



Türkiye surpasses 2025 solar target as capacity doubles in 2.5 years

Türkiye has doubled its solar capacity in just 2.5 years, surpassing its current target more than a year ahead of schedule. The progress underlines the opportunity for an upgraded target in its upcoming Nationally Determined Contribution.

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Translations: Turkish

About

This study examines the recent development of solar and wind energy capacities in Türkiye in the context of current renewable energy targets and strategies.

Highlights

+102% **14.6 GW** **\$15 billion**

The increase in solar energy capacity over the past two and a half years

Planned installed capacity of solar power plants with storage to be implemented in the next five years

Value in USD of natural gas imports avoided due to total electricity generation from wind and solar over the past two and a half years

Executive Summary

Türkiye's solar energy capacity doubled in 2.5 years, exceeding the 2025 target

Installations primarily for self-consumption have driven 94% of the growth since July 2022, raising capacity from 9.7 GW to over 19 GW by the end of 2024.

The previous doubling of solar energy capacity required more than four years between 2018 and 2022, whereas the latest doubling demonstrates a rapid acceleration over recent years. To sustain the momentum, Türkiye could utilize rooftop, hybrid, floating and storage-integrated solar potential, which collectively represent a vast untapped potential.

01 Türkiye surpasses 2025 solar capacity target ahead of schedule

Türkiye's solar energy capacity doubled in two and a half years and reached 19.6 GW by the end of 2024, achieving its 2025 target one and a half years early in 2024. This rapid progress showcases the country's potential for more ambitious future goals.

02 \$15 billion in natural gas imports avoided through solar and wind

Over the past two and a half years, solar and wind energy combined have prevented \$15 billion in natural gas imports, reinforcing Türkiye's energy independence and reducing dependency on fossil fuels. Solar energy alone generated 52 TWh of electricity during this period, which accounted for 6% of the country's total electricity supply. This avoided \$5.4 billion in natural gas imports over the same period.

03 33 GW storage capacity in the pipeline

Türkiye could utilize untapped capacities to advance solar energy momentum through floating, storage-integrated, hybrid and rooftop solar potential. The country has a pipeline of 33 GW in pre-licensed storage-integrated solar and wind projects, far exceeding the official 2030 target of 2.1 GW. With these capacities, the country is well-positioned to sustain its renewable energy growth trajectory.

By doubling its solar energy capacity in just two and a half years and surpassing its 2025 target ahead of schedule, Türkiye has demonstrated its potential to set more ambitious goals. Raising renewable energy targets and maintaining the momentum offers Türkiye the opportunity to reduce its dependence on energy imports, strengthen energy security, and assert its commitment more prominently on the international stage.

Bahadır Sercan Gümüş
Energy analyst, Ember



Türkiye's solar energy breakthrough

Solar energy capacity has been continuously gaining momentum

The facilitation of self-consumption-focused power plant installations in Türkiye has accelerated annual new installations, pushing solar energy capacity beyond the current 2025 target.

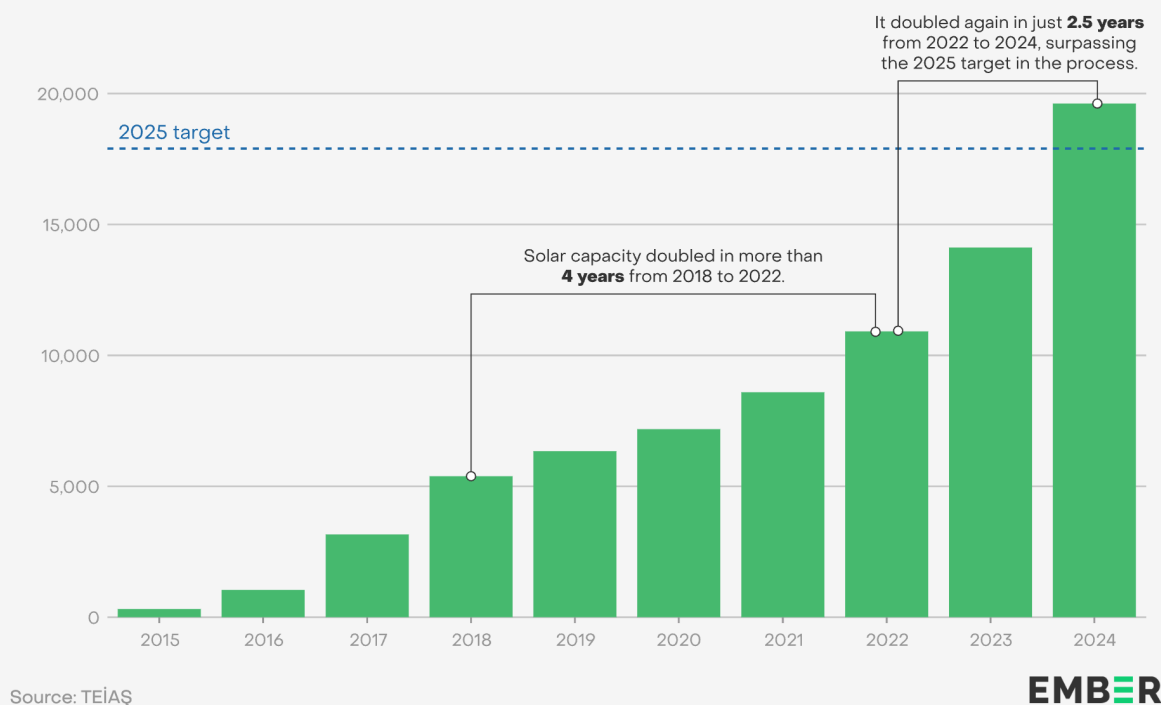
Türkiye's solar energy capacity doubled from 9.7 GW in July 2022 to exceed 19 GW by the end of 2024. By August 2024, the country had already exceeded the 18 GW target set for 2025 in the [National Energy Plan \(NEP\)](#) by the Ministry of Energy and Natural Resources (MENR). Achieving this target 1.5 years ahead of schedule underscores Türkiye's strong commitment to solar energy and signals the need for more ambitious future targets.

Unlicensed plants, primarily built for self-consumption, accounted for 90% of new installations in the past four years. These installations have consistently driven growth, particularly after the regulatory changes introduced in 2022, which expanded opportunities for distributed solar generation.

Solar energy's growth rate has accelerated significantly in recent years. While it took 51 months to double installed capacity before July 2022, the same growth was achieved in just two and a half years between 2022 and 2024. This rapid progress highlights the sector's remarkable momentum and Türkiye's evolving energy landscape.

Türkiye's solar capacity doubled in the last two and a half years

Total installed solar capacity (MW)



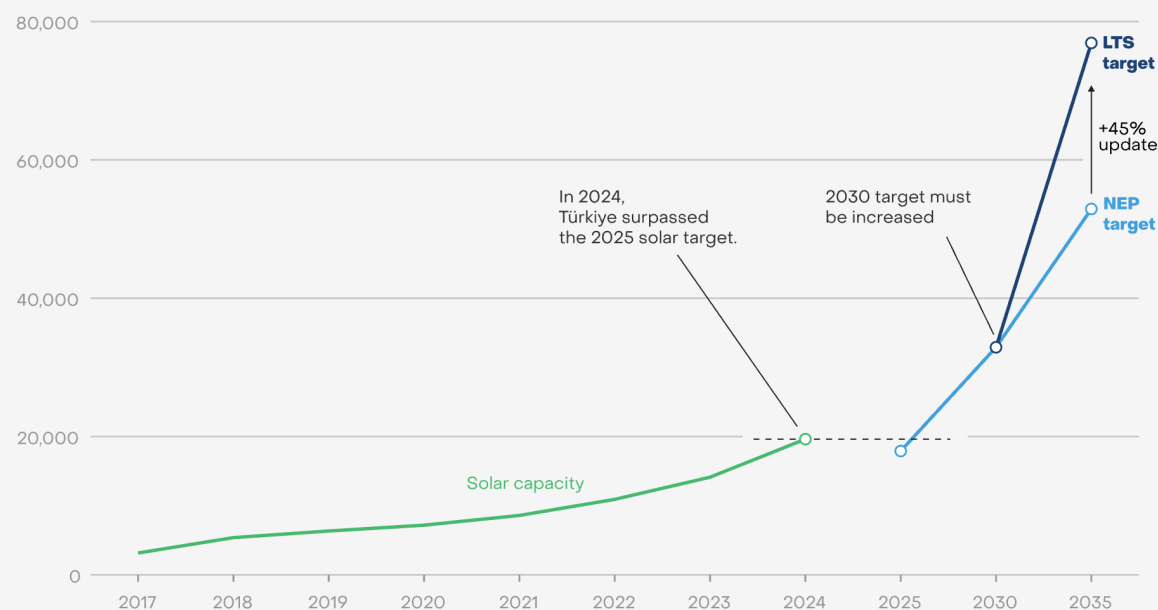
Alongside the increase in installed capacity, a total of 52 TWh of electricity was generated from solar energy over the past two and a half years, providing 6% of Türkiye's electricity. If this electricity had been produced using natural gas power plants, an additional \$5.4 billion worth of natural gas imports would have been required. In 2024 alone, Türkiye's total solar generation displaced gas imports worth \$1.7 billion, an increase of 22% year-on-year due to the huge growth in solar generation and [despite an 18% drop in average](#) natural gas prices in 2024 compared to 2023.

Over the same period, the combined electricity generation from solar and wind energy helped Türkiye avoid \$15 billion in natural gas imports. This underscores that raising renewable capacity targets not only strengthens Türkiye's energy independence but also amplifies its economic benefits.

The National Energy Plan (NEP), outlining targets for 2025, 2030 and 2035, was published in 2023. In November 2024, during COP29, the Ministry of Environment, Urbanisation and Climate Change introduced the [Long-Term Climate Change Strategy \(LTS\)](#), which updated the 2030 and 2035 targets. Under the LTS, Türkiye's 2035 solar capacity target was revised to 77 GW, which is 45% higher than the 53 GW target set in the earlier NEP.

Türkiye's solar capacity exceeds 2025 target in 2024

Solar energy capacity and targets (MW)



Source: TEİAŞ

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Rooftop, hybrid and storage-integrated solar power plants can sustain Türkiye's solar energy momentum

The momentum in solar power installations can be maintained through the commissioning of battery storage plants, hybrid power plant projects, and the utilisation of Türkiye's vast [120 GW solar energy potential](#) available on rooftops.

Hybrid power plants, which generate electricity from multiple sources, allow more efficient use of existing grid connection capacity with renewable energy sources, reducing the need for additional grid investments. By the end of 2024, [1 GW of solar capacity](#) had been commissioned as a secondary source, with 3.5 GW of licensed hybrid solar capacity in development.

In the area of storage-integrated solar power, Türkiye is making significant progress. As of 2024, [412 solar power plants with storage](#), representing a combined installed capacity of over 14 GW, have received pre-licenses. This figure far exceeds the 2.1 GW storage capacity target set in the NEP for 2030. The scale of storage-integrated solar capacity alone

demonstrates Türkiye's potential to achieve a far more ambitious growth trajectory in battery storage, paving the way for stronger integration of renewable energy into the grid.

In 2016, Türkiye introduced the [Renewable Energy Resource Zone \(YEKA\) model](#) to facilitate land allocation for investors, ease the deployment of large projects and encourage the domestic production of renewable energy technologies. Over eight years, 3 GW of solar energy tenders have been conducted under the YEKA framework, resulting in [1.5 GW of capacity being commissioned](#), while 630 MW of projects were cancelled.

[Recent changes in 2024](#) enhanced the YEKA model to attract more investors. These improvements include streamlining post-tender permitting processes and offering financial incentives, such as transmission fee exemptions. Additionally, the [announcement of an 800 MW](#) solar power plant tender planned for 2025 has expanded the total YEKA GES project portfolio to 3.8 GW.

Looking ahead, the [Renewable Energy 2035 Roadmap](#), announced by the Ministry of Energy and Natural Resources (MENR), sets a goal of conducting at least 2 GW of wind and solar tenders annually. A key highlight of this plan is the inclusion of floating solar power plant (GES) projects on state-owned large dams. With an estimated [floating solar potential of at least 53 GW](#), these projects present a significant opportunity to increase renewable energy capacity. They also provide an efficient use of unused water surfaces and reduce water losses caused by evaporation.

With hybrid plants, YEKA projects, and the [24 GW of self-consumption-focused solar power plants](#) currently under development, solar energy capacity could increase two and a half times by the end of this decade, surpassing 55 GW.

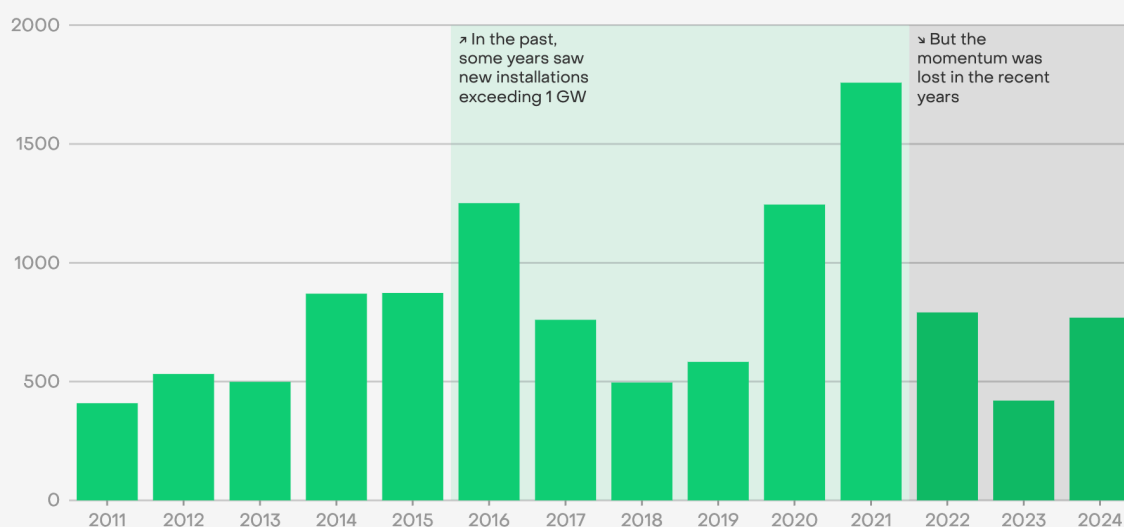
Momentum in wind energy is slowing

In 2024, Türkiye's wind energy capacity grew by only 6.5% (+770 MW), marking a significant slowdown compared to the peak annual additions of 1.7 GW in 2021. This slower pace of installation brought the total wind energy capacity to 12.5 GW by the end of 2024—falling short of the 13.3 GW target for 2024 set in the [Strategic Plan](#) published by the Ministry of

Energy and Natural Resources (MENR). The slowing growth trend underscores the need for renewed focus and strategic interventions to revitalise wind energy development in Türkiye.

New installations in wind are far from its peak

Capacity of new installations (MW)



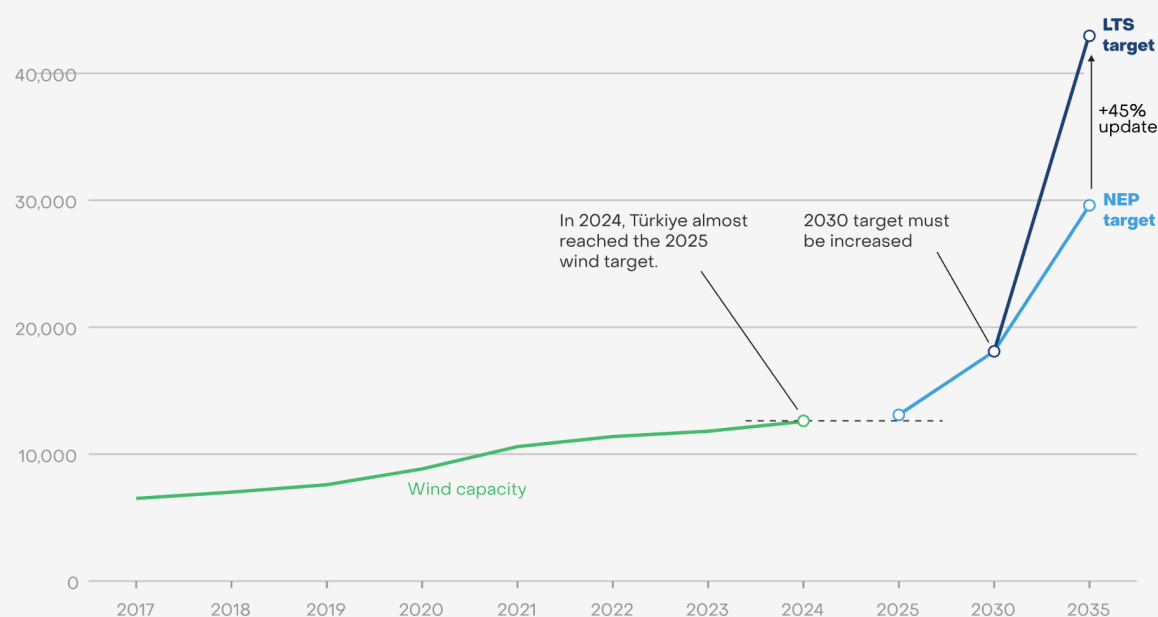
Source: TEİAŞ

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[The National Energy Plan \(NEP\)](#) sets a modest wind capacity target of 18 GW by 2030, envisioning annual additions of only 1 GW. Considering that the average annual new installation in wind energy over the last five years has been approximately 1 GW, it appears that the set targets are not particularly ambitious. However, the [Long-Term Strategy \(LTS\)](#), published during COP29, raises the bar significantly, projecting wind capacity to reach 43 GW by 2035. This ambitious goal requires commissioning 5 GW annually between 2030 and 2035, signalling a critical need to accelerate wind energy momentum.

Seizing the opportunity to update Türkiye's 2030 wind targets

Wind energy capacity and targets (MW)



Source: TEİAŞ

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To meet these ambitious targets, Türkiye is focusing on regulatory reforms, including the introduction of "super permits" to streamline approval processes. These measures include conducting environmental assessments alongside other permits, expediting technical reviews, and accelerating expropriation procedures. The super permit regulations will continue in 2025, with a focus on forest and zoning permits, to address key bottlenecks in project development.

[Renewable Energy Resource Zone \(YEKA\)](#) tenders represent another avenue for scaling up wind energy capacity. Despite 2.9 GW of capacity allocated through YEKA tenders to date, only 301 MW had been commissioned by the end of 2024, and [the cancellation of the 1 GW YEKA RES-1 tender](#) in 2024 highlighted implementation challenges. However, the announcement of a 1.2 GW wind capacity tender for 2025, alongside [regulatory adjustments](#), aims to boost investor confidence. These adjustments include the right for YEKA projects to install battery storage systems, compensation for revenue losses due to government

production restrictions, exemptions from transmission fees, and guaranteed minimum prices for electricity sales.

Türkiye is also exploring its untapped offshore wind potential. [With an estimated total offshore wind capacity of 75 GW](#), the country has set a target of 5 GW by 2035. In 2023, four regions along the Aegean and Marmara coasts were identified for offshore wind projects, with technical assessments and pre-feasibility studies underway. Increasing the 2035 offshore wind target offers a significant opportunity to accelerate wind energy growth.

Additionally, 18 GW of wind capacity has been allocated for storage-integrated projects by 2030. The integration of storage systems, enhancements to the YEKA model, streamlined permitting processes, and the development of offshore wind projects collectively provide a pathway for Türkiye to revitalise its wind energy sector and potentially exceed previous installation rates.

Battery storage: unlocking renewable energy potential

Türkiye has introduced progressive regulations for storage-integrated power plants to facilitate the integration of renewable energy into the grid, define the role of battery storage in the energy market, and accelerate the transition to clean energy. [A regulation published](#) in 2022 allows storage-integrated wind and solar power plants to obtain pre-licenses for electricity production up to their storage capacity without capacity allocation restrictions on the grid. These plants can also benefit from existing renewable energy incentives, further promoting investment.

While no grid-scale storage-integrated power plants are operational in Türkiye yet, the country has a robust pipeline of approximately 33 GW of storage-integrated wind and solar projects with pre-licensing periods extending until 2030. This strong investor interest highlights the potential of storage-integrated power plants. However, both the [The National Energy Plan \(NEP\)](#) and [Long-Term Strategy \(LTS\)](#) aim for 7.5 GW of battery storage by 2035, a target significantly below the existing project pipeline of 33 GW. This gap suggests an

urgent need to update official targets or reassess the capacity allocated to storage-integrated projects.

Storage systems are critical for grid stability, balancing electricity supply and demand, and integrating renewable energy into the grid. These advancements will enhance energy security and reduce both dependence on and payments for fossil fuel imports. Additionally, Türkiye could utilise grid interconnections and regional collaborations, [particularly with Central Asia](#), to strengthen energy security, ensure grid stability, improve demand-supply balance, and diversify the energy supply.

Ensuring targets are reflected in the Nationally Determined Contribution (NDC)

Türkiye's current [Nationally Determined Contribution \(NDC\) for 2030](#) sets an emissions target approximately 25% higher than the total emission levels recorded in 2022. This target not only lacks absolute reductions but also does not take into consideration the new goals, which aim to increase the current wind and solar capacity (32 GW) to nearly four times its size (120 GW) by 2035. Moreover, recent developments in solar energy indicate that the 2025 target has already been surpassed, while wind energy potential demonstrates that more substantial annual installations are achievable.

To advance its clean energy transition sustainably, Türkiye must align renewable energy capacity growth with electricity demand increases. Electricity demand has risen at an average annual rate of 2.8% over the past decade and is projected to grow at 3.5% annually by 2035. Meeting this demand sustainably will require annual additions of at least 5 GW of solar and 2 GW of wind energy capacity between 2025 and 2035. However, the current targets outlined in the National Energy Plan (NEP) and the NDC fall short of accommodating this scale of annual installations.

Raising Türkiye's 2030 renewables targets and incorporating the newly announced 2035 goals into the updated NDC presents a transformative opportunity. The 2035 targets reflect a 45% increase in capacity compared to the current NEP, signalling a strong commitment to renewables, but the absence of new interim milestones makes it challenging to track

progress. The current targets for 2025 and 2030 fall short of the ambition set out for 2035. Indeed, the 2025 solar target in Türkiye's Energy Plan has already been surpassed, highlighting the need to revise the 2030 targets to align with the rapid growth of solar energy and battery storage.

Updating the NEP to include these revised targets and integrating the new 2035 goals into the updated NDC would make these ambitions binding, ensuring alignment with global climate objectives. This move will also enhance Türkiye's position on the global stage, particularly as one of the [two candidate countries to host COP31](#), demonstrating its dedication to the clean energy transition.

Supporting Materials

Methodology

Electricity Capacity, Generation and Consumption

Electricity generation and consumption calculations were obtained using the [EPIAS Transparency Platform](#) web API. The annual increase in electricity demand over the past decade was calculated using the Compound Annual Growth Rate (CAGR). To determine the amount of electricity that solar and wind energy can produce per unit of installed capacity, capacity factor data from the past three years were taken into account. The historical changes in power plant installed capacities obtained from [TEİAŞ Load Dispatch Information System](#) webpage.

Avoided Imports

A scenario was developed in which the electricity generation from solar and wind power plants is replaced by natural gas power plants operating at a 55% capacity factor to calculate the cost of avoided imports. In this scenario, natural gas prices were calculated daily using the previous day's [Netherlands TTF prices](#).

Acknowledgements

Contributors

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Cover image

[Süleyman Kahraman](#) / Alamy Stock Photo

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