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COAL TO CLEAN

Türkiye Electricity Review 2023

Türkiye's coal import bill for power hits record high

Türkiye coal generation returned to its previous peak in 2022, but not from domestic sources. Coal imports for power reached \$5.3 billion while Russia became the main supplier. Türkiye can replace costly coal imports with its untapped solar power potential.

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Lead author: Ufuk Alparslan

 **TÜRKÇE**

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About

Ember's Türkiye Electricity Review presents full-year data on electricity generation and demand for 2022 in Türkiye. It reviews annual highlights of the country's electricity system, analyzing progress in transitioning from coal to clean in comparison with other European countries.

Highlights

7%

Share of imported coal in Türkiye's power generation in 2010

20%

Share of imported coal in Türkiye's power generation in 2022

\$5.3 bn

Cost of using imported coal for power generation in Türkiye in 2022

Executive Summary

Türkiye's coal import bill doubles, as Russia becomes main supplier

01 Coal import bill for power reaches \$5.3bn, an all time high

Imported coal continued to drive up Türkiye's coal generation in 2022, even as coal prices skyrocketed. Imported coal's share in total power generation reached 20%, up from 7% in 2010. Half of thermal coal imports came from a single country: Russia. With this dependency came a record-high payment for coal imports in 2022, as Türkiye's coal import bill doubled. Domestic coal does not account for the majority of coal generation in Türkiye: in 2022, coal power plants relying on imports generated 25% more electricity than those burning domestic coal. As of 2022, imported coal generation is over four times higher (63.2 TWh) than it was in 2010 (14.5 TWh). In 2022 Russian coal imports for power more than doubled by reaching 11.3 million tonnes (up from 5.2 million in 2021).

02 Hydro generation doubled to compensate for drop in gas during the Iran gas crisis

Hydropower quickly reacted when Türkiye experienced its own local energy crisis in the middle of the winter, on top of the global energy crisis. Gas supply from Iran was cut off for ten days from January 21st, with gas power necessarily curtailed in response. This was compensated by hydro dams, showing its flexibility to step up generation. Hydro almost doubled daily generation (+110 GWh) in that period, while daily gas generation was almost halved (-130 GWh).

03 Wind and solar share nears 16%

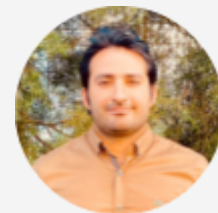
The steady rise in wind and solar generation in Türkiye continues, led by wind power. With almost 11% wind share in generation, Türkiye outranks G20 countries like France and Italy. However, solar underperforms compared to many European countries, with similar solar share to countries with much lower solar potential, such as Poland and Ukraine.

04 Annual solar installations in Türkiye need to triple to reach capacity targets

Türkiye's new energy plan offers a fivefold rise in solar power capacity by 2035, with yearly projected new solar installations between 3-4 GW. However, the country has added around 1.2 GW solar power capacity annually in the last five years. Barriers against solar need to be removed to reach these targets.

"Türkiye has seen dependence on imported coal rise, and it is coming at a cost. Contrary to popular belief, Türkiye's coal generation is dominated by imports, not domestic coal. With the cost of coal imports at a record high, Türkiye needs to look for clean alternatives to lower import bills and secure its energy independence."

Ufuk Alparslan
Regional Lead
Türkiye, Ukraine and the Western Balkans



Coal

Coal import bill doubles as Russia becomes the main supplier

The price tag for Türkiye's coal imports for power reached \$5.3 billion USD in 2022, an all time high. Russia ends Colombia's long lasting stop as top thermal coal supplier to Türkiye.

Coal generation returns to previous peak

In Türkiye, coal generation has hovered around 113 TWh over the last five years, excluding 2020 and 2021. In 2020, coal generation dipped as [five lignite plants](#) were forced to cease operation for six months, due to their non-compliance with the air pollution limits. In 2021, coal generation fell by 1.7 TWh because of skyrocketing hard coal prices.

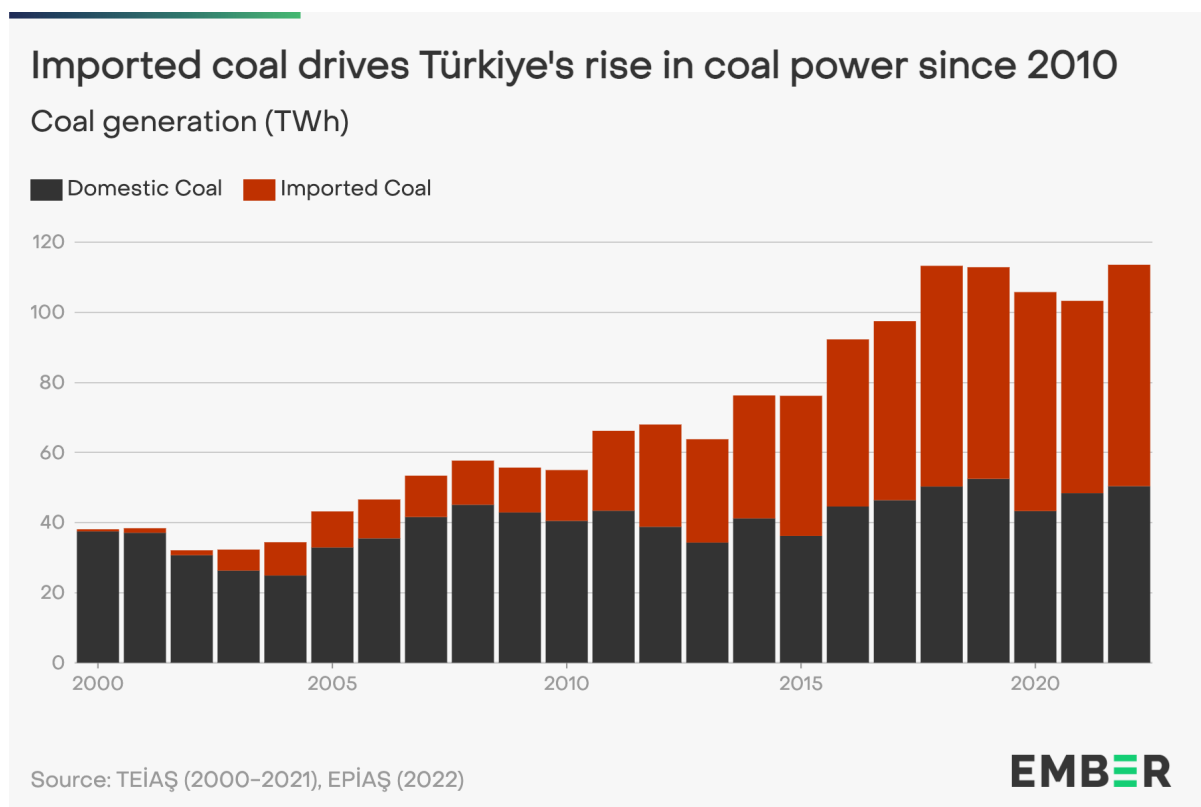
In 2022, coal power generation rebounded to 113.6 TWh, with a 10% rise year-on-year. This is also slightly above the highest annual coal power generation from 2018 (113.2 TWh). This recovery from coal power was fueled by imported coal, partly because the market price cap was relaxed in 2022. As power market prices were allowed to rise, market prices became profitable enough for imported coal power plants. The newly commissioned 1.3 GW coal power plant, *Hunutlu*, also added to the import dependence, as it burns imported coal.

Although coal generation appears to have plateaued in the last five years, coal generation may be set to rise again. *Hunutlu's* two units came online only in June and October respectively, so its generation will likely be more evident in 2023. The long term [National Energy Plan](#) published at the end of 2022 also foresees around 2.5 GW additional coal capacity by 2035, up from 21.8 GW now.

Coal is not a domestic source

Türkiye's coal generation is not dominated by domestic coal, contrary to popular belief. In 2022, coal power plants relying on imports generated 25% more electricity than those

burning domestic coal. Imported coal accounts for 8.3 TWh of the 10.2 TWh total increase in coal power generation between 2021 and 2022.



Imported coal has also pushed the upward trend in coal generation since 2010. In 2010, the share of imported coal generation was 7%, reaching 20% share in total power generation as of 2022. As of 2022, imported coal generation is over 4 times higher (63.2 TWh) than it was in 2010 (14.5 TWh).

Record coal import bill

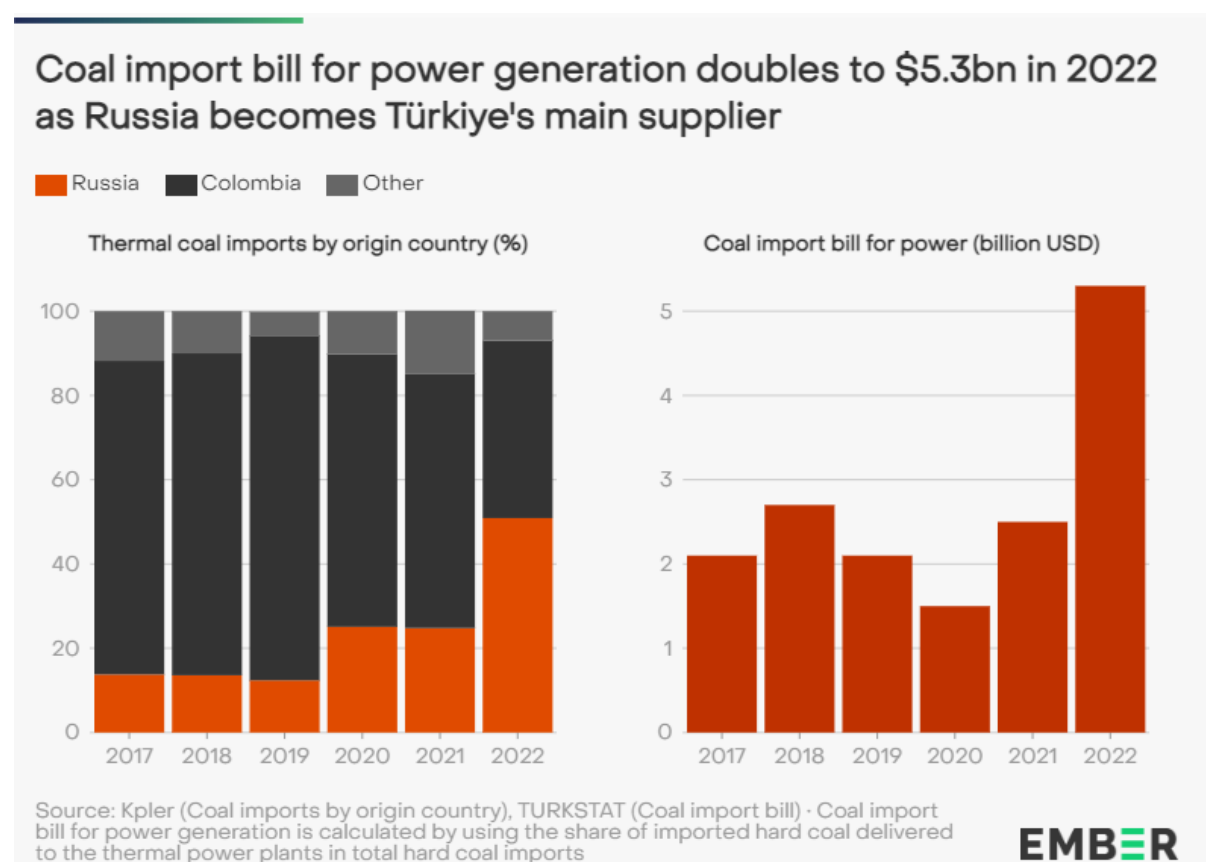
With coal prices volatile in recent years, Türkiye has paid the price for dependence on imports for power generation.

[Coal prices skyrocketed](#) in late 2021, seeing a fourfold rise in a year. As prices reached 260 USD per tonne, unprofitable hard coal power plants in Türkiye reduced generation, leading to the decline in coal generation overall.

Russia's invasion of Ukraine pushed the price of coal to another record, reaching \$425 USD per tonne in May 2022, 60% higher than the previous all time record. Unlike 2021, extremely

high coal prices did not reduce levels of coal power plants burning imported coal. On the contrary, imported coal generation was 13% higher year-on-year.

The rise in coal prices combined with this sustained generation is directly reflected in the coal import bill of the country. Official numbers show that in 2022 Türkiye paid [8.8 billion USD for coal imports](#), with 60% of total hard coal imports delivered to thermal power plants according to [TURKSTAT](#). Accordingly, coal imports for power more than doubled in 2022 year over year, reaching a record \$5.3 billion USD.



Türkiye compounds risky reliance on a single country for energy

Alongside record breaking coal imports, 2022 also saw dramatic changes to coal suppliers for Türkiye. For many years, Colombia was the top thermal coal supplier of Türkiye for power generation. However, as of 2022 Russia overtook Colombia’s place, supplying almost half of the country’s hard coal imports for power generation across the year. In 2022, thermal coal imports from Russia doubled, reaching 11.3 million tonnes (up from 5.2 million in 2021). The share of Russian coal in total coal imports also reached 44% in 2022 (up from 26% in 2021) rising from 9.7 to 17.5 million tonnes.

Türkiye was already highly reliant on Russia for fossil gas imports. Türkiye produces almost no gas domestically, and is fully reliant on imports for gas generation. In 2021 and 2022, [Türkiye imported 45% and 40% of gas from Russia](#) respectively.

Since the start of the war, Türkiye's reliance on Russia for crude oil and oil products has also risen. In 2021, Türkiye [imported less than a quarter](#) of total oil and oil products from Russia. Between March and December 2022 Russia's share in oil and oil products imports reached 44%.

The country's first and only nuclear power plant project under construction, *Akkuyu*, is also owned by the Russian government.

Hydro vs Gas

Continued trend of inverse relationship between hydro and gas

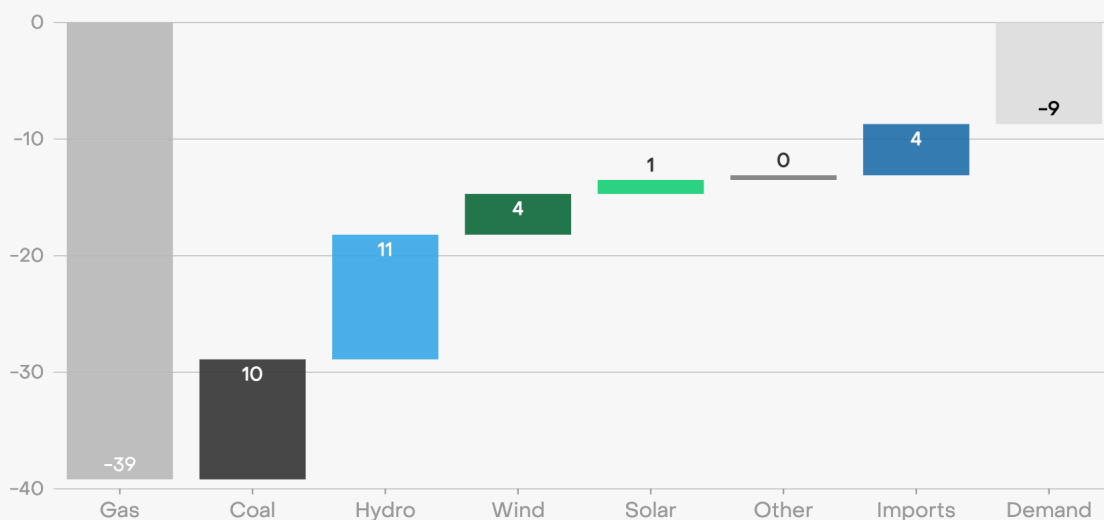
Gas supply issues from Iran in 2022 were partially compensated by hydropower, as large dams acted like batteries.

Hydro is back from drought, mild summer limited summer demand

In 2022, gas power generation was almost 40 TWh lower year-on-year. Gas power dipped amid a partial switch to coal (+10 TWh) because of [sky high gas prices](#), the rebound of hydro (+11 TWh) from [a dry year](#) and a rise in wind generation (+4 TWh) and power imports (+4 TWh). Lower power demand (-9 TWh) thanks to the relatively cool summer also brought down gas generation compared to the previous year.

Türkiye coal, hydro and wind rise in 2022, replacing gas

Change in power generation between 2021–2022 (TWh)



Source: TEİAŞ (2021), EPIAŞ (2022)

Türkiye left vulnerable to gas as an intermittent generation source

High dependence on imported gas left Türkiye vulnerable to supply issues in 2022. Türkiye supplies its gas through five pipelines, four liquefied natural gas (LNG) terminals and two gas storage facilities. In total, the daily technical maximum supply capacity of [Turkish gas infrastructure](#) is around 350 million m³. Iran, as one of the pipeline gas suppliers, owns just less than 10% share of daily capacity (28.5 million m³/day).

Almost every single year [Iran is unable to supply the contracted capacity in full](#), especially on winter days when Iran is hit by a cold spell (This includes 2023: [Iran lowered gas supply to Türkiye](#) from the beginning of January 2023 while [Iranian households were also left without gas](#)).

Depending on countrywide daily gas consumption levels, these gas supply issues originating from Iran can impact Türkiye's security of supply. Thanks to the warm winter, Türkiye is so far unaffected by the supply cut in 2023. However, in 2022 the country experienced its own local energy crisis in the middle of the global energy crisis when the [gas supply from Iran stopped for ten days](#) in January.

Securing supply in a gas crisis

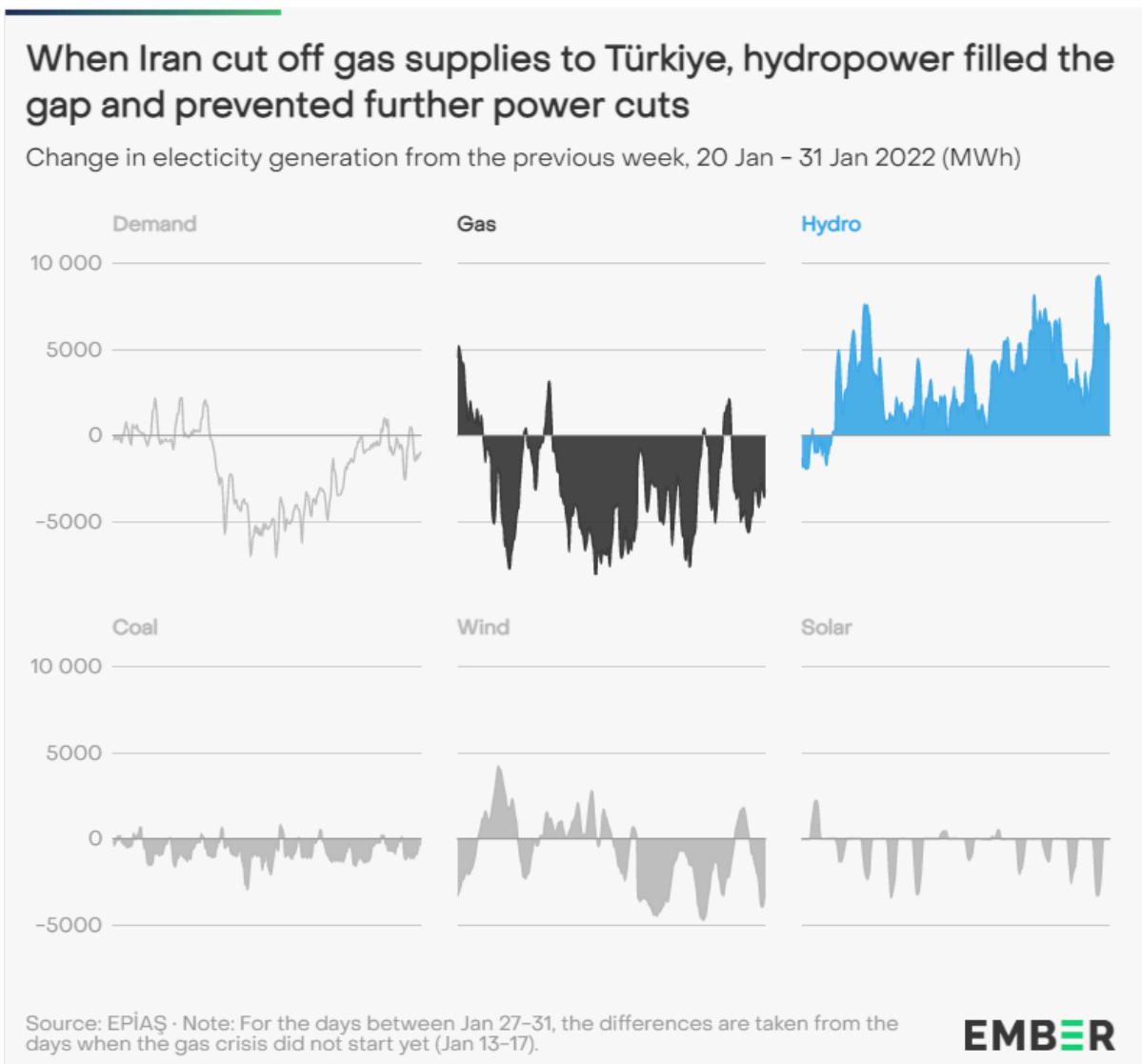
In periods of gas supply crisis, such as the ten days in January 2022, hydropower plants with large dams play a crucial role in Türkiye.

During the January crisis, the state-owned gas operator, *BOTAŞ*, initially curtailed gas supply to the gas power plants. This is typical for periods of gas supply uncertainty, and the emergency measure is extended to the industrial gas consumers if needed. As a last resort the lack of sufficient gas-fired generation can lead to power shortages as well, as it did in January 2022.

When the gas power generation was hit in the first four days of the gas crisis, hydropower plants ramped up their generation and compensated for the fall in gas-fired generation. In the first days of the crisis, hydropower more than doubled its daily generation (+110 GWh) when daily gas generation was almost halved (-130 GWh). Because of this, there was no trouble meeting the total electricity demand between 20-23 January, despite the sudden drop in gas power.

Following the 24th January, hydropower was only able to limit the collapse in power demand, as coal, wind and solar power generation also dipped. From this day the government [slashed electricity supply to industrial consumers](#) for five days until 29th January.

As of January 29, the crisis ended for power consumers, although the gas curtailment to power plants and industrial consumers continued until the end of January. This recovery in the last three days of January was a period when exceptional hydroelectricity production compensated for all the other generation sources to keep up with the electricity demand in the country.



Large dams as energy storage

The gas crisis showed that hydropower dams in Türkiye are crucial during shortages in any power generation source. With their flexibility in stepping up power generation, hydropower plants with dams can quickly react to a deficit in power generation within the day. Large dams can also save water for other periods within a year as a backup source. This signals

the importance of hydro as Türkiye's energy transition progresses: as a large and flexible source of generation, the hydro fleet offers a complement to variable sources.

This complementary role will also become increasingly important if Türkiye takes advantage of its enormous potential for solar power. If large scale solar capacities are deployed, solar power can displace the current high hydropower generation in summer, allowing more water to be saved in dams for winter. Doing this would allow some summer hydropower generation to shift into winter months, reducing the need for costly gas in cold winters when Türkiye struggles to meet the gas demand. As solar can also compensate for hydropower in dry years, these two clean power sources will play a vital role securing the energy supply.

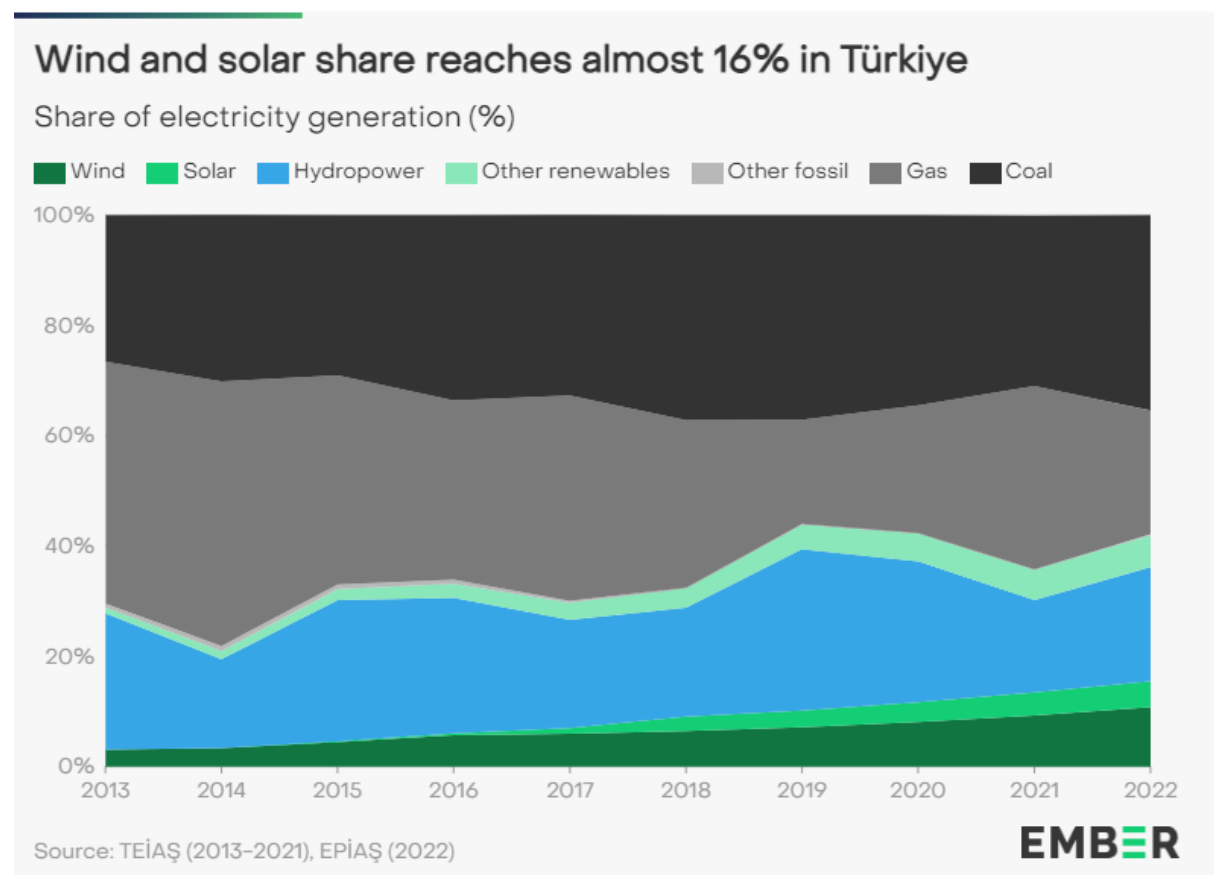
Wind and Solar

Steady rise in wind continues, solar lags behind

Wind and solar share has more than doubled since 2017. However, the country is falling short of its enormous potential for solar power.

Wind and solar reach almost 16% share

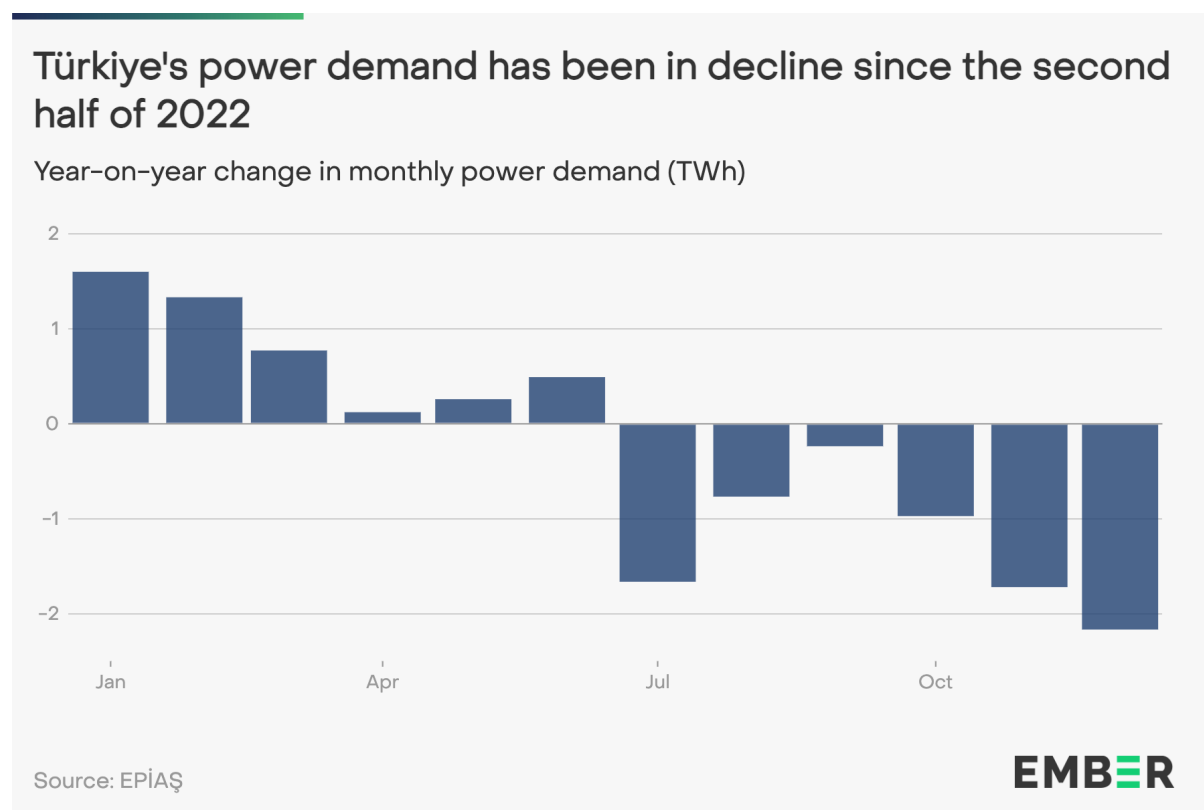
Wind and solar power continue their upward trend in 2022 by reaching 15.5% share in total generation, up from 13.5% a year ago. The share is now more than twice as much as it was in 2017 (7%).



Although both wind and solar’s shares have grown over the last five years, wind power leads the electricity transition in Türkiye. Wind power now has an 11% share in power generation (up from 6% in 2017), while solar power has reached a 4.7% share (up from 1% in 2017).

Record breaking July

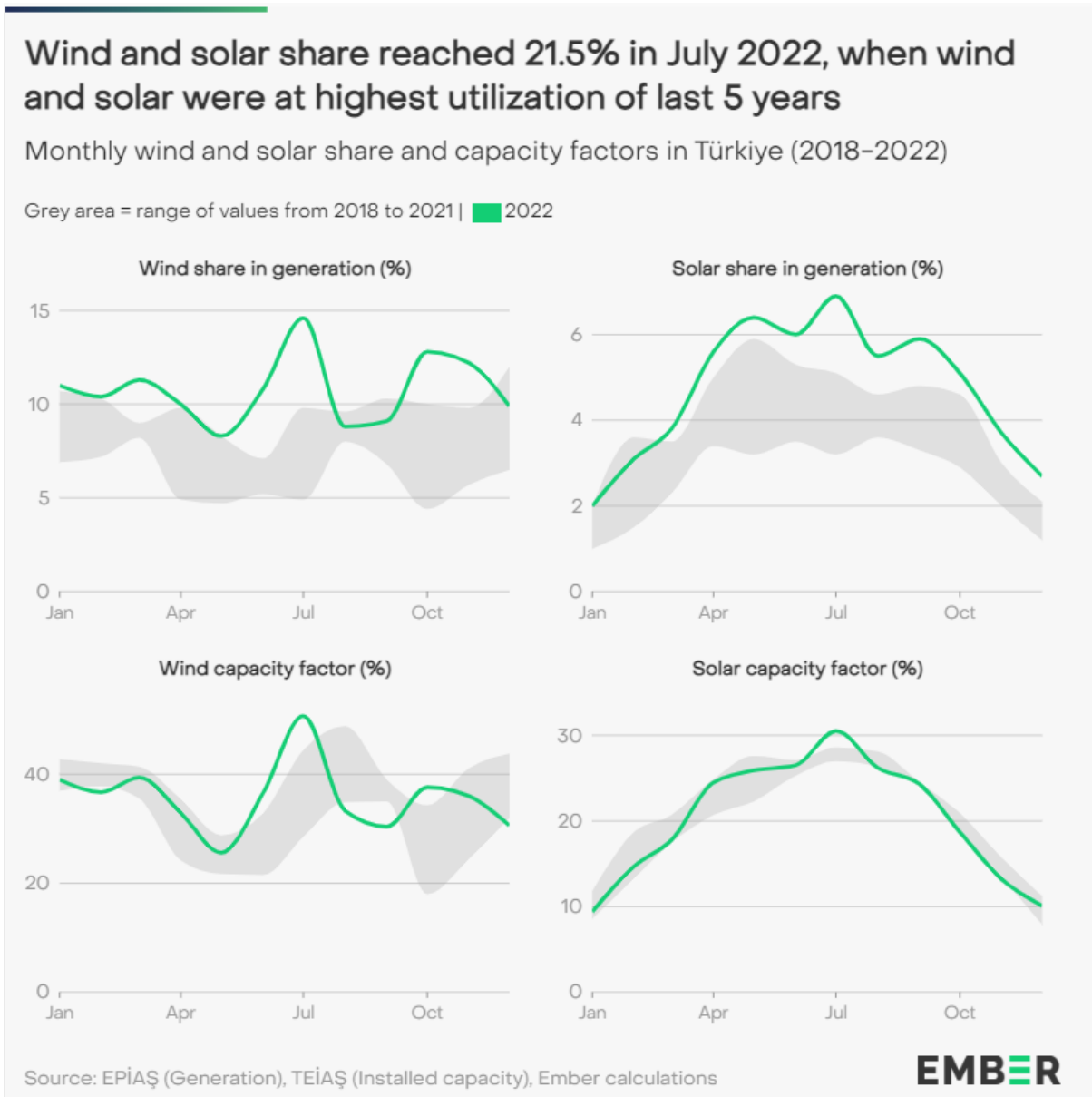
The rising share of wind and solar in 2022’s overall mix was the result of several factors. A modest rise in wind and solar power capacity (+2 GW in total) and the decline in annual power demand (-2.6%) from 2021 played a role. Indeed monthly power demand has been in decline since the second half of 2022, [similar to most EU countries](#).



The annual capacity factors of wind and solar were similar to the previous years. However, July stands out as an exception, with favorable weather conditions increasing wind and solar generation. Wind and solar saw their highest capacity factors of the last five years, with 50% and 30% capacity utilization respectively.

The decline in monthly power demand and the highest capacity factors of recent years led to a monthly wind and solar record in July, as generation reached 21.5% share of total power. The previous record for monthly wind and solar share was 15.1% in September 2021. By reaching 6.1 TWh, monthly wind and solar generation also set a new record in absolute

terms for July 2022, a third more than the previous monthly generation record (4.6 TWh in July 2021).

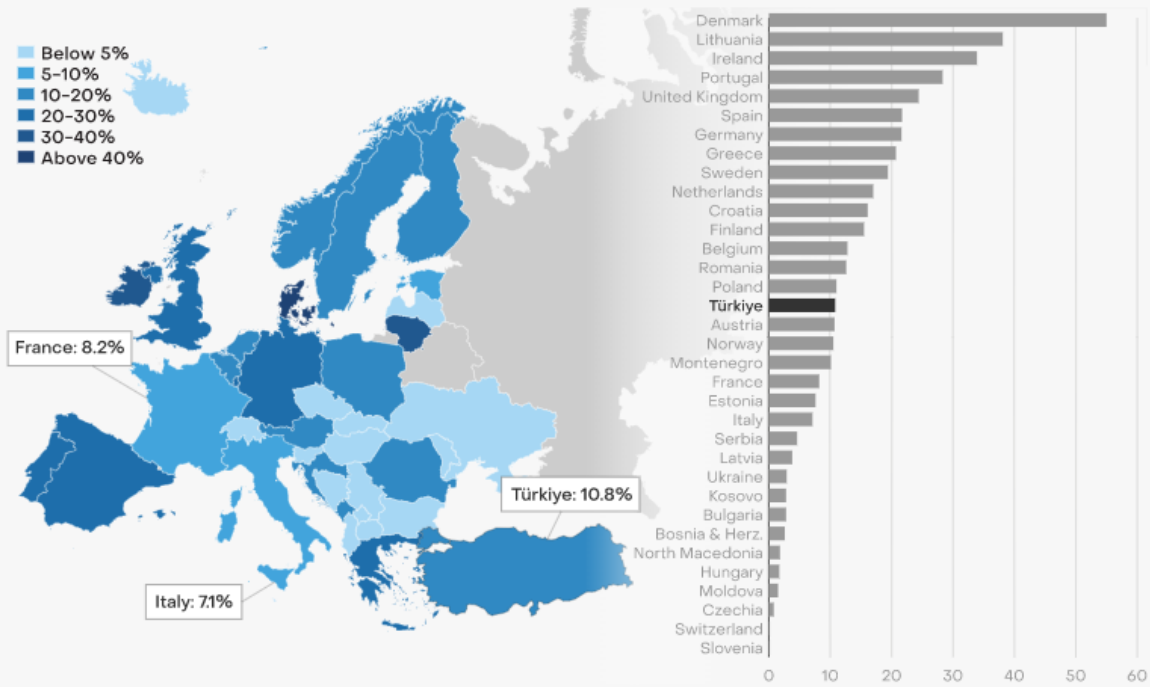


Türkiye outranks France and Italy in wind

Across Europe, northern countries lead on wind power, with Denmark at the top with a staggering 55% wind share in power generation. But southern countries like Spain, Portugal and Greece also have more than 20% wind share in generation.

Türkiye outranks France and Italy in wind share in power generation

Wind share in power generation, 2022 (%)



Source: Ember Türkiye Electricity Review 2023
*2021 data is used for Ukraine

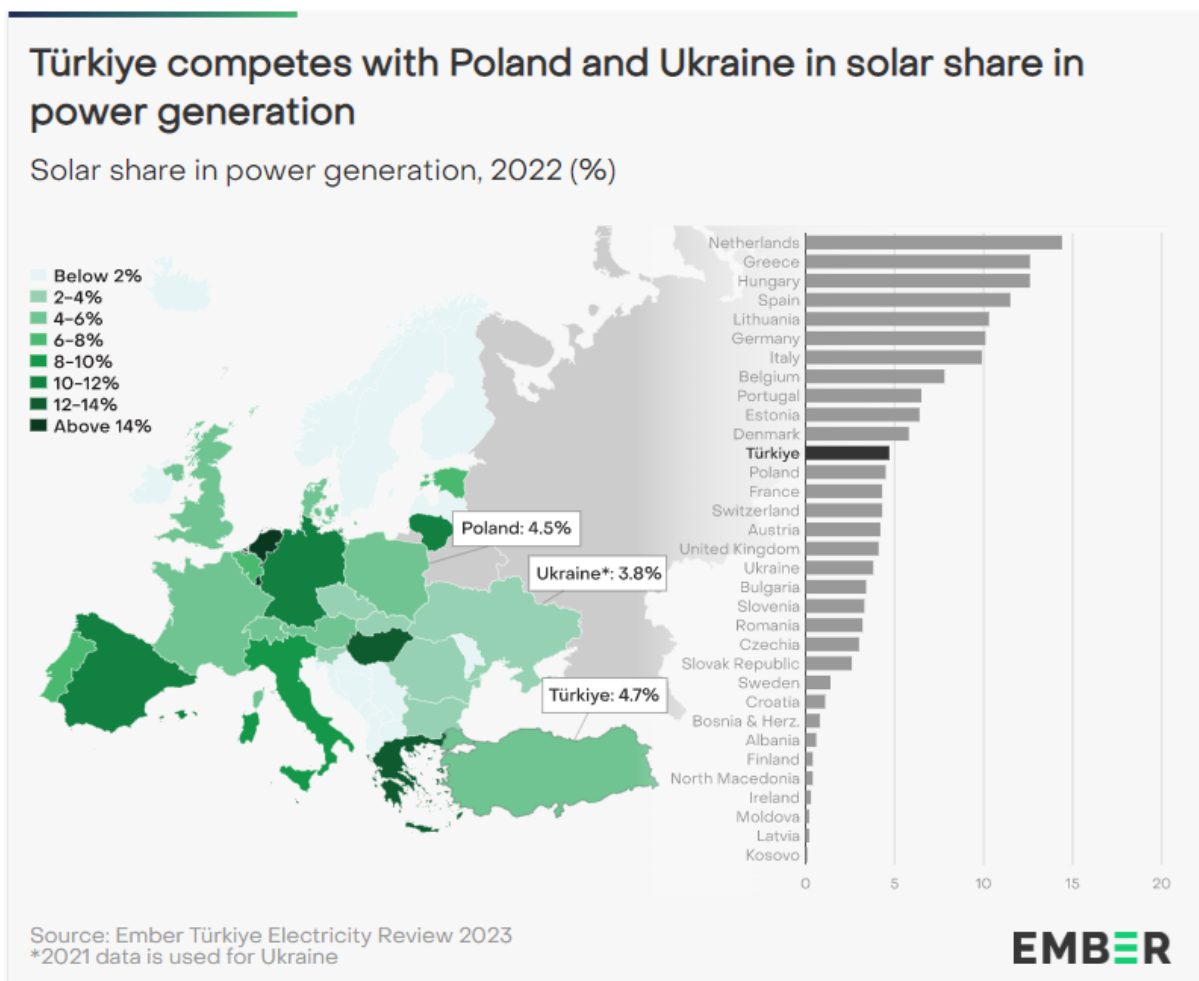
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Although [Türkiye's wind power potential](#) is mostly concentrated in a narrow region in the western part of the land, it outranks several countries in Europe in terms of wind power share. For instance the country's 10.8% wind share in total generation is higher than some G20 countries like France (8.2%) and Italy (7.1%). But still this number is not enough to place Türkiye among the top 15 European countries in terms of highest wind power share.

Türkiye competes with Poland and Ukraine in solar

A number of southern European countries with relatively [higher solar potential](#) like Spain, Greece and Italy predictably have a sizable share of solar, at or above 10%. However, even in less favorable weather conditions, northern countries like the Netherlands, Germany, Lithuania and Hungary are not far behind them. Despite much lower solar potential, policy support helped the northern Netherlands to generate 14% of its power with solar alone in 2022.

Despite a higher solar potential than most other European countries, Türkiye has not yet seen that translate into a proportionally large role for solar in the power mix. As of 2022, Poland has a 0.2% less solar share in generation than Türkiye (4.5% vs 4.7%), despite much lower solar power potential. And another low solar potential country—Ukraine— had only 0.4% lower solar share in generation than Türkiye in 2021 (3.8% vs 4.2%)*.



**NOTE: For Ukraine only 2021 data is available because of the fact that the Ukrainian transmission system operator UKRENERGO had to stop providing electricity data since the war.*

Conclusion

Can 2023 be a new beginning for solar?

Türkiye's new energy plan shows a five times rise in solar power capacity by 2035. But barriers against solar power still prevail.

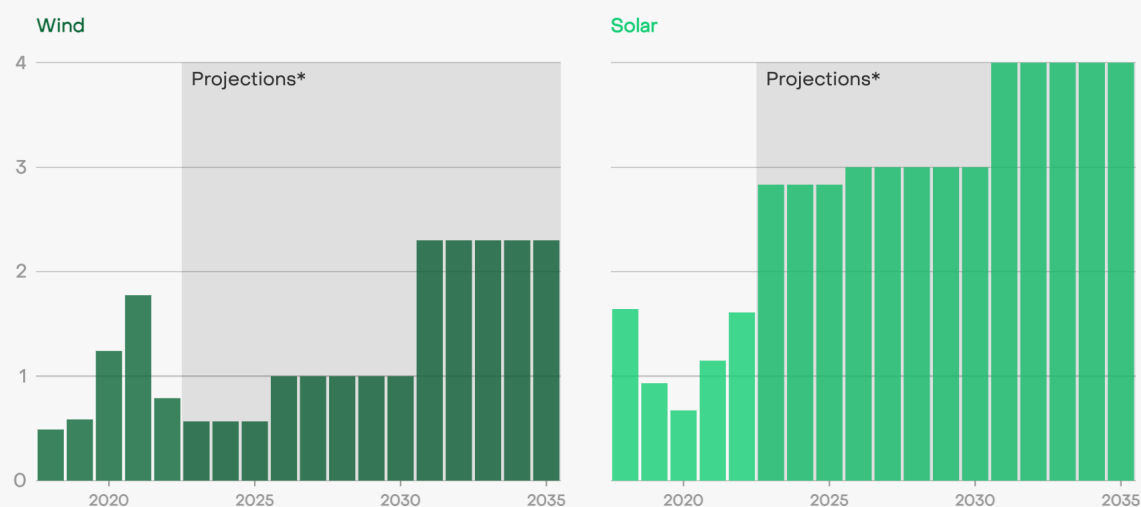
Focus on solar

The Ministry of Energy published a [long term energy plan](#) at the end of 2022, which sets capacity targets for each generation source up to 2035. In the plan, total installed capacity almost doubles by 2035, with most new capacity coming from renewables, led by solar.

The energy plan projects that solar reaches almost 53 GW by 2035, up from 9.4 GW in 2022. With this increase, solar power is expected to have the largest installed capacity among all generation sources in Türkiye. This would put solar generating 16.5% of Türkiye's power in 2035, up from 4.7% in 2022.

Türkiye's new energy plan projects a dramatic rise in new solar installations, while wind capacity target is unambitious

Historical and planned new wind and solar power capacity installations (GW)



Source: TEİAŞ (Historical data), Turkish Ministry of Energy (Planned capacity) · *Based on total projections for different forecast periods

In order to reach these solar power targets, Türkiye has to increase the pace of new solar installations almost immediately. Over the course of the last five years, the country deployed around 1.2 GW of new solar power plants annually. The plan foresees 2.8 GW capacity addition every year between 2022 and 2025, while targeted annual new capacity reaches 4 GW between 2030-2035.

No ambition in wind, increase in coal capacity

Despite ambitious plans for solar, Türkiye's new energy plan lacks ambition for wind deployment. The projected annual wind capacity addition between 2022 and 2030 is even lower than annual new wind installations in the last five years. Indeed, the wind and solar capacity targets for 2030 (18 and 32 GW respectively) are lower than the wind and solar capacities necessary to [halve foreign dependence in power generation](#) in comparison to 2021 (30 GW wind and 40 GW solar).

The new energy plan lacks clarity for coal. While the policy paper states that coal generation will decrease year by year, it also projects a rise in coal power capacity by 2.5 GW by 2035. Doing so negates any potential 'no new coal' pledge from the government, and leaves unclear how the planned decrease in coal will be implemented. The plan also projects a 10 GW additional gas power capacity by 2035, up from 25 GW in 2022.

Capacity allocation barrier against solar

Continued barriers for solar deployment raise questions about the ambitious solar power capacity targets of the country. In particular, the lack of sufficient grid capacity allocated for solar power has been one of the biggest hurdles in recent years.

Türkiye organizes only 1 GW [solar power auctions](#) every year, linked to domestic manufacturing obligations. The government has also supported domestic manufacturing by applying a [levy on Chinese solar panels](#) since 2017. Backing domestic panels has caused a boom in [domestic solar panel manufacturing capacity](#). However, this capacity is only marginally utilized, as Türkiye [deployed only 1.6 GW solar](#) power plants in 2022.

Until recently it was not possible to secure grid capacity for a utility-scale licensed solar power plant project. New legislation issued in November 2022 has enabled wind and solar projects paired with energy storage facilities of the same size to more easily obtain licenses. However, only 30 GW capacity is allocated by the transmission system operator for this purpose, although the [applications have already exceeded 165 GW](#) in only two months.

Furthermore, the required batteries will raise the costs of project development, making the timeline for delivery less certain.

The recent [capacity allocation announcement by the Transmission System Operator](#) also paints a bleak picture, allocating 160 MW new capacity for hybrid power plants. As a hybrid power plant allows more than one power generation source (such as hydro and solar) to be combined in one, the lack of new hybrid capacity will block the country from realizing its vast floating solar potential on its large dams.

Everything starts with a plan

Despite shortcomings, Türkiye's new energy plan improves the country's wind and solar targets. The wind and solar capacity targets submitted as a part of its Nationally Determined Contribution in 2015 were to reach [16 GW wind and 10 GW solar](#) by 2030. Now these targets are 13% higher for wind and 230% higher for solar.

As one Turkish saying goes, *"Well begun is half done"*. Türkiye has made a very good first step with a heartening increase to its solar power targets especially. However, no plans can happen by themselves. Türkiye's focus on solar in its energy plan now requires a focus on how to enable it.

Supporting Materials

Data

For Türkiye's 2022 licensed generation data *"/production/real-time-generation"*, for the unlicensed generation *"/production/renewable-unlicensed-generation-amount"* web services of the Turkish power market operator's (EPIAŞ) Transparency API are used. The historical generation data between 2000-2021 is taken from the [generation statistics](#) of the transmission system operator, TEİAŞ.

The electricity generation data for the European Union (EU) countries are taken from Ember's European Electricity Review 2023 report which collates the datasets from ENTSO-E, Eurostat and national transmission system operators. Please see Ember's [European Electricity Review 2023](#) for more details. The data for the non-EU countries excluding Türkiye are taken from Ember's global yearly dataset. Please visit [Ember's web page](#) for more information on this dataset.

The data source for the coal import bill of Türkiye is the country's official statistical institute, [TURKSTAT](#), while the thermal coal imports by origin country data is from Kpler.

Acknowledgements

Thanks

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Image credit

[Pashkov Andrey](#) / Alamy Stock Photo

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