

A Decade of Growth in Solar and Wind Power:

Trends Across the U.S.



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CLIMATE  CENTRAL

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Summary

America's capacity to generate carbon-free electricity grew during 2023 — part of a decade-long growth trend for renewable energy. Solar and wind account for more of our nation's energy mix than ever before.

To study America's growing renewable electricity capacity and generation, Climate Central analyzed historical data on solar and wind energy over a 10-year period (2014 to 2023).

The analysis shows that the amount of electricity produced from solar and wind power increased across the U.S. Our nation generated 238,121 gigawatt-hours (GWh) of electricity from solar in 2023 — more than eight times the amount generated a decade earlier in 2014. Wind power has more than doubled this decade, with 425,325 GWh coming from wind installations across the country in 2023. Together, these two renewable energy sources generated enough electricity in 2023 to power the [equivalent of more than 61 million average American homes](#).

The most solar power generation came from California (68,816 GWh) and Texas (31,739 GWh) in 2023. Texas also led the country in power generated from wind (119,836 GWh).

These data — combined with federal capacity forecasts — show how renewable energy growth is driving America's progress toward net-zero carbon emissions targets in the U.S.

This report and supplementary data show:

- How much solar and wind power increased from 2022 to 2023
- Growth trends in solar and wind power over the past decade (2014-2023)
- Which states are the biggest producers of solar and wind energy

[Download the data.](#)

Introduction

Renewable energy from solar panels and wind turbines is increasingly important in the United States, as costs for these technologies continue to [rapidly decline](#). As the power grid grows to meet increasing electricity demand in the coming decades, the [U.S. Energy Information Administration \(EIA\) forecasts](#) that most of the nation's new energy capacity will come from renewables like solar and wind — shifting the energy mix away from fossil fuels like coal, oil, and natural gas.

Low-carbon renewable energy sources such as solar and wind provide electricity without producing

heat-trapping gases or other air pollutants. Renewable energy projects [create jobs](#), [support local economies](#), and help meet U.S. commitments to reduce carbon pollution.

Solar and wind are the fastest-growing renewable energy sources in the U.S. In 2019, [wind generation surpassed](#) the amount of electricity generated from hydropower — a longtime leader in renewable energy. In 2022, [solar overtook](#) hydropower for the first time. Solar and wind energy [will lead the growth in U.S. power generation](#) for at least the next two years, according to EIA estimates.

This report uses data from the [EIA](#) to analyze solar and wind capacity and generation over the past decade (2014 to 2023) in all 50 states and the District of Columbia. Recent data are compared across states and against historical figures to show which states have led growth in solar and wind energy.

The key terms in this report — capacity and generation — gauge renewable energy in the U.S.

- **Capacity** reflects the number and size of operational solar and wind installations. Renewable energy in the U.S. comes from both large utility-scale power plants and small-scale installations (which have less than 1 megawatt of capacity).
- **Generation** reflects how much electricity is produced by those installations, which depends on the weather and number of daily sunlight hours.

See Box 1. Key Terms for more details.

Together, capacity and generation data provide insight into renewable energy growth, by showing the new capacity that comes online each year as well as the amount of electricity generated with new installations.

[Download](#) datasets with all variables included in this report.

Box 1. Key Terms

- **Capacity:** measure of the maximum rate at which electricity can be generated by equipment on the ground, reported here in megawatts (MW) for state totals and gigawatts (GW) (equal to 1,000 MW) for national totals.
- **Generation:** the amount of electricity produced over a period of time, reported here in gigawatt-hours (GWh) (equal to 1,000 megawatt-hours). For reference, the average American household consumed [10.8 MWh](#) of electricity in 2022.
- **Small-scale installations:** power operations with less than 1 MW of capacity, usually located onsite or near where the electricity is used (e.g., residential rooftop solar panels or [community solar](#) projects). Note: The only small-scale installations discussed in this report are for solar power.
- **Utility-scale installations:** power plants with at least 1 MW of capacity.

Learn more about U.S. electricity capacity and generation from the [U.S. Energy Information Administration](#).

SOLAR

National Solar Power in 2023

By the end of 2023, the U.S. had an estimated total capacity of 139 gigawatts from utility- and small-scale solar installations — an increase of more than 26 GW or 23% from 2022.

During 2023, the U.S. produced an estimated 238,121 GWh of electricity from utility- and small-scale solar installations combined. This is an increase of 33,042 GWh or 16% compared to 2022.

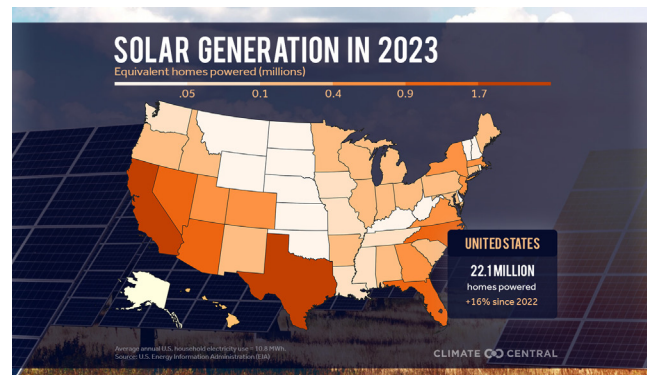


Figure 1: National solar electricity generation (GWh) in 2023 by state

Box 2. Solar Power in the National Electricity Mix

Utility-scale solar accounts for around 8% of the nation’s capacity from all utility-scale electricity sources (including renewables, nuclear, and fossil fuels such as coal, oil, and natural gas). In 2023, nearly 4% of electricity in the U.S. was produced by utility-scale solar. A decade earlier in 2014, it accounted for less than 0.5% of the total electricity generated.

California and Nevada are among the states for which utility-scale solar comprises a significant portion of the current electricity mix. In 2023, utility-scale solar contributed 19% (40,714 GWh) of electricity in California and 23% (9,733 GWh) of the electricity in Nevada.

Nevada’s capacity for solar power is projected to increase during 2024, as the Gemini solar facility is scheduled to come online. The facility will add a planned 690 MW of solar capacity and 380 MW of battery storage – which is one way solar power facilities can capture and store some energy to meet evening electricity demand. It’s expected to be the largest solar energy project in the U.S. once fully operational.

Note: These data reflect total utility-scale energy sources only and exclude small-scale solar.

Box 3. Real Stories: Solar Powered Job Boom in Nevada

Solar energy projects are bringing jobs and skills training to Nevada. Climate Central’s [Partnership Journalism program](#) collaborated with the Mountain West News Bureau to investigate how Nevada is leading the way for renewable energy workforce development.

[Read the full story.](#)

Box 4. Growing Role of Small-scale Solar

The EIA considers a solar installation to be “small-scale” if it has less than 1 MW of capacity. Most residential or commercial rooftop solar installations are small-scale, along with most community solar projects (those that provide electricity to multiple residents or businesses in an area).

Small-scale solar installations account for an estimated 48 GW (around 34%) of all solar capacity in the U.S. at the end of 2023. Nearly 8 GW of new small-scale solar capacity was brought online in 2023, representing a record 20% increase compared to 2022.

During the past decade, small-scale solar capacity and generation have grown steadily, but at a slower pace than utility-scale. Small-scale capacity in 2023 was more than six times the amount compared to 2014; utility-scale saw an eight-fold increase. The [EIA estimates](#) that small-scale solar capacity could grow to 55 GW by the end of 2024.

Small-scale solar produced an estimated 73,619 GWh or about 31% of all solar generation in 2023 — compared to 164,502 GWh generated by utility-scale installations.

California generated the most electricity from small-scale operations (28,102 GWh) in 2023, which accounts for around 41% of the state’s total solar electricity generation for the year. On the East Coast, New York generated the most electricity from small-scale solar in 2023 (3,973 GWh) — accounting for nearly 62% of electricity generated from solar that year in the state. In the middle of the country, wind is typically a bigger source of electricity than solar; however, Illinois was the 10th highest small-scale solar generating state in 2023, with 1,536 GWh of electricity from small-scale operations — accounting for 44% of the state’s solar electricity.

Solar-powered States in 2023

The states with the most solar capacity in 2023 (combined utility- and small-scale) were California, with 36,461 MW, Texas (18,476 MW), Florida (10,352 MW), North Carolina (7,150 MW), and Arizona (5,848 MW).

These same five states also generated the most electricity from solar power (utility- and small-scale combined) in 2023 (Figure 1): California (68,816 GWh); Texas (31,739 GWh); Florida (17,809 GWh); North Carolina (12,085 GWh); and Arizona (11,778 GWh).

Texas led the nation in growth from 2022 to 2023 for both solar capacity and generation (Table 1). Texas added 4,996 MW of capacity (37% annual increase) and generated 6,302 GWh more than the previous year (25% annual increase).

California followed with an addition of 4,714 MW of solar capacity — a 15% increase from 2022. The state produced 5,906 GWh more (9% increase) than the year before.

Table 1. Top states for utility- and small-scale solar (combined) capacity and generation in 2023. Find data for all 50 states and the District of Columbia in the [full dataset](#).

State	Solar Capacity (MW) 2023	Solar Capacity Growth 2022 to 2023	Solar Generation (GWh) 2023	Solar Generation Growth 2022 to 2023
California	36,461	15%	68,816	9%
Texas	18,476	37%	31,739	25%
Florida	10,352	33%	17,809	28%
North Carolina	7,150	11%	12,085	2%
Arizona	5,848	14%	11,778	6%
United States total	139,012	23%	238,121	16%

A Decade of Solar Growth Across the U.S., 2014-2023

The U.S. added more than 121 GW of utility- and small-scale solar capacity in total during the last decade — an increase of around 688% (Figure 2). This means there was nearly eight times more solar capacity in 2023 than in 2014.

The amount of electricity produced from solar increased at a similar rate. In 2023, the U.S. generated over eight times more electricity from solar energy than in 2014 — an increase of more than 209,197 GWh or 723%.

The states with the most significant growth in solar capacity over the last 10 years include: California, which added 27,864 MW from 2014 to 2023; Texas (18,179 MW); Florida (10,203 MW); North Carolina (6,416 MW); and Nevada (4,313 MW).

These five states saw the most growth in generation, too (Table 2). Present-day data on solar capacity and generation reflect these strong historical growth trends, as these states were among the highest solar-generating states in 2023.

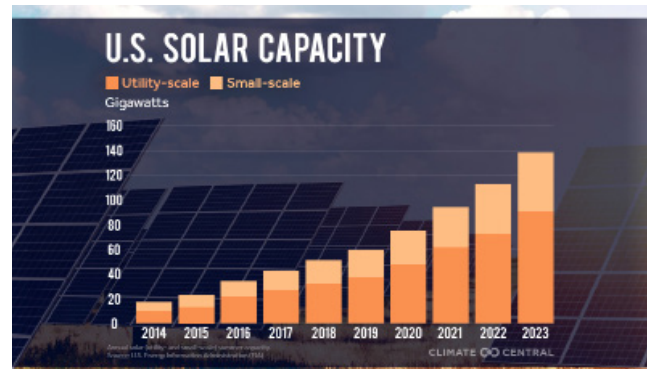
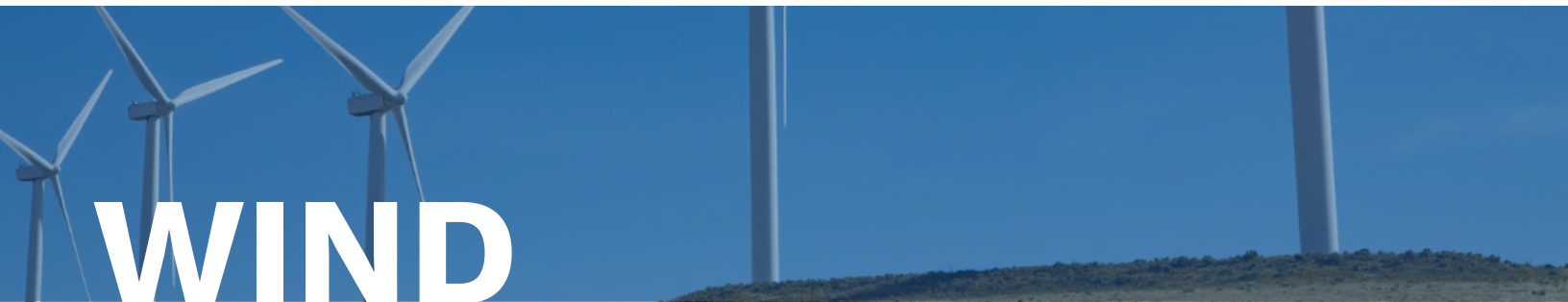


Figure 2: National solar capacity (GW) by year (2014-2023)

Table 2. Top states for growth in solar (utility- and small-scale combined) capacity and generation from 2014 to 2023. Find data for all 50 states and the District of Columbia in the [full dataset](#).

State	Solar Capacity Growth (MW) 2014 to 2023	Solar Capacity Growth 2014 to 2023	Solar Generation Growth (GWh) 2014 to 2023	Solar Generation Growth 2014 to 2023
California	27,864	324%	54,210	371%
Texas	18,179	6,124%	31,293	7,016%
Florida	10,203	6,858%	17,448	4,833%
North Carolina	6,416	874%	11,282	1,405%
Nevada	4,313	647%	10,305	922%
United States total	121,363	688%	209,197	723%



National Wind Power in 2023

By the end of 2023, the U.S. had an estimated total capacity of 148 GW from utility-scale onshore and offshore wind installations — an increase of 6 GW or 4% from 2022.

During 2023, the U.S. produced an estimated 425,235 GWh of electricity from utility-scale wind installations. This represents a slight drop of 9,062 GWh or 2% compared to 2022 due to [lower average wind speeds](#), mostly in the Midwest.

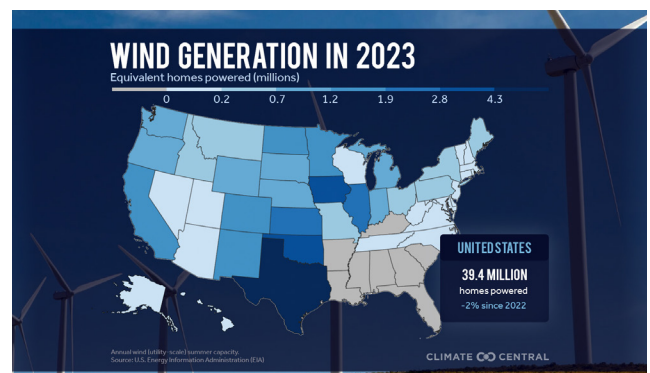


Figure 5: National wind electricity generation (GWh) in 2023 by state

Box 5. WeatherPower: Connecting Weather to Local Solar and Wind Power

Solar and wind installations produce energy daily, year-round. Seasonal weather plays an important role. The amount of electricity generated is influenced, in part, by when the sun shines or the wind blows.

Solar generation in the U.S. peaks in the summer, when days are long and the sun’s rays strike the Northern Hemisphere more directly. In 2023, solar electricity produced from utility- and small-scale installations (combined) peaked (Figure 3) in July (26,626 GWh) and August (25,372 GWh).

Wind energy generation is typically highest during the spring. In 2023, the most wind energy was produced across the U.S. in March (44,580 GWh) and April (43,072 GWh) (Figure 4).

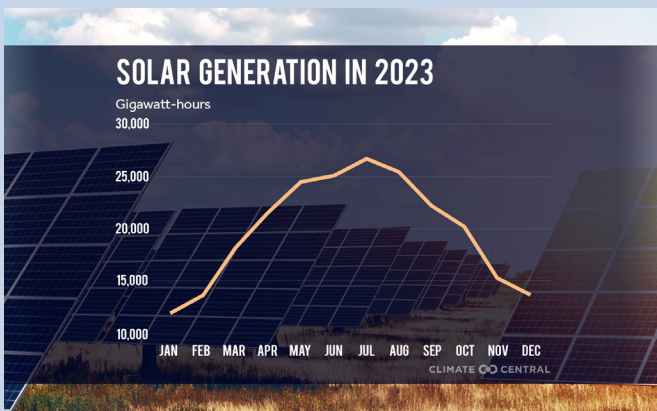


Figure 3: Monthly solar generation (GWh) in the U.S. in 2023. During 2023, U.S. solar electricity generation peaked in July (26,626 GWh).

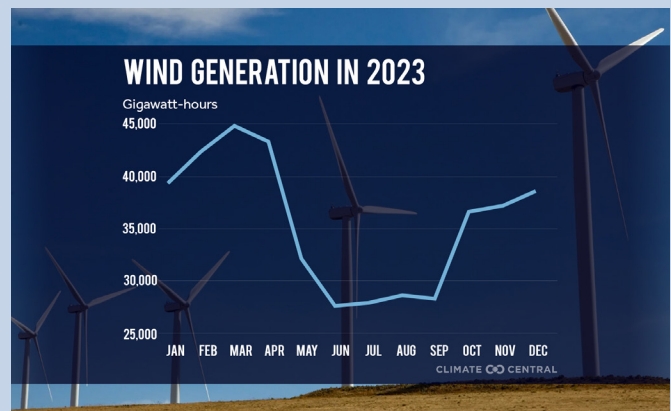
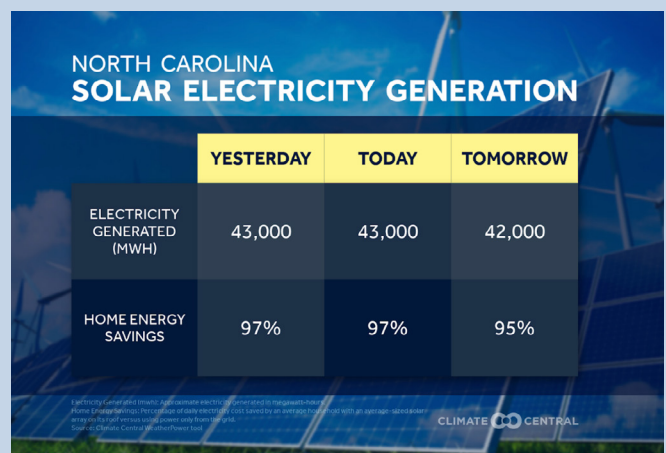


Figure 4: Monthly wind generation (GWh) in the U.S. in 2023. During 2023, U.S. wind generation peaked in March (44,580 GWh).

Climate Central’s [WeatherPower™](#) tool produces daily estimates and forecasts of local solar and wind generation across the continental U.S. Daily forecasts from WeatherPower reflect the influence of weather on local solar and wind generation. WeatherPower data provide a snapshot of solar and wind energy across the U.S., at local scales, on any given day. It can be used to generate figures relevant to any state, media market, county, or congressional district in the continental U.S.



This WeatherPower graphic shows estimates and forecasts for solar generation in North Carolina in March 2024

Box 6. Wind Power in the National Electricity Mix

Wind accounts for around 12% of the nation's capacity from all utility-scale electricity sources (including renewables, nuclear, and fossil fuels such as coal, oil, and natural gas).

In 2023, around [10% of electricity in the U.S.](#) was produced by wind. A decade earlier in 2014, wind accounted for 4% of the total electricity generated.

The [EIA forecasts](#) that electricity generation from wind will grow by 6% in 2024, while coal and natural gas will continue to decline.

For Iowa and South Dakota, wind comprises more than half of the current electricity mix. In 2023, wind generated almost 60% (41,869 GWh) of electricity in Iowa and about 55% (9,389 GWh) in South Dakota.

Although Texas leads the way in wind power — generating almost three times more than the next biggest wind energy-producing state — electricity generated from wind made up a more modest 22% of the Texas' electricity mix in 2023.

Box 7. Offshore Wind Growth in the U.S.

Most [wind energy in the U.S.](#) is produced onshore, in the middle of the country. However coastal states can take advantage of offshore winds to generate electricity. Offshore wind currently makes up a small portion of the national electricity mix, but it has the potential to grow substantially in the coming decades.

In 2023, only two states (Rhode Island and Virginia) had operational offshore wind facilities, which contributed [42 MW](#) to the total national wind capacity (148 GW). Offshore wind capacity has already grown early in 2024. Vineyard Wind, a wind installation off the coast of Martha's Vineyard, Massachusetts, began operating in February 2024 with [68 MW of capacity](#). This facility will have 800 MW of capacity when fully operational, which could happen as soon as late 2024. In March 2024, South Fork Wind Farm off the coasts of New York and Rhode Island began operating with around 130 MW of capacity — making it the country's largest operational offshore wind installation.

Rising costs have challenged the economic viability of offshore wind installations, delaying some projects. Financial incentives such as those in the Inflation Reduction Act could ease some of the economic burden. According to the U.S. Department of Energy, state policies are poised to support development of nearly [43 GW of offshore wind capacity by 2040](#). Offshore wind projects across more than a dozen coastal states are in various stages of approval or construction.

Learn more about offshore wind in the [U.S. Department of Energy's Offshore Wind Market Report: 2023 Edition](#).

Wind-powered States in 2023

The states with the most wind capacity in 2023 were Texas, with 40,652 MW; Iowa (12,803 MW); Oklahoma (12,245 MW); Kansas (9,043 MW); and Illinois (7,874 MW).

These same five states also generated the most electricity from wind power in 2023: Texas (119,836 GWh); Iowa (41,869 GWh); Oklahoma (37,731 GWh); Kansas (27,462 GWh); and Illinois (22,054 GWh) (Fig 5).

Texas led the nation in absolute growth from 2022 to 2023 for both wind capacity and generation (Table 3). Texas added 1,309 MW of capacity (3% annual increase) and generated 5,049 GWh more than the previous year (4% annual increase).

Arizona and New York stand out for their relative growth in wind capacity from 2022 to 2023. Arizona's capacity increased by 39% (238 MW added), and New York's by 25% (557 MW added).

Table 3. Top states for utility-scale wind capacity and generation in 2023. Find data for all 50 states and the District of Columbia in the [full dataset](#).

State	Wind Capacity (MW) 2023	Wind Capacity Growth 2022 to 2023	Wind Generation (GWh) 2023	Wind Generation Growth 2022 to 2023
Texas	40,652	3%	119,836	4%
Iowa	12,803	3%	41,869	-9%
Oklahoma	12,245	6%	37,731	0%
Kansas	9,043	10%	27,462	-7%
Illinois	7,874	12%	22,054	-6%
United States total	147,640	4%	425,235	-2%

A Decade of Wind Growth Across the U.S., 2014-2023

The U.S. added more than 83 GW of wind capacity during the last decade — an increase of around 130%. This means that wind capacity more than doubled from 2014 to 2023 (Figure 6).

The amount of electricity produced from wind increased at a similar rate. In 2023, the U.S. generated more than twice as much electricity from wind energy than in 2014 — an increase of

243,580 GWh or 134%.

The states with the most significant growth in wind capacity during this decade include: Texas, which added 26,658 MW from 2014 to 2023; Oklahoma (8,466 MW); Iowa (7,241 MW); Kansas (6,074 MW); and Illinois (4,347 MW).

Four out of these five states saw the most growth in generation, too (Table 4). Present-day wind generation reflects these strong historical growth trends, as there is overlap with the highest wind-generating states in 2023.

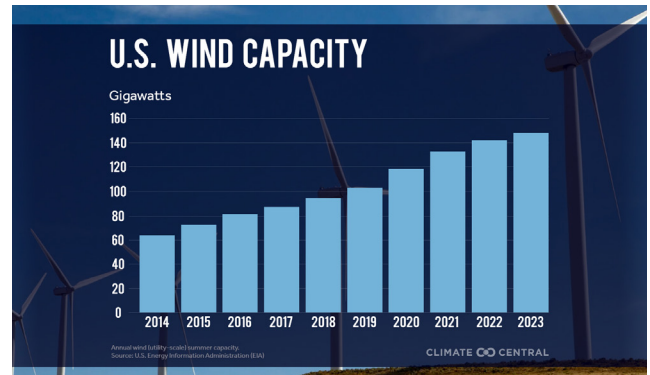


Figure 6: National wind capacity (GW) by year (2014-2023)

Table 4. Top states for growth in utility-scale wind capacity and generation from 2014 to 2023. Find data for all 50 states and the District of Columbia in the [full dataset](#).

State	Wind Capacity Growth (MW) 2014 to 2023	Wind Capacity Growth 2014 to 2023 (%)	Wind Generation Growth (GWh) 2014 to 2023	Wind Generation Growth 2014 to 2023 (%)
Texas	26,658	190%	79,831	200%
Oklahoma	8,466	224%	25,794	216%
Iowa	7,241	130%	25,562	157%
Kansas	6,074	205%	16,617	153%
United States total	83,408	130%	243,580	134%

Clean Energy Growth Relative to U.S. Climate Targets

The U.S. is among nearly 200 countries that joined the [Paris Agreement](#) to limit warming. As part of its commitment, the U.S. has set the following [goals](#):

- By 2030: reducing U.S. greenhouse gas emissions to 50-52% below 2005 levels
- By 2035: reaching 100% carbon pollution-free electricity

- By 2050: achieving a net-zero emissions economy

Recent landmark laws are fostering renewable energy growth and moving the U.S. toward its climate goals. The 2022 [Inflation Reduction Act](#) (IRA) contains hundreds of billions of dollars to boost clean energy and cut emissions. The IRA includes provisions such as tax credits, grants, and other financial incentives for renewable energy projects from the utility-scale to individual households.

The [Rapid Energy Policy Evaluation and Analysis Toolkit \(REPEAT\)](#), a project led by Princeton University scientists, estimates the potential impact of these policies, and tracks progress towards U.S. climate targets.

By 2030, REPEAT estimates U.S. net annual emissions could be as low as 4.0 gigatons of carbon dioxide equivalent (Gt CO₂e), compared to 6.6 Gt CO₂e in 2005: a reduction of around 40% compared to 2005 levels. Although this represents significant progress, the U.S. would still fall short of its 2030 target (50% below 2005 levels) (Figure 7).

Solar and wind energy are key to reducing emissions and reaching 100% carbon pollution-free electricity by 2035. If current policies are taken advantage of, a boom in solar and wind energy capacity is expected based on REPEAT analysis. By 2035, solar and wind could make up a majority (more than 50%) of state energy capacity in 46 of the 48 contiguous states (Figure 8).

In 12 states, wind and solar could make up over 80% of electricity capacity by 2035 by utilizing current policies. And New Mexico, Vermont, Virginia, and Wyoming could have over 90% of their electricity capacity from wind and solar by 2035.

Explore more data: [State Solar and Wind Boom to Bring U.S. Toward Climate Targets](#)

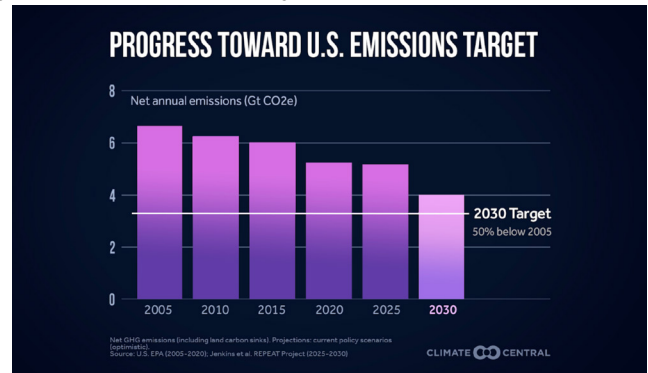


Figure 7. Measured and modeled net annual U.S. emissions (Gt CO₂e). U.S. greenhouse gas emissions have decreased from 2005 to 2020, but even in the most optimistic scenario based on current policies, the U.S. is projected to progress toward, but fall short of, its 2030 target.

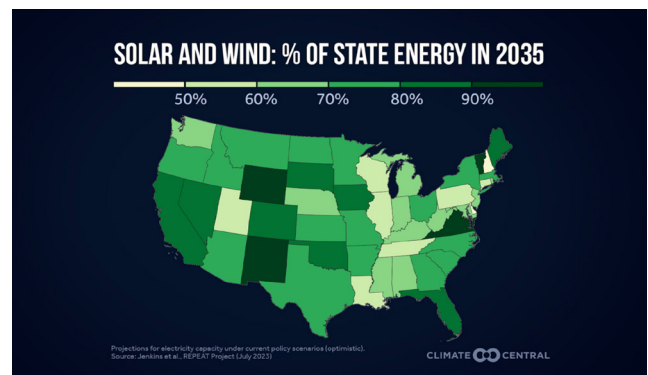


Figure 8. Projected solar and wind proportion of electricity capacity under current (optimistic) policy scenarios. Solar and wind (combined) are expected to make up a majority of electricity capacity in most U.S. states by 2035 under optimistic current policy scenarios.

Methodology

All national and state-level data come from the U.S. Energy Information Administration (EIA). Utility-scale solar and wind summer capacity values for 2014-2022 are as reported in EIA's [Historical State Data](#) for each year. For 2023, utility-scale solar and wind summer capacity values are for December 2023 as reported in EIA's [Electric Power Monthly](#). Small-scale solar capacity for 2014-2022 are for December of each year, as reported in [form EIA-861M](#). All generation values (wind, utility- and small-scale solar) for 2014-2022 come from EIA's [electricity data browser](#).

To calculate the portion of total capacity and electricity generation contributed by solar and wind (as a percentage), we compared electricity capacity/generation for utility-scale solar and wind to all fuel sources and all energy sectors at the utility-scale level, which includes: renewable sources; nuclear; and fossil fuels such as natural gas, oil, and coal. Solar and wind 10-year growth is a direct comparison between capacity/generation in 2014 and 2023.

[Climate Central](#) is an independent group of scientists and communicators who research and report the facts about our changing climate and how it affects people's lives.

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