet set an official renewables target, while the IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030.

Italy

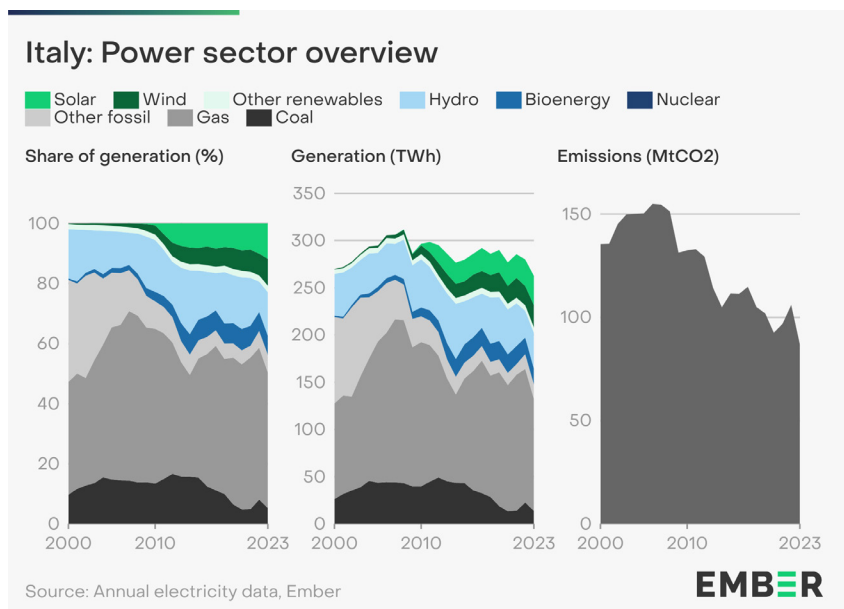
Italy is falling behind its European peers in harnessing cheap, clean solar and wind energy

Italy relied on fossil fuels for 56% of its electricity in 2023. Its per capita emissions were below the global average.

Italy's largest source of clean electricity is hydro (14%). While its share of wind and solar (21%) is above the [global](#) average (13%), it is almost half that of its southern European peers [Spain](#) (40%) and [Portugal](#) (40%).

Italy's power sector emissions have fallen over the last two decades, predominantly due to a decline in electricity generation from oil and coal, which were in part replaced by an increase in wind and solar.

Italy aims for [72% renewable electricity by 2030](#), while the IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030.

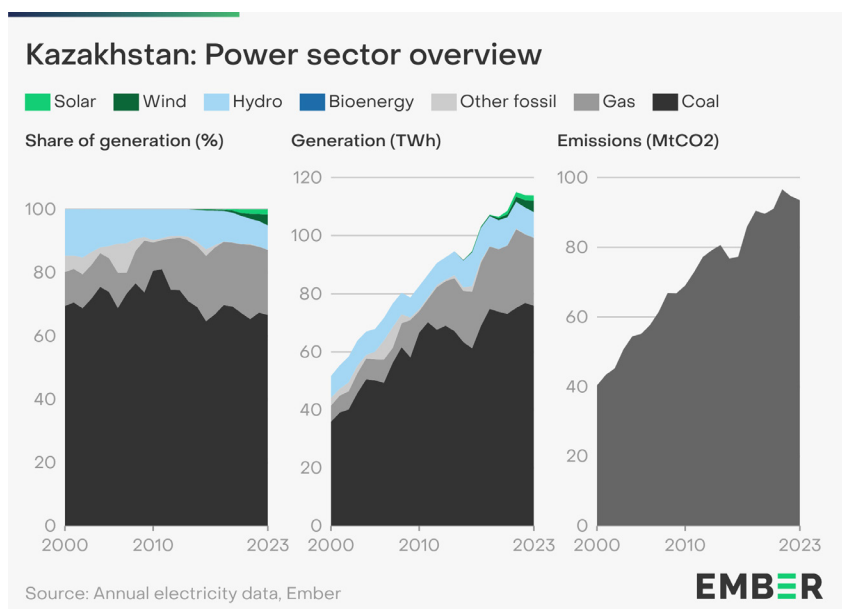


Kazakhstan

Kazakhstan's untapped renewables potential can help it transition away from fossil fuels whilst meeting demand

Kazakhstan relied on fossil fuels for 87% of its electricity in 2023, falling only slightly from 90% in 2015. Its per capita emissions were more than two and a half times higher than the global average.

Kazakhstan's largest clean electricity source is hydro (8%). Wind and solar are starting to play a role, reaching 5% of Kazakhstan's electricity in 2023 – a significant increase from their near-zero share in 2015. However, this is still far below the [global](#) average (13%) and regional average for [Asia](#) (13%).



Over the last two decades, Kazakhstan's electricity demand has more than doubled and so have its power sector emissions. The country continues to rely heavily on coal and gas to meet a large portion of this demand.

Malaysia

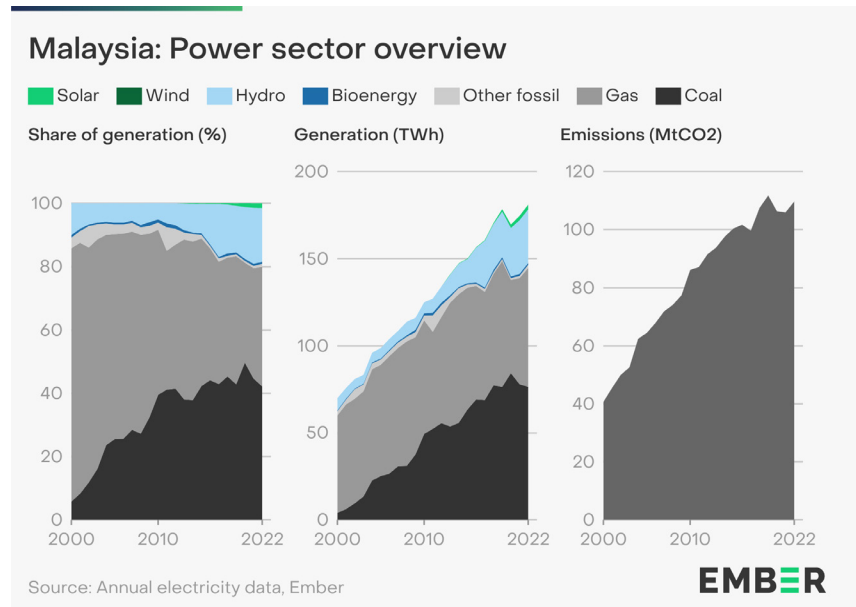
Malaysia boasts a largely untapped solar potential that can help it overcome fossil fuel reliance to meet growing power demand

Malaysia relied on fossil fuels for 81% of its electricity in 2022. Its per capita power sector emissions are below the global average.

Malaysia generates 19% of its electricity from clean sources, with hydropower providing the majority (17%). However, its share of solar and wind (1.5%) is far below the [global](#) average (13%) and less than half the ASEAN average (4.4% in 2023).

Malaysia's increasing power demand is instead being met by rising coal generation, which has doubled in the last two decades, overlooking its vast solar power [potential](#). Consequently, its power sector emissions have also doubled during the same period.

Malaysia aims for [29% renewable electricity by 2030](#), while the IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030.



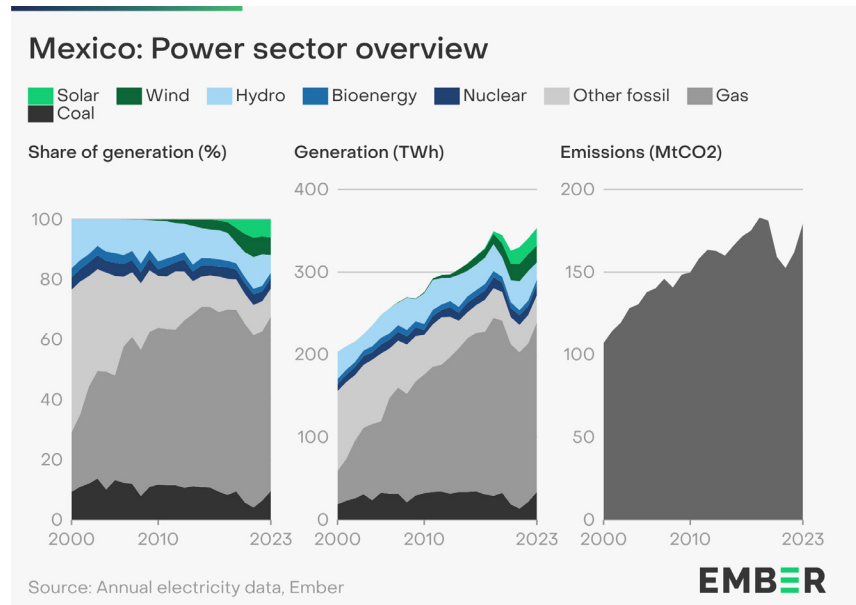
Mexico

Mexico is yet to harness its high potential for cheap, clean solar and wind energy

In 2023, Mexico relied on fossil fuels for 77% of its electricity generation, with gas remaining the single largest source at 58%. Its per capita emissions are below the global average.

Mexico's largest source of clean electricity is solar (6%). Despite [high potential](#) for wind and solar, their combined share in the electricity mix (12%) is below the [global](#) average (13%) and its neighbour [the United States](#) (16%).

Despite being the second country in the world to [introduce a legally binding emissions reduction target](#) in 2012, Mexico has [not meaningfully increased ambition](#) on emissions reduction in recent years. Mexico aims for [33% renewable electricity by 2030](#), while the IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030.



Pakistan

Pakistan's vast solar and wind potential can help tackle its ongoing energy crisis

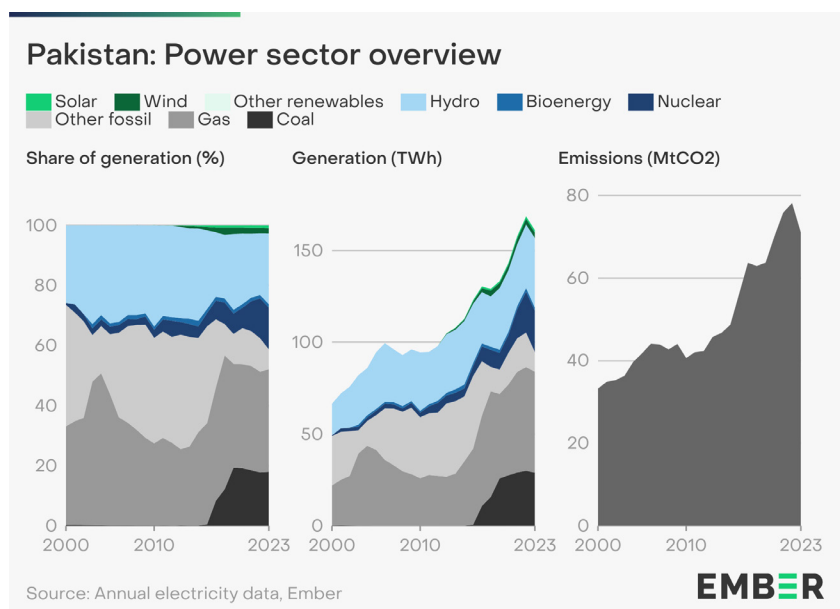
Pakistan relied on fossil fuels for 59% of its electricity in 2023. However, its emissions per capita remain below the global average.

Hydro dominates Pakistan's low-carbon electricity at 24% while its share of wind and solar (2.7%) is far below the [global](#) average (13%) and its neighbours [India](#) (10%) and [Afghanistan](#) (13%).

As Pakistan's electricity demand more than doubled in the last two decades, so have

its power sector emissions. This rising electricity demand was predominantly met by fossil fuels, with coal seeing a huge jump from less than 1% in 2016 to almost 18% in 2023. However, [high oil- and-gas-powered plant running costs](#) have led to the government imposing energy conservation measures, artificially suppressing demand, which fell 7.5% year-on-year. Increasing wind and solar would help Pakistan to meet demand more cost-effectively and resolve its ongoing energy crisis.

While Pakistan has committed to increasing its [renewable electricity share to 60% by 2030](#), it also has plans to [quadruple its coal-fired capacity](#). The IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030.



The Philippines

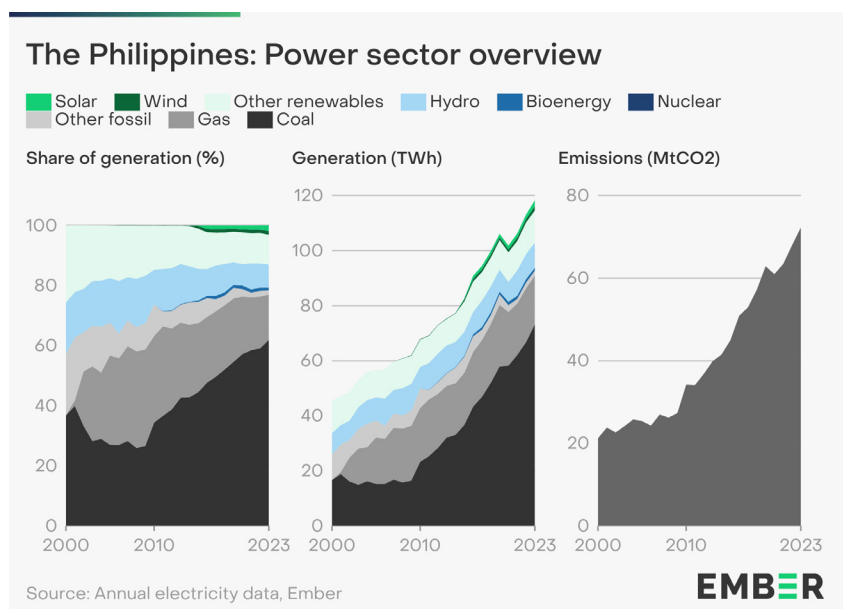
The Philippines can harness its wind and solar potential to reduce its reliance on coal

In 2023, the Philippines relied on fossil fuels for 78% of its electricity. Its per capita power sector emissions were below the global average.

Low-carbon sources provide more than a fifth of the Philippines' electricity, with the majority from hydropower and geothermal. Solar and wind shares make up just 2.5%, which is below the [global](#) average (13%) and the average among ASEAN countries (4.4%).

The Philippines saw its power sector emissions nearly double in the last ten years as rising demand was met with a more than doubling of coal power generation.

The Philippines aims for [35% renewable electricity by 2030](#), while the IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030.



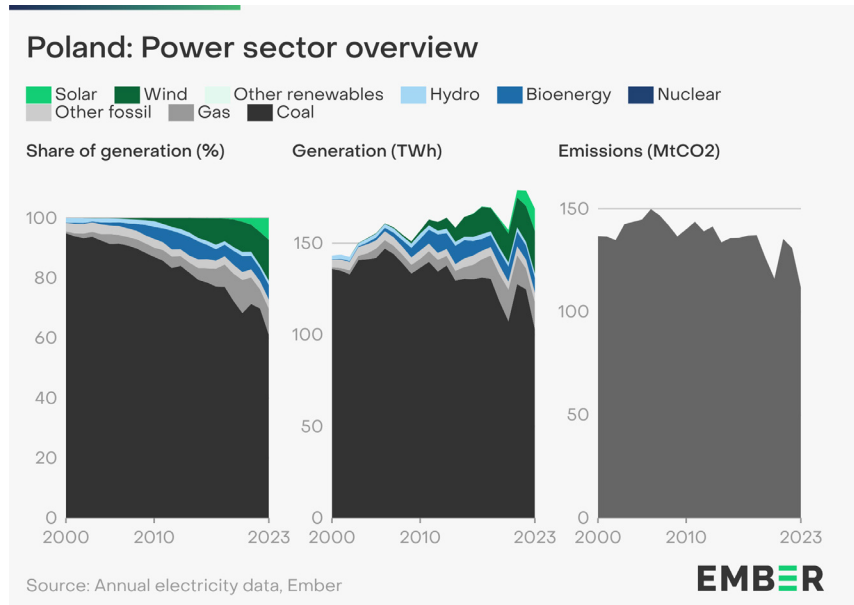
Poland

Poland has increased its share of wind and solar but still lags behind EU peers

In 2023, Poland generated nearly three-quarters (73%) of its electricity from fossil fuels, falling from 79% in 2022, with 61% of its electricity generated by coal. Its per capita power sector emissions were above the global average.

Wind and solar produced a record 21% of the Polish electricity mix in 2023 and in June they covered [66% of domestic power demand in certain peak hours](#).

Poland aims for [53% renewable electricity by 2030](#). However, [Ember's analysis](#) found 60-70% is feasible in the same timeline, while the IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030.

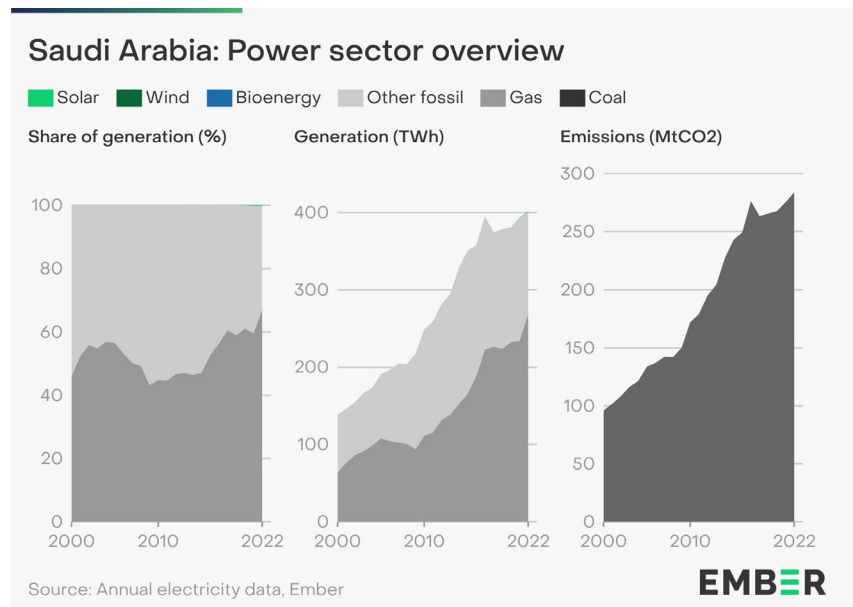


Saudi Arabia

Saudi Arabia needs to rapidly increase its renewables share from near-zero today to meet its ambitious 2030 targets

Saudi Arabia relied almost entirely on fossil fuels (99.8%) for its electricity generation in 2022, with per capita emissions four times higher than the global average.

While solar provided only 0.2% of Saudi Arabia's electricity generation, the country did not generate any electricity from nuclear or renewable sources such as hydro and wind. Whereas, in 2022 its neighbour the [United Arab Emirates](#) generated 17% of its electricity from clean energy sources.



Saudi Arabia's power sector emissions more than doubled in the last two decades, with the increase in electricity demand predominantly met by fossil gas. The country generated 67% of its electricity from fossil gas and 33% from oil.

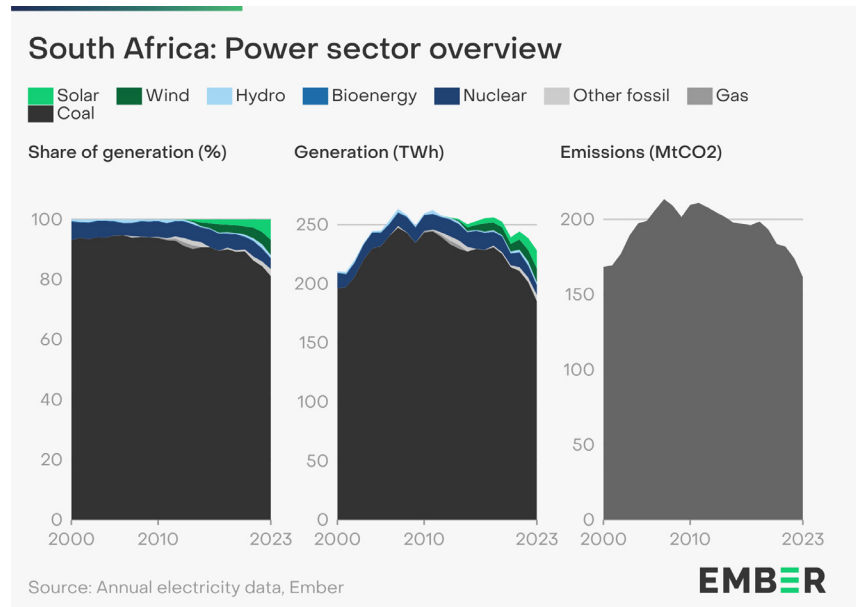
Saudi Arabia is targeting 50% renewable electricity by 2030, while the IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030. However, while it is planning [one of the most](#) rapid scale-ups of renewables globally, the path to implementation remains unclear.

South Africa

South Africa's vast renewables potential can safeguard it from its looming electricity demand growth and over-reliance on coal

In 2023, South Africa relied on fossil fuels for 83% of its electricity generation. Its emissions per capita are 1.5 times the global average, while its [coal emissions per capita](#) are the highest in the G20.

South Africa is by far Africa's largest generator of coal-fired electricity, responsible for 83% of Africa's coal generation in 2023. Wind and solar produced 12% of electricity in 2023, up from just 2% in 2015. This is below the [global](#) average (13%), but above [Africa's](#) average (6%).



Power sector emissions have seemingly declined since 2007. However, the ongoing energy crisis is suppressing demand growth and South Africa risks seeing emissions rebound if future demand growth is met by coal instead of clean sources.

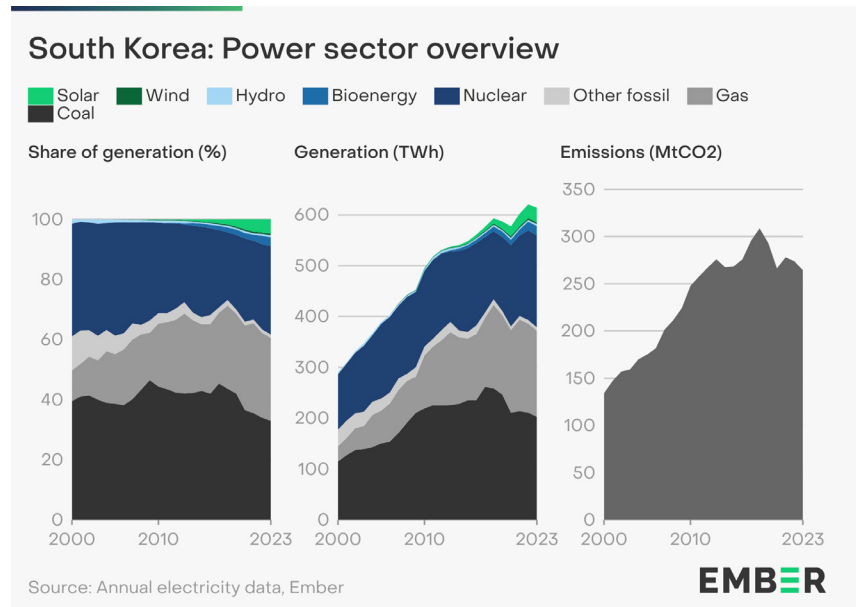
South Africa aims for [33% renewable electricity by 2030](#), while the IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030.

South Korea

South Korea's solar and nuclear generation have helped drive a decline in power sector emissions in recent years

In 2023, South Korea relied on fossil fuels for 62% of its electricity in 2023, ranking as the G20's [second-highest](#) emitter per capita.

South Korea's largest single source of low-carbon electricity is nuclear (29%), but its combined share of wind and solar (5%) lags behind the [global](#) average (13%) and its neighbours [Japan](#) (12%) and [China](#) (16%). Despite this, solar has already [saved the country billions](#) in fossil fuel costs.



South Korea's power sector emissions grew in the last two decades as increasing demand for electricity was met predominantly by coal and gas, but emissions reached their peak in 2018 as solar and nuclear power increased and replaced coal.

South Korea [aims for 20% renewable electricity](#) by 2030, while the IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030.

Thailand

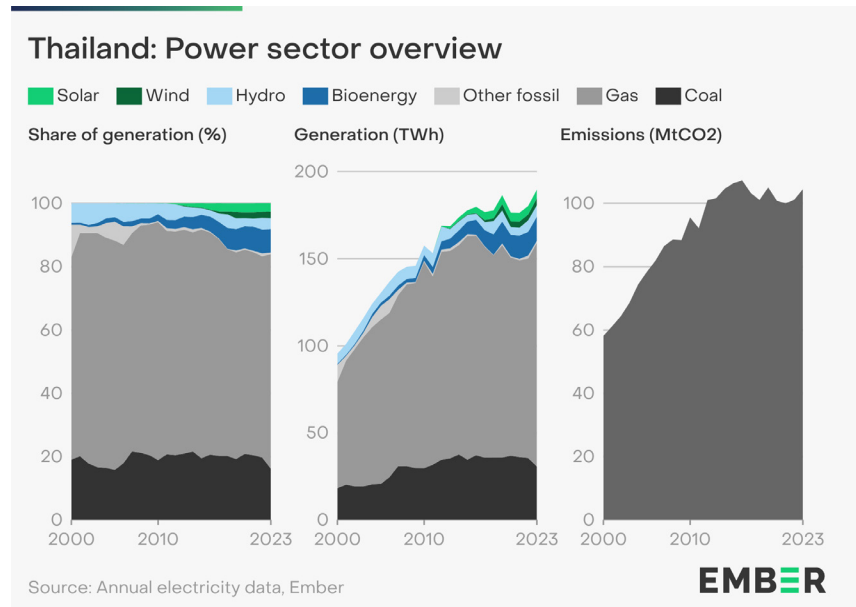
Thailand can harness its solar and wind power potential and overcome its historic reliance on fossil gas

In 2023, Thailand relied on fossil fuels for 84% of its electricity, primarily gas (68%). Its per capita power sector emissions are below the global average.

About one-sixth of Thailand's electricity generation comes from renewables, mostly bioenergy and hydropower. Solar and wind accounted for only 4.7% of Thailand's electricity, which is less than the [global](#) average (13%) and behind [Viet Nam](#) (13%).

Thailand has a high per capita power demand that is almost double the regional average. To meet that demand, fossil gas has powered around two-thirds of Thailand's electricity since 2000, overlooking the country's largely untapped solar and wind [potential](#).

Thailand has a target to reach [37% renewable electricity by 2037](#), while the IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030.



Türkiye

Türkiye can harness its huge renewables potential to reduce its reliance on fossil fuel imports and avoid being left behind

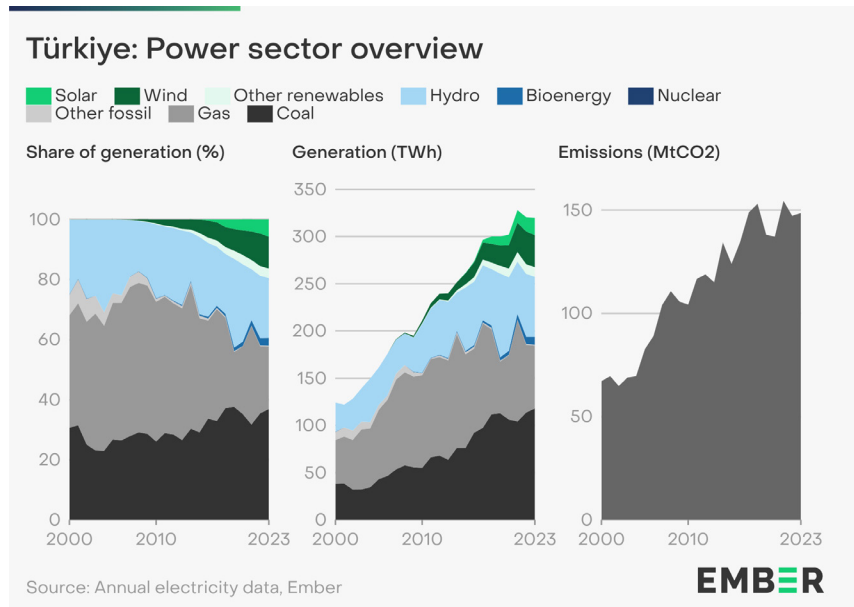
Türkiye became the [second largest coal-fired power generator](#) in Europe in 2023, with coal accounting for over a third of its total power generation.

In 2023, fossil fuels generated 58% of the country's electricity. Its per capita emissions were similar to the global average.

Despite [enormous potential](#), Türkiye produced only 16% of its electricity from wind and solar in 2023. With solar accounting for just 6% of its

power generation, the country lags behind nations with similar solar potential, such as Greece (19%) and even those with lower solar potential, such as [Poland](#) (7%).

Türkiye aims for [47% renewable electricity by 2030](#), while the IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030.



United Arab Emirates

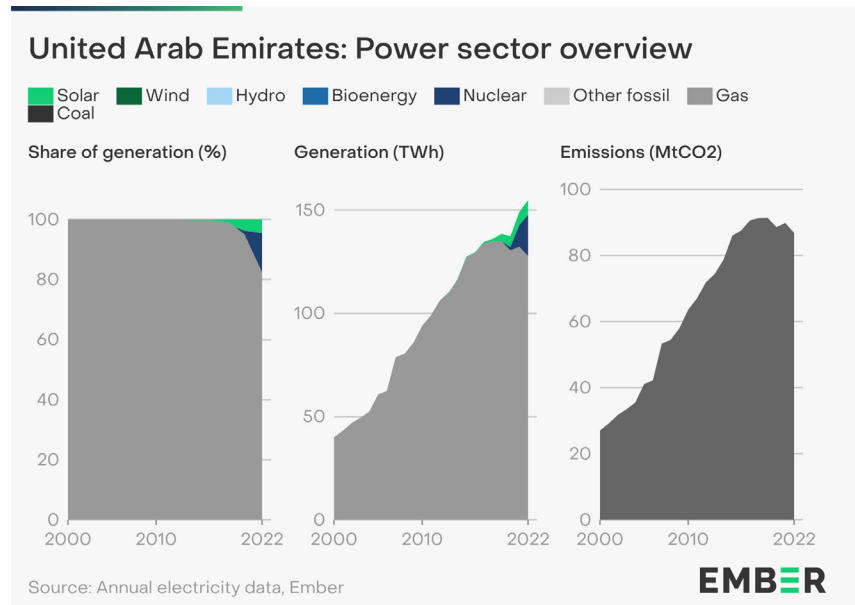
UAE can harness its untapped solar potential to decrease its reliance on fossil gas

In 2023, the United Arab Emirates (UAE) relied on fossil fuels for 83% of its electricity. Its per capita emissions were five times higher than the global average.

The UAE's largest source of clean electricity is nuclear which provides 13% of its total electricity mix. Its share of wind and solar (4.5%) is below the [global](#) average (13%), but higher than that of its neighbour [Saudi Arabia](#) (0.2%).

The UAE's electricity demand has more than tripled in the last two decades and so have its power sector emissions. The increase in demand has largely been met by fossil gas, with increased contributions from nuclear and solar since 2019.

The UAE aims for [32% renewable electricity by 2030](#), while the IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030.

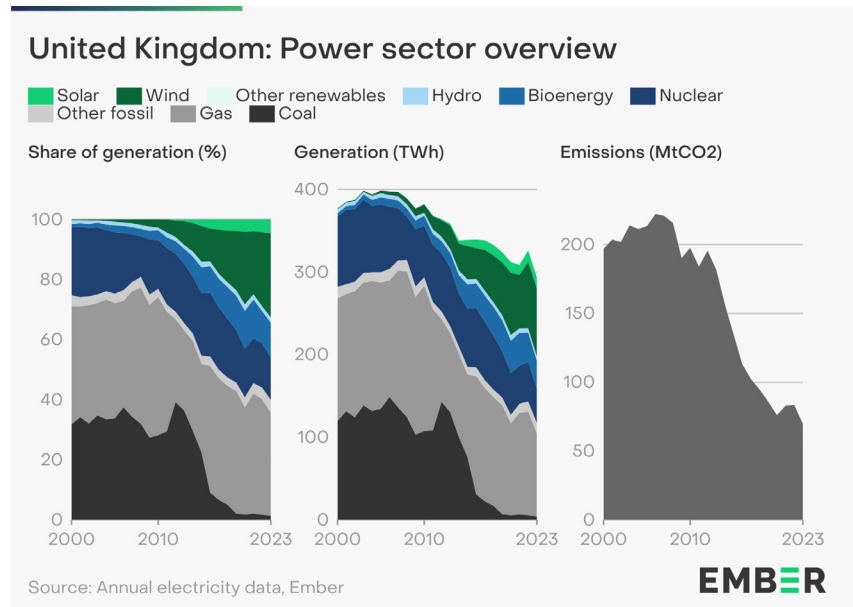


United Kingdom

Wind power has displaced coal and the UK is now targeting a fully decarbonised electricity system

The United Kingdom relied on fossil fuels for 40% of its electricity in 2023. Its per capita emissions were below the global average, and three times lower than in 2010.

The country still relies on gas for 34% of its electricity production, but its coal phase-out is almost complete with the last remaining coal plant set to close by October 2024. In 2023, coal generation was about 30 times lower than in 2013, at just 1.4% of the UK's electricity mix.



The expansion of renewable energy has been the driver of this collapse in coal generation. The UK's largest source of clean electricity in 2023 was wind (28%), up from 8% in 2013. Wind and solar combined accounted for 33% of total electricity generation, which is above the [global](#) average (13%) and just behind its neighbour Ireland (37%).

Britain aims for [87% renewable electricity by 2030](#), while the IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030.

Uzbekistan

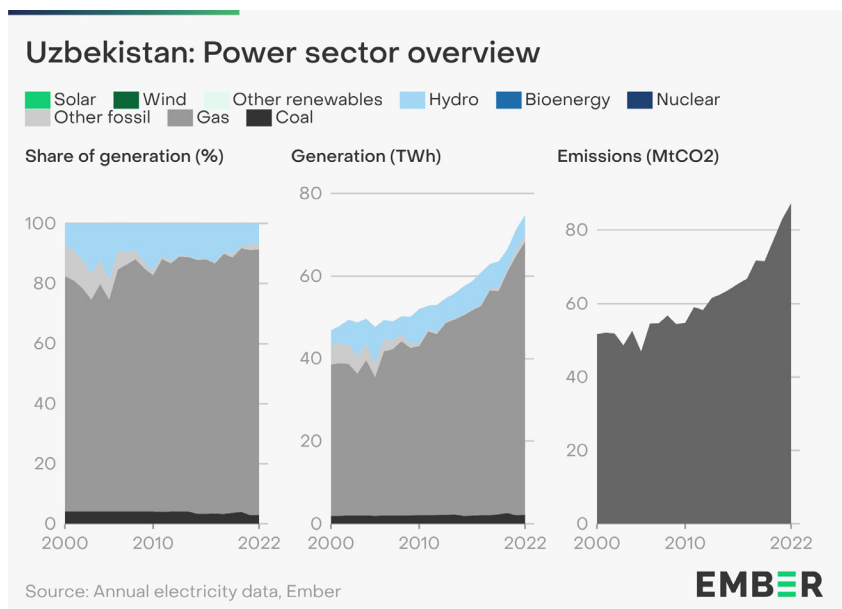
Wind and solar could help Uzbekistan overcome hydro deficits and meet increasing demand

Uzbekistan relied on fossil fuels for 93% of its electricity in 2022. Its emissions per capita were above the global average.

Uzbekistan's largest source of clean electricity is hydro (6%). Its share of wind and solar is less than 1% and is below the [global](#) average (13%) as well as its neighbour [Kazakhstan](#) (5% in 2023).

Uzbekistan's power sector emissions grew over the last two decades as increased demand was met almost entirely by fossil generation. Hydro generation has been falling since 2017 due to [droughts in the region](#), leading to an increase in fossil generation. Uzbekistan [plans to bring new hydropower online](#) in 2024.

Uzbekistan aims for [27% renewable electricity by 2030](#), while the IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030.

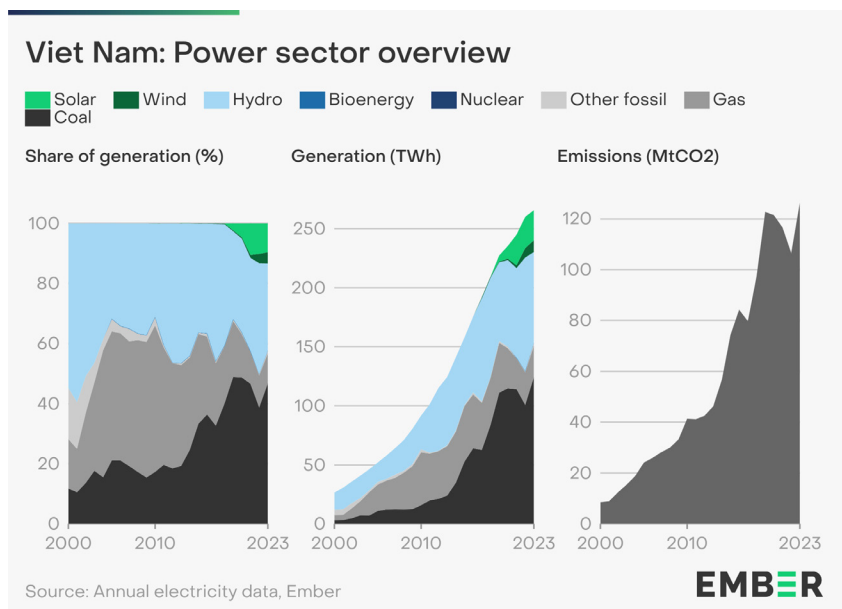


Viet Nam

As Southeast Asia's renewable powerhouse, Viet Nam can quickly decarbonise its power sector by integrating untapped solar and wind potential

In 2023, Viet Nam relied on fossil fuels for 58% of its electricity. Its per capita emissions are below the global average.

Viet Nam leads Southeast Asia in share of low-carbon generation (42%), primarily from hydro (29%). From 2015 to 2023, solar and wind grew tenfold to 13% of electricity generation, on a par with the [global](#) average and exceeding peers like [Thailand](#) (4.7%) and [the Philippines](#) (3.2%).



However, as electricity demand more than doubled over the past decade, Viet Nam met this with a doubling of coal generation, which led to a tripling of emissions. Its [latest plans](#) will more than double fossil capacity by 2030. The IEA's Net Zero Emissions scenario sets out a global target of 60% renewable electricity by 2030.

With its vast solar and wind potential, Viet Nam can ramp up renewables and ensure their [integration](#) into the electricity system. This will reduce reliance on fossil fuels to meet rising demand.