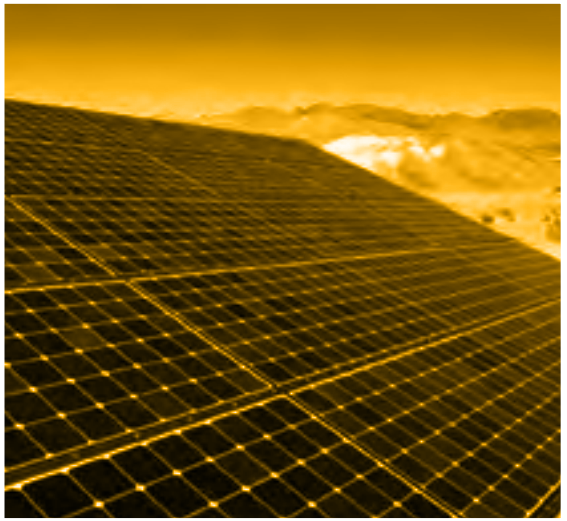
AMERICAN CLEAN POWER

CLEAN POWER ANNUAL MARKET REPORT 2021

Executive summary



Full report is available to ACP members only

CLEAN POWER ANNUAL MARKET REPORT 2021

America's clean power companies are building the clean energy economy.

ACP sincerely thanks its member companies and other organizations for their contributions to the industry data provided in this report. ACP strives to provide the best information on the clean power industry—for the industry and by the industry—and therefore welcomes your comments.

We united the power of the renewable energy industry.

The American clean power sector is providing cost-effective solutions to the climate crisis while creating jobs, spurring investment, and driving innovation.

The American Clean Power Association enables the transformation of the U.S. power grid to a low-cost, reliable and renewable power system. By uniting the power of wind, solar, transmission, and storage companies and their allied industries, both public and private, we are championing policies that enable the continued and aggressive growth in renewable energy in the United States.

Clean Power Definitions

Advanced development: Projects not under construction, but with a PPA, firm equipment order, or moving forward with plans to be placed under utility ownership as of the end of the most recent quarter. For offshore wind, advanced development consists of projects that have secured offtake or have had successful bids in response to a state solicitation even if final offtake negotiations have not concluded.

Capacity: Project nameplate capacity. Unless otherwise stated, ACP reports capacity in MW-ac.

Clean power: For the purposes of this report, clean power includes land-based wind, offshore wind, utility-scale solar, and battery storage technology.

Decommissioned: Project is offline and is no longer delivering power to the grid on a permanent basis. Physical removal of equipment is not a requirement.

Duration: The amount of time, in hours, a battery can discharge its power capacity before depleting its energy capacity. For example, a 2 MW battery that has 4 MWh of energy capacity has a duration of 2 hours.

Full repowering: Full decommissioning of a utility-scale project. The original equipment is physically removed from the project site and replaced with new utility-scale equipment.

Inverter Loading Ratio (ILR): The ratio of installed DC capacity to the inverter's AC power rating. Also known as the AC-to-DC ratio.

Online: Project has reached commercial operation and is delivering electricity to the ultimate point of delivery.

Partial repowering, nacelle replacement: Complete replacement of a utility-scale wind turbine's nacelle, rotor, and blades. The tower and foundation are retained.

Partial repowering, major retrofit: Complete replacement of a utility-scale wind turbine's rotor and blades, along with the replacement of at least one major component within the nacelle, typically the gearbox or the generator.

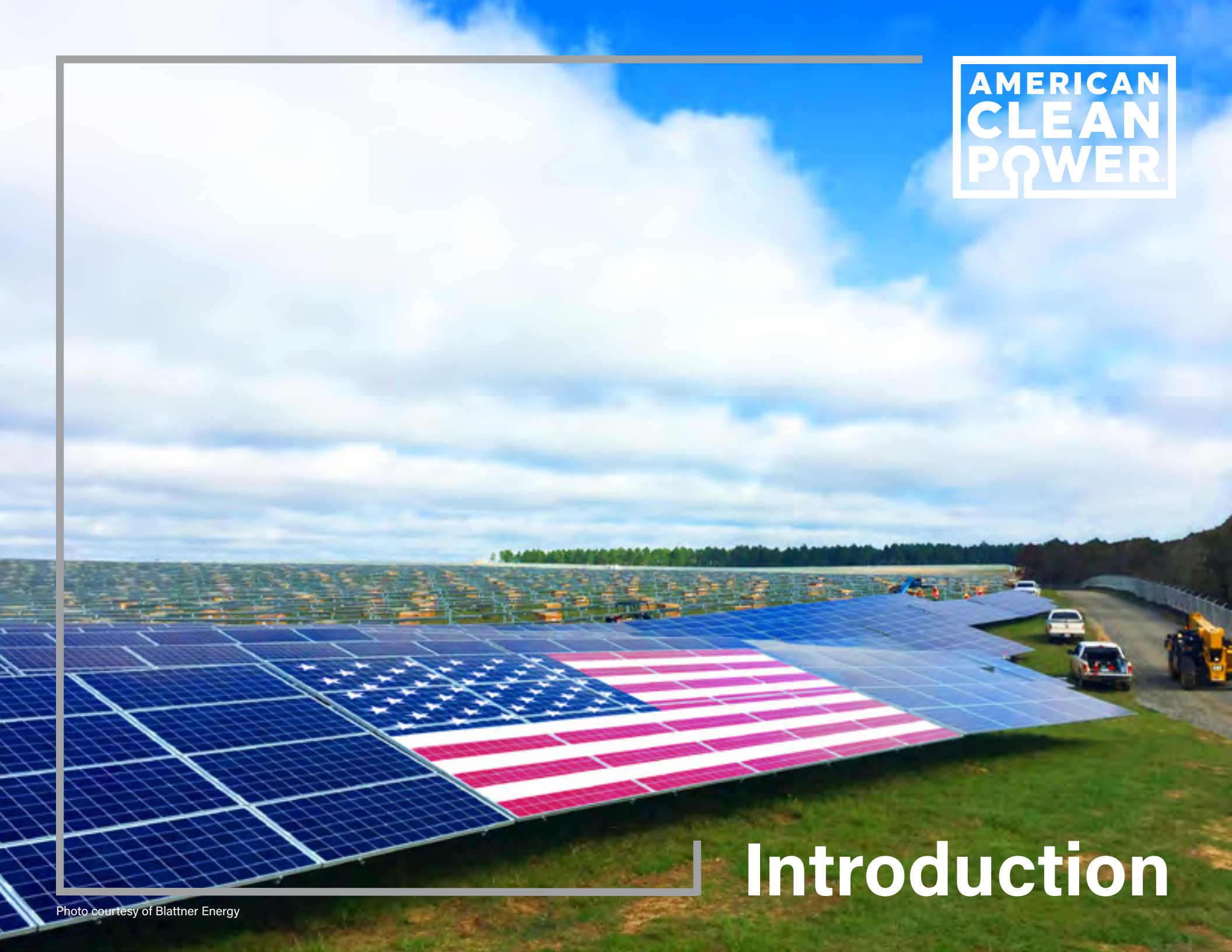
Pipeline: Projects either under construction or in advanced development.

Repowered: Full or partial equipment replacement. Currently only wind repowering activity is tracked, but ACP will expand repowering activity tracked as the market progresses.

Under construction: Construction team has begun work on the ground at the project site. For offshore wind, under construction is defined as in-ocean construction.

Clean Power Acronyms

AC	Alternating Current
C&I	Commercial & Industrial
CAISO	California ISO
CES	Clean Energy Standard
CO_2	Carbon Dioxide
DC	Direct Current
EPA	Environmental Protection Agency
ERCOT	Electric Reliability Council of Texas
FERC	Federal Energy Regulatory Commission
FRCC	Florida Reliability Coordinating Council
GHI	Global Horizontal Irradiance
GW	Gigawatts
GWh	Gigawatt hours
ILR	Inverter Loading Ratio
IOU	Investor-Owned Utility
ISO	Independent System Operator
ISO-NE	ISO New England
LCOE	Levelized Cost of Energy
MISO	Midcontinent ISO
MRO	Midwest Reliability Organization
MW	Megawatts
MWh	Megawatt hours
NERC	North American Electric Reliability Corporation
NO_x	Nitrogen Oxides
NPCC	Northeast Power Coordinating Council
NYISO	New York ISO
OEM	Original Equipment Manufacturer
OREC	Offshore Renewable Energy Credit
PM2.5	Particulate Matter
PPA	Power Purchase Agreement
REC	Renewable Energy Credit
RFC	Reliability First Corporation
RPS	Renewable Portfolio Standard
RTO	Regional Transmission Organization
SREC	Solar Renewable Energy Credit
SERC	Southeast Reliability Corporation
SO_2	Sulfur Dioxide
SPP	Southwestern Power Pool
TRE	Texas Reliability Entity
TW	Terrawatts
TWh	Terrawatt Hours
WECC	Western Electricity Coordinating Council
WRO	Withhold Release Order



Introduction

Photo courtesy of Blattner Energy

Letter from ACP CEO Heather Zichal

To the builders of America's clean energy economy,

Thank you for helping to deliver $40 billion in essential clean energy infrastructure across America in 2021. While our industry deserves a moment to celebrate the progress made toward building a clean, reliable, and secure grid for our country – and the investment, jobs, and economic growth opportunities that our industry continues to deliver to our communities – I know it also may be difficult to ignore the significant headwinds that threaten this continued and rapid growth. But first – let's take a celebratory moment for 2021:

America now has more than 200 gigawatts (GW) of utility-scale wind, solar, and battery storage after the industry added 28.5 gigawatts (GW) to our grid in 2021. These clean energy projects are a critical component of the United States' electricity system – generating enough energy to power nearly 56 million American homes. In fact, wind and solar currently provides 13% of America's electricity needs.

The steady drumbeat of dramatically falling costs for renewable energy is fueling this continued growth. Over the past decade, the costs for wind and solar electricity have dropped considerably, making wind and solar the most affordable forms of electricity generation today. Thanks to this strong competitive position, wind and solar were the #1 and #2 choice, respectively, of new utility-scale power capacity across all technology types in 2021, accounting for 73% of all new projects built in 2021. Clean power is not just the future; it's already here, and it's delivering clean, affordable power to Americans.

Energy storage projects also came into their own this year. 2021 was the largest year on record for battery storage installations, with 2,695 megawatts (MW) and 7,774 MWh of battery storage coming online – a 200% and 330% increase from 2020 respectively. Along with the maturation of technology and reductions in cost, a critical part of the energy storage story is the growing recognition of the resilience gained from pairing storage with other renewable generation technologies like wind and solar into hybrid projects. This valuable synergy resulted in two-thirds of the almost 100 storage projects that came online in 2021 being paired with solar or wind projects in a hybrid capacity. We expect this trend to continue across clean energy projects of all sizes.

Corporate buyers are playing an increasingly important role in helping to scale up clean energy as they look to power operations with our technologies and realize their sustainability goals. While active in the market for several years now, corporate buyers helped achieve a remarkable milestone in 2021. For the first time on record, corporate buyers and non-utility purchasers announced more new clean power purchase agreements than all utilities combined. With almost 13 GW of power purchase agreements, corporate buyers also helped set a new annual power purchase agreement record. Combined with utilities, more than 29 GW of power purchase agreements were announced in 2021 – a 28% jump from 2020 levels. American businesses clearly recognize the value of powering their activities with clean, homegrown, affordable power.

U.S. offshore wind accelerates forward. The year started off with a bang as the first two offshore wind turbines located in federal waters finished construction and started delivering electricity to the grid. Throughout the rest of the year, the industry set a record for offshore wind procurement as states and utilities announced 8.4 GW of offshore wind procurement in 2021. And more offshore wind is on its way: the Bureau of Ocean Energy Management announced its Offshore Wind Leasing Path Forward, which includes plans to hold lease area auctions in seven regions by 2025. The first of these auctions took place in six lease areas in the New York Bight in early 2022. It's a testament to American innovation and ingenuity to see this nascent industry reach full sail.

But for every two steps forward, the industry was pushed back one. Unrelenting challenges from the COVID-19 pandemic and the global supply chain

Letter from ACP CEO Heather Zichal (cont'd)

crunch slowed U.S. clean power growth. Roughly 10 GW of clean power capacity originally expected online in 2021 was delayed, in some cases indefinitely. Looking into 2022 and beyond, inflation, supply chain issues, and the uncertainty of tax policy and lack of predictable regulatory action for renewable energy are all expected to have a concerning impact on our ability to deliver growth. Further, continued and arguably heightened uncertainty brought about by challenges to existing trade precedent – like this year's Department of Commerce inquiry into solar module tariffs – are already taking a toll. Previously expected to experience robust growth, utility solar now faces modules shortages and trade risks that are delaying projects or even causing them to be canceled. At a time when every MW of clean energy is crucial to protect Americans' pocketbooks, drive economic growth, and achieve the country's climate targets, these unnecessary barriers are slowing progress.

In the context of our country's climate targets, we need to be scaling clean energy deployment much faster. While 200 GW is a significant amount of electricity capability, it accounts for only 13% of the nation's electricity currently. Maintaining last year's project volume would provide only 35% of what's needed to reach a net zero grid by 2035. The climate crisis gets more urgent by the day, and these challenges need to be faced directly and swiftly.

Transmission and interconnection backlogs are also becoming serious concerns. As we add more utility-scale renewable energy projects to meet our energy targets, we need more infrastructure to move electricity generated from the plains, the mountains, and the oceans to the places we use electricity most. While the U.S. has installed 1,800 miles of new transmission lines on average over the past decade, in 2021 we installed just 386 miles – and a single project accounted for nearly half of those new miles added. This pace needs to accelerate immediately in order to integrate just the projects in development now, notwithstanding any projects proposed in the future. We've already seen long grid connection timelines and higher costs for grid upgrades this year. Federal regulators must provide policy certainty and clarity in the transmission development process to avoid transmission continuing to be a major bottleneck to renewable energy deployment.

Maintaining last year's project volume would provide only 35% of what's needed to reach a net zero grid by 2035. The climate crisis gets more urgent by the day, and these challenges need to be faced directly and swiftly.

We can overcome these challenges, but we must continue to fight for policies that provide our industry the necessary certainty and stability to grow at a pace yet unseen. Clean energy is bipartisan: 18 of the top 20 districts by clean power capacity are represented by Republicans. Clean energy lifts up our communities: nearly 80% of clean power capacity is installed in counties where the median household income falls below the national median household income, and it provides stable, well-paid jobs, along with tax revenues, directly to these communities. Clean energy improves air quality: the health benefits of averted pollution from our current domestic wind and solar capacity are expected to generate between $18-$47 billion in health outcomes. These clean power benefits will accelerate at the pace we need if policymakers in Washington take bold action to deliver the clean energy future that Americans want and deserve. Making critical investments in accelerating clean energy deployment and continuing to build out the clean energy domestic supply chain – which have bipartisan support – will help us reach our climate and clean energy goals while delivering U.S. jobs, economic growth and a domestic source of clean energy.

There is a case to be made for expanding clean energy in America, and we are making it every single day. We expect the information included in this market report will help you make that case, and we hope that you use it to help us continue scaling a clean energy economy that provides cleaner air, energy security, affordable electricity, and hundreds of thousands of good jobs for Americans across the country. I look forward to working with you as we continue building the clean energy economy.

Sincerely,

Heather Zichal
Chief Executive Officer
American Clean Power

Clean Energy Powers America — 2021 Top Facts

The U.S. now has over

200 GW

of wind, solar, and battery storage capacity online.

80% of that is located low-income communities where **projects create jobs, revenue, and economic growth.**

The U.S. has enough installed utility wind and solar **capacity to power nearly**

56 million homes.

28 GW

of clean power was installed in 2021

enough to power

500 million

LED lightbulbs

WIND and SOLAR power were the #1 and #2 choice

of utility-scale power generation across all technology types in 2021.

Wind is America's #1 source of renewable electricity.

Combined with solar, these clean power technologies deliver **13% of the nation's electricity.**

Wind, solar, and battery storage represented

81% **of new power additions**

across all energy types in 2021.

In 2021, wind and solar projects produced the same amount of electricity used in the following states, combined:

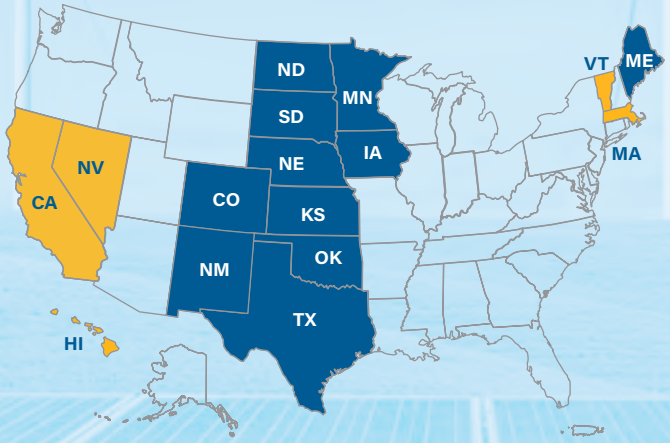
AR CT IA KY MO MS NJ OR WI WV

Wind energy delivers over 20%

of the electricity produced in 11 states.

Solar energy delivers over 10%

in five states.



Wind was the largest source of electricity generation in four states in 2021: Iowa, South Dakota, Kansas, and Oklahoma.

Wind, solar and energy storage provide over

415,000

Americans with good-paying jobs across the country with more on the way.

There are over

575

clean power-related manufacturing facilities across the U.S. supplying parts and components to wind, solar, and storage projects.

Clean power is **red, white, and blue** with projects or manufacturing facilities in **93% of Congressional districts. Projects can be found in all 50 states.**

Corporate buyers of renewable energy announced a record

13.6 GW

of new clean power contracts in 2021

Wind and solar deliver over

$2.5 billion

every year in state and local tax payments and landowner lease payments.

In 2021, the clean power project pipeline grew to **120 GW** representing over **$145 billion in new investment.** Trade restrictions and supply chain constraints threaten the delivery of many of these projects in 2022 and beyond.

Clean power prevents **397 million metric tons of CO_2** from being released into the atmosphere each year. **That's like taking 86 million cars off the road.**

A record

8.4 GW

of offshore wind capacity was procured in 2021. Total offshore wind procured stands at **nearly 17.5 GW.**

Clean Power Activity

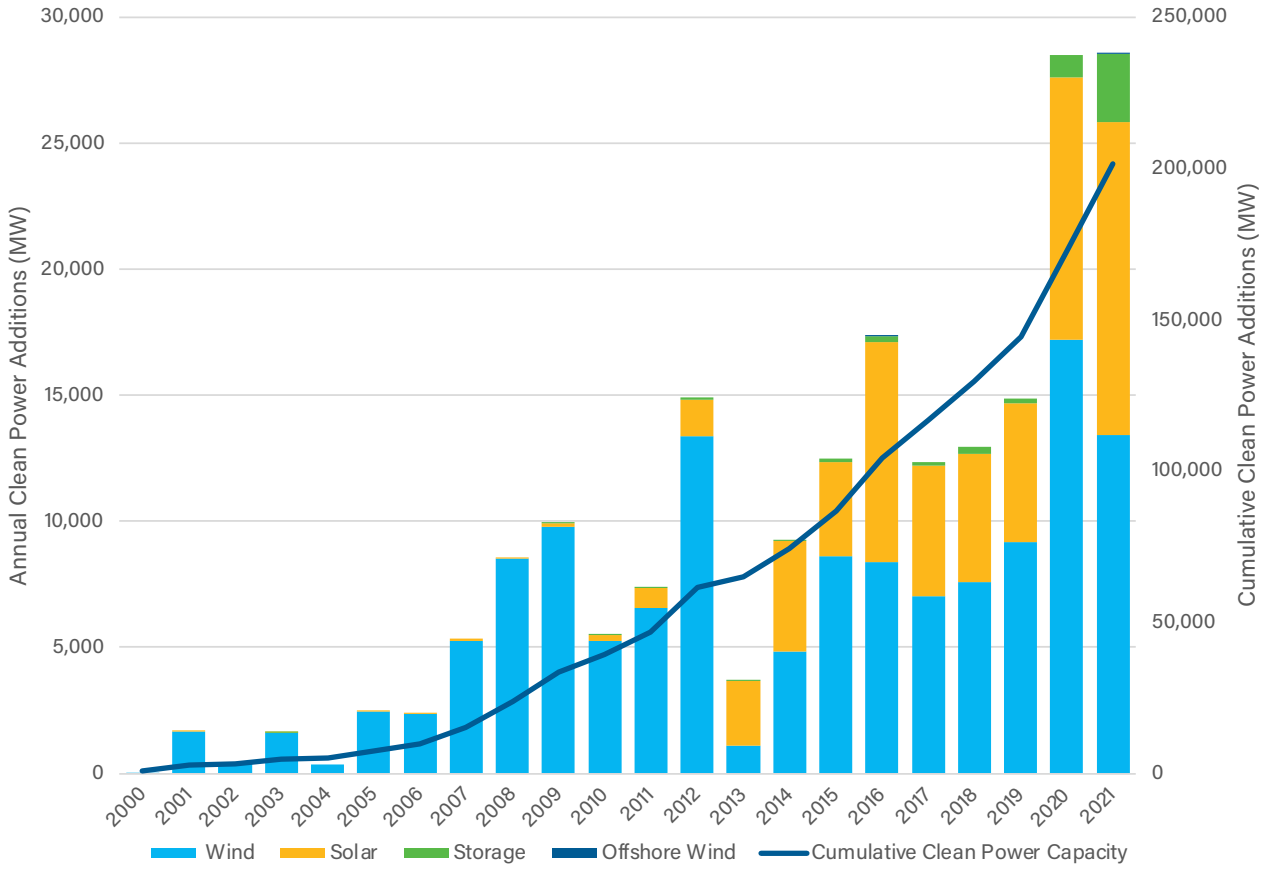
2021 Clean Power Activity

Annual and Cumulative Clean Power Capacity

Industry installs 28.5 GW of new clean power in 2021

- In 2021, the U.S. added 28,540 MW of new clean power capacity, enough to power more than 6.6 million homes.
- Installations were flat compared to 2020 levels, though it was a record year for solar and battery storage installations. The industry installed 12,433 MW of solar and 2,695 MW of battery storage. Land-based wind installations fell by 22% compared to 2020.
- Nearly 10 GW of project capacity originally expected online in 2021 was delayed due to policy uncertainty, supply chain issues, and long interconnection queues.
- Cumulative online clean power capacity is now 201,354 MW. Land-based wind continues to dominate operating clean power capacity, accounting for 67% of online capacity. Solar makes up 30% of operating capacity, and storage 2%.
- Clean power additions in 2021 represent sizable capital investment. The 28,540 MW of new clean power plants installed in the year represents approximately $41 billion in infrastructure investment. Cumulative clean power capital investment has surpassed $408 billion.

U.S. Annual and Cumulative Utility-Scale Clean Power Capacity Growth

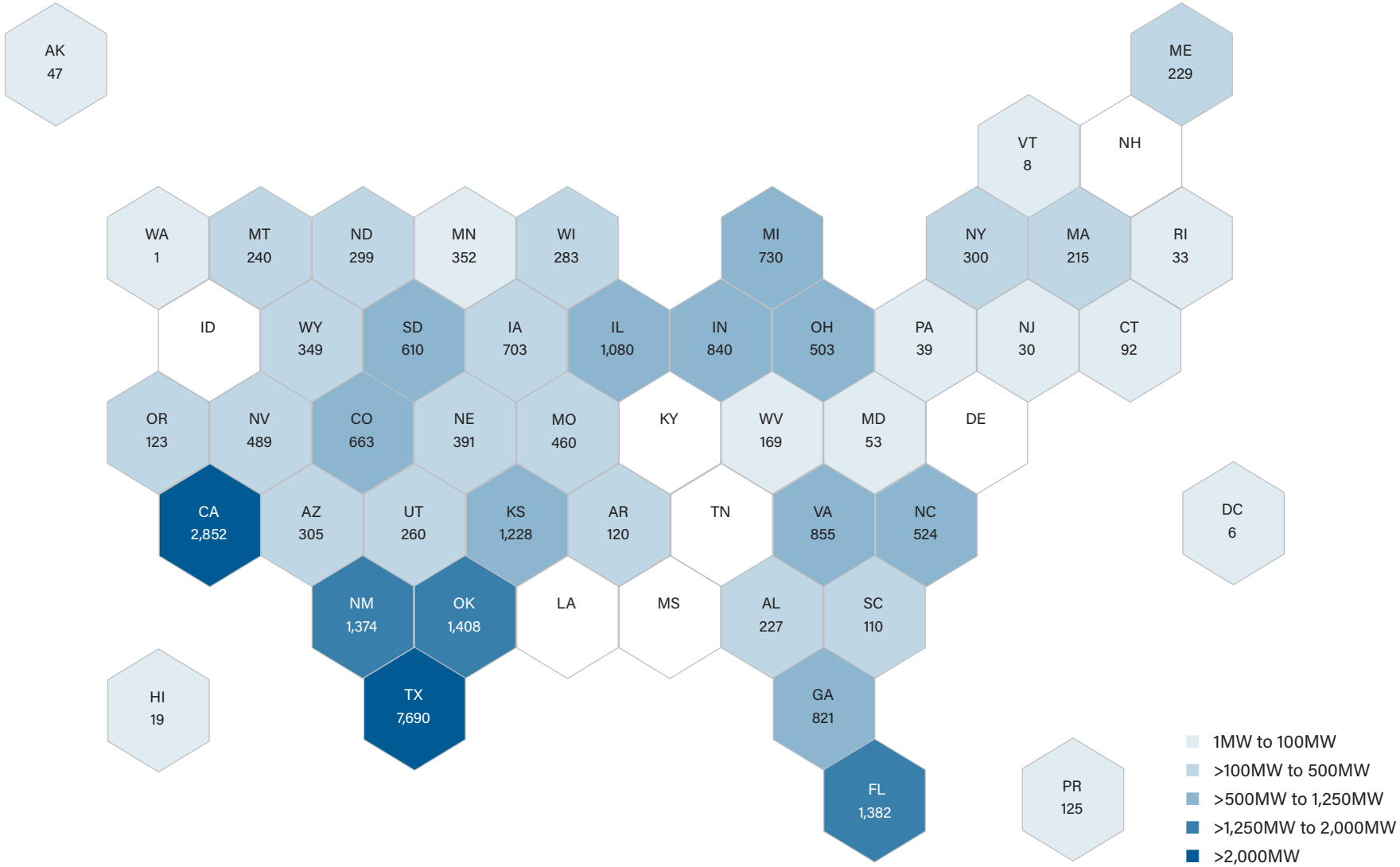


Note: Online capacities for 2021 have been updated since the Q4 2021 Market Report to reflect updated data available to ACP.

2021 Clean Power Activity

Clean Power Capacity Installations in 2021

Industry built 594 clean power projects across 44 states, totaling 28.5 GW



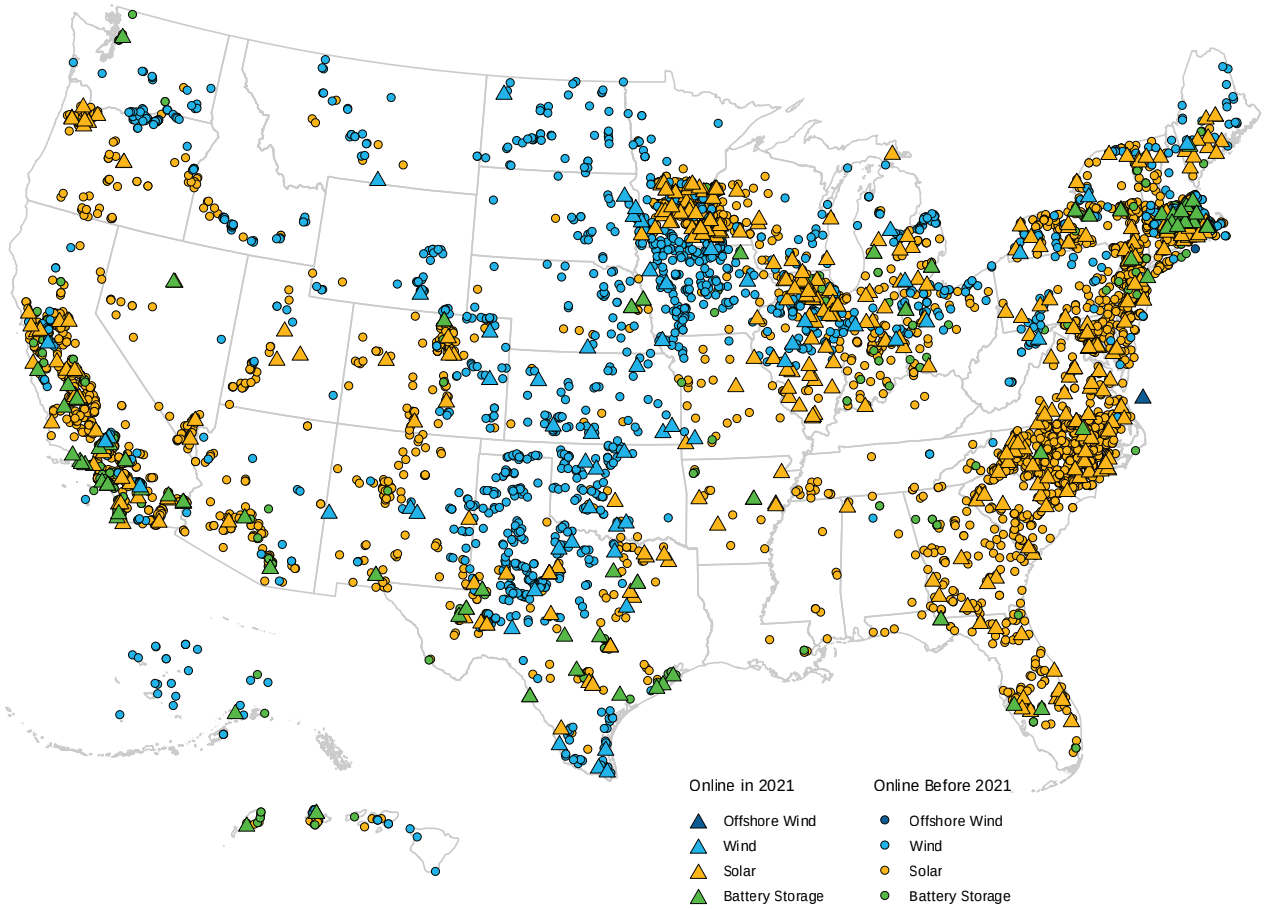
2021 Clean Power Activity

U.S. Clean Power Projects

Projects generate renewable energy in all 50 states

- The Western Spirit Wind project in New Mexico took the top spot for the largest wind project built in 2021 at 1,056 MW. This was followed by the 508 MW White Mesa project built in Texas, and the 384 MW Isabella I & II project in Michigan.
- The top solar projects that came online in 2021 were all built in Texas. The 420 MW Eunice Solar project was the largest, followed by the 300 MW Juno Solar project and the 255 MW Greasewood and Taygete projects.
- In capacity terms, the 409 MW Manatee Energy Storage Center project built in Florida was the largest storage project that came online in 2021. This project was followed by the 230 MW McCoy Storage project built in California, and a tie for the third spot between the 115 MW Blythe II and Blythe III projects, also built in California. All four of these projects are part of larger solar + storage hybrid projects.
- In energy terms, however, McCoy Storage (920 MWh) surpasses the Manatee Energy Storage Center (900 MWh) for the top spot. Both Blythe II and Blythe III can store 460 MWh of energy.

Operating U.S. Clean Power Projects

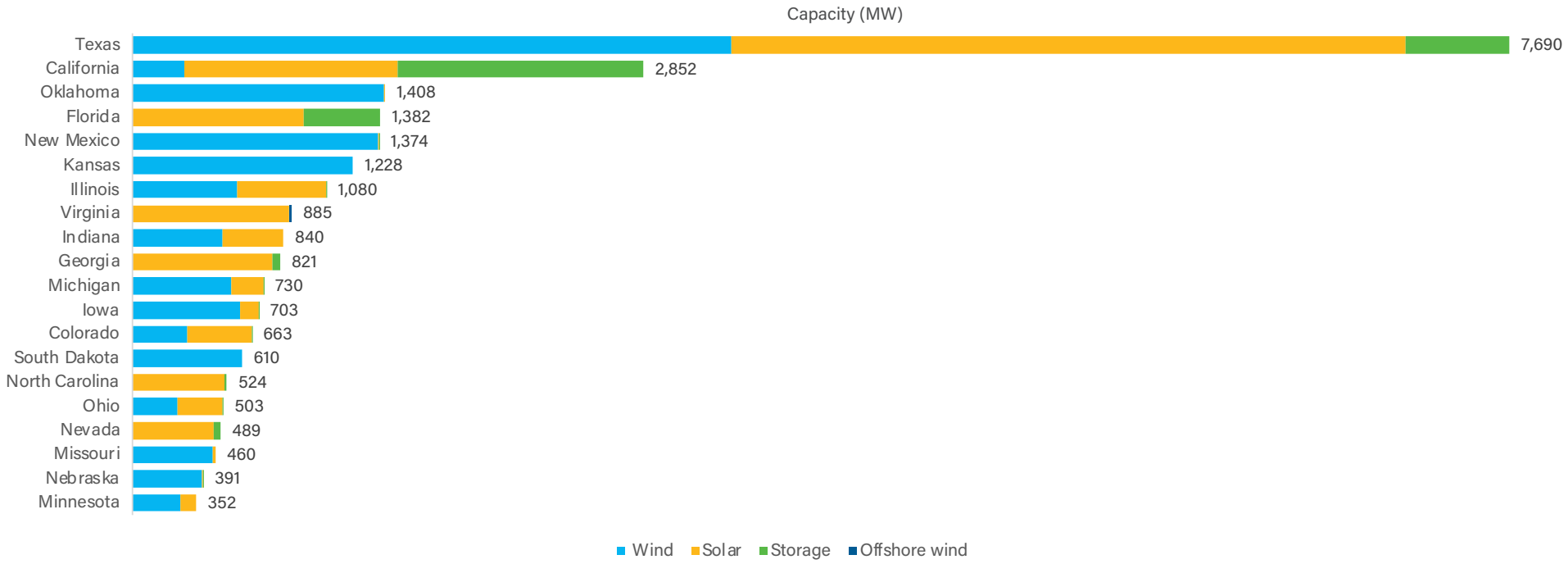


2021 Clean Power Activity

Clean Power Additions, Top States

Texas outpaces the rest of the country in annual clean power additions

Top States for Clean Power Additions in 2021

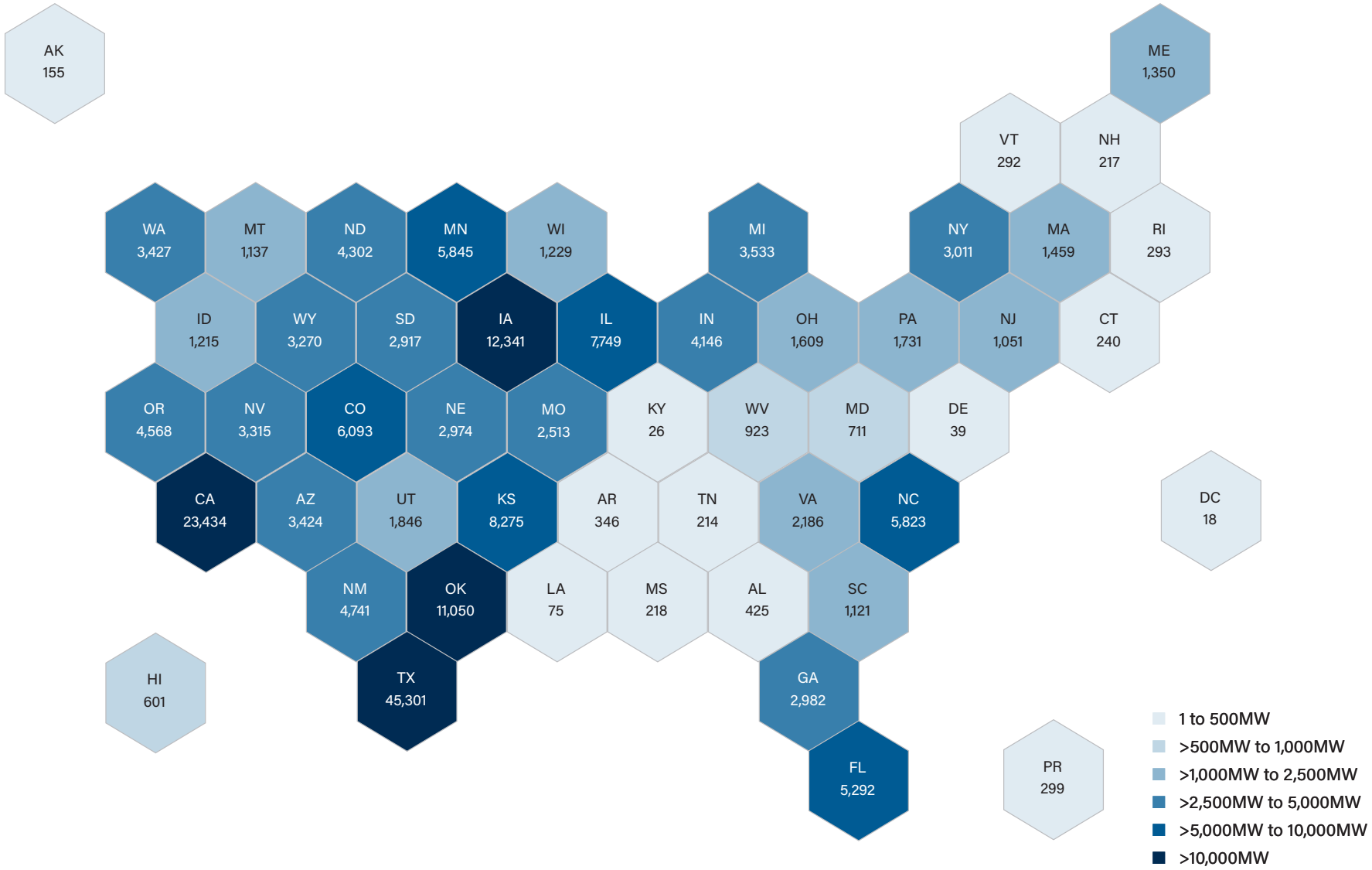


- Texas led the country in clean power installations in 2021, installing 7,690 MW. California came in second with 2,852 MW installed, followed by Oklahoma with 1,408 MW and Florida with 1,382 MW. In total seven states installed more than 1 GW of new clean power capacity in 2021.
- Texas was the top installer of the year for both wind (3,343 MW) and solar (3,768 MW) and came in second behind California for storage additions (579 MW). California installed 1,371 MW of new storage capacity in 2021.
- Once again Texas leads the nation in terms of total operating clean power capacity with 45,301 MW online, followed by California (23,434 MW), Iowa (12,341 MW), Oklahoma (11,050 MW), and Kansas (8,275 MW).

2021 Clean Power Capacity

Clean Power Capacity, by State

Clean power is present in all 50 states; 10 states have 5 GW or more installed



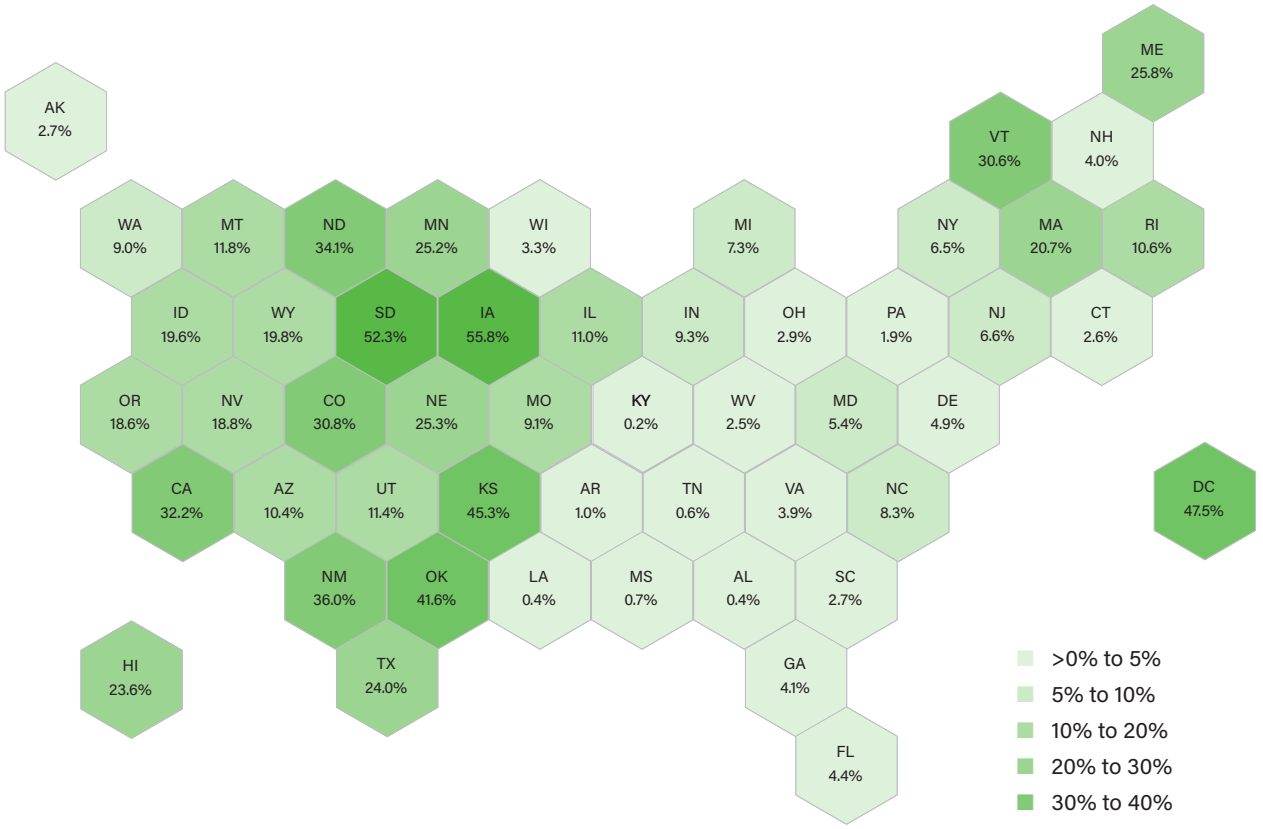
2021 Clean Power Activity

Clean Power Share of Electricity Generation

Wind and solar provided 13.0% of the nation's electricity in 2021

- By the end of 2021, 25 U.S. states were generating at least 10% of electricity from wind and utility-scale and small-scale solar.
- Iowa remains the leader in clean power share, at 56%, followed by South Dakota at 52% which exhibited an impressive increase from a 33% clean power share in 2020. This increase was driven by several large wind projects coming online in late 2020 and early 2021 that were able to produce electricity throughout 2021, such as the 250 MW Triple H and 201 MW Crowned Ridge II projects.
- Next, both Kansas and Oklahoma top 40% clean power share. Note, the District of Columbia, buoyed by large amounts of distributed solar and little overall generation, also generated more than 40% of electricity from clean power.
- Additionally, there are five states above a 30% clean power share of electricity generation and another six states between 20% and 30%.
- The pattern of top performers coincides with windy Midwestern states where there are significant amounts of wind capacity installed.

Wind + Solar Share of State Electricity Generation
U.S. Clean Generation Share: 13.0%



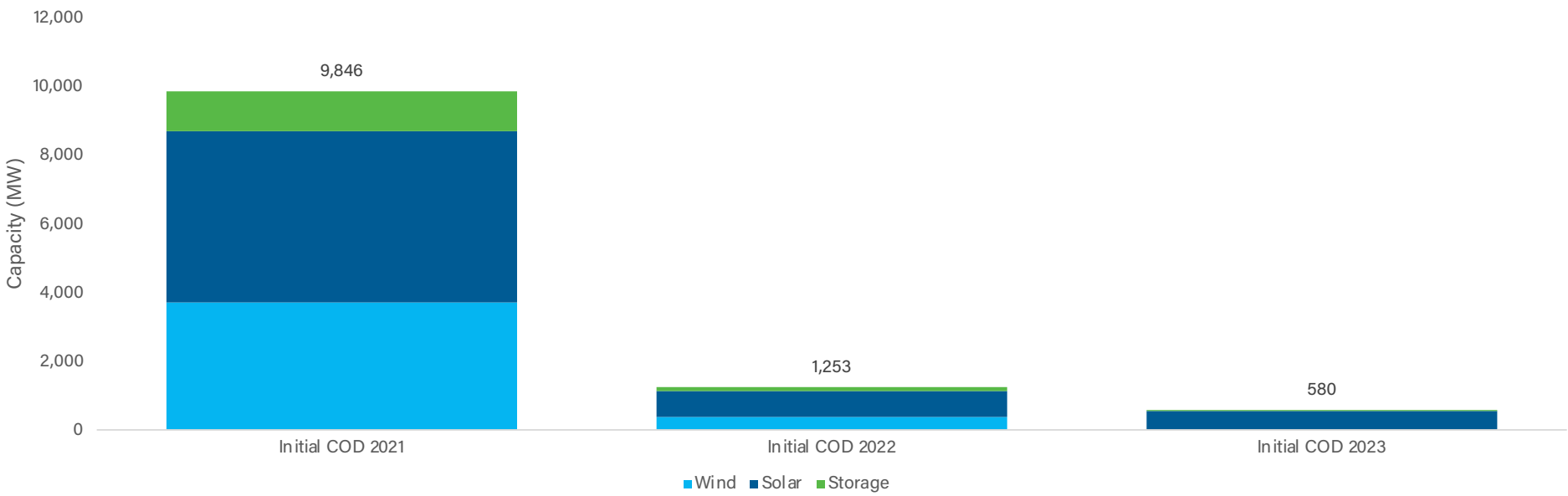
Source: EIA

2021 Clean Power Activity

Clean power pipeline delays

Nearly 12 GW of clean power projects delayed

Clean Power Project Capacity Delayed



- Nearly 11.7 GW of wind, solar, and battery storage projects experienced delays. Of those, 54% were solar projects, 35% wind, and 11% battery storage.
- Over 9.8 GW of project capacity that was expected online in 2021 were pushed into 2022, 2023, and for a few projects out to 2024. 67% of the delayed projects that were expected online in 2021 are now expected to come online in 2022.
- Projects expected online in 2022 and 2023 were also impacted. Over 1,250 MW of clean power capacity expected online in 2022 was delayed to either 2023 or 2024, and 580 MW expected online in 2023 experienced delays.
- Policy uncertainty, supply chain issues, and long interconnection queues are in part to blame for delayed project timelines.

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U.S. Electricity Sector

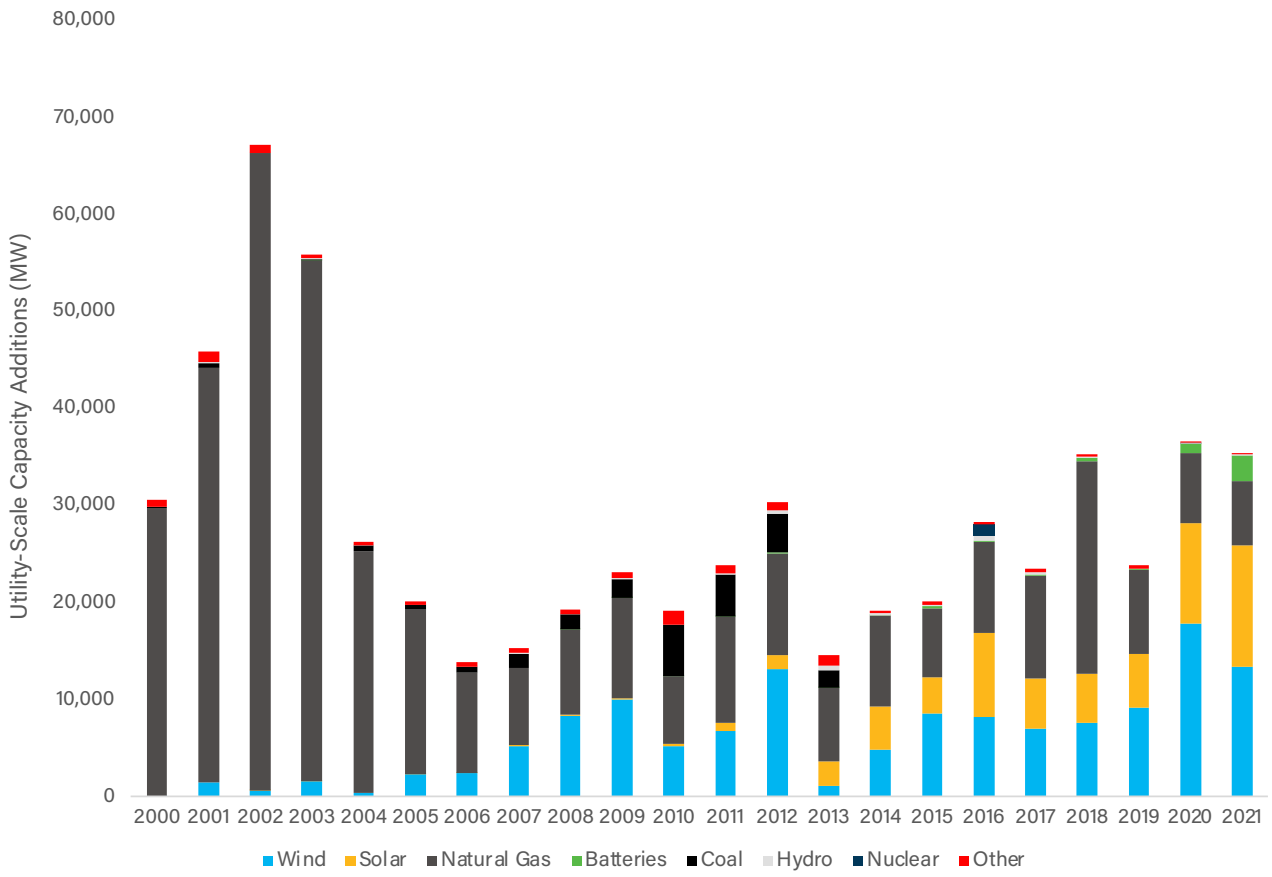
U.S. Electricity Sector

Electric grid adds 35.3 GW; wind and solar top technologies

Utility-scale capacity additions down 4% in 2021

- Project developers added 35,292 MW of new power capacity to the electric grid in 2021. This is down 4% from the 36,609 MW added in 2020, but the second highest year in the last decade.
- For the third year in a row, onshore wind led capacity additions, capturing 38% of the market. Utility solar was a close second, representing 35% of new additions. Battery storage captured 8% of the market, leaving clean power resources with 81% of 2021 installations.
- Natural gas projects totaling 6,636 MW were added to the grid. Gas-fired capacity continues to be added to the grid in significant quantities, but only once in the last seven years has more natural gas capacity come online than renewables.
- These four technologies—battery storage, natural gas, solar, and wind—captured essentially the entire market in 2021. This has been the case every year since 2014.

Annual Grid Power Capacity Additions



Source: ACP, EIA

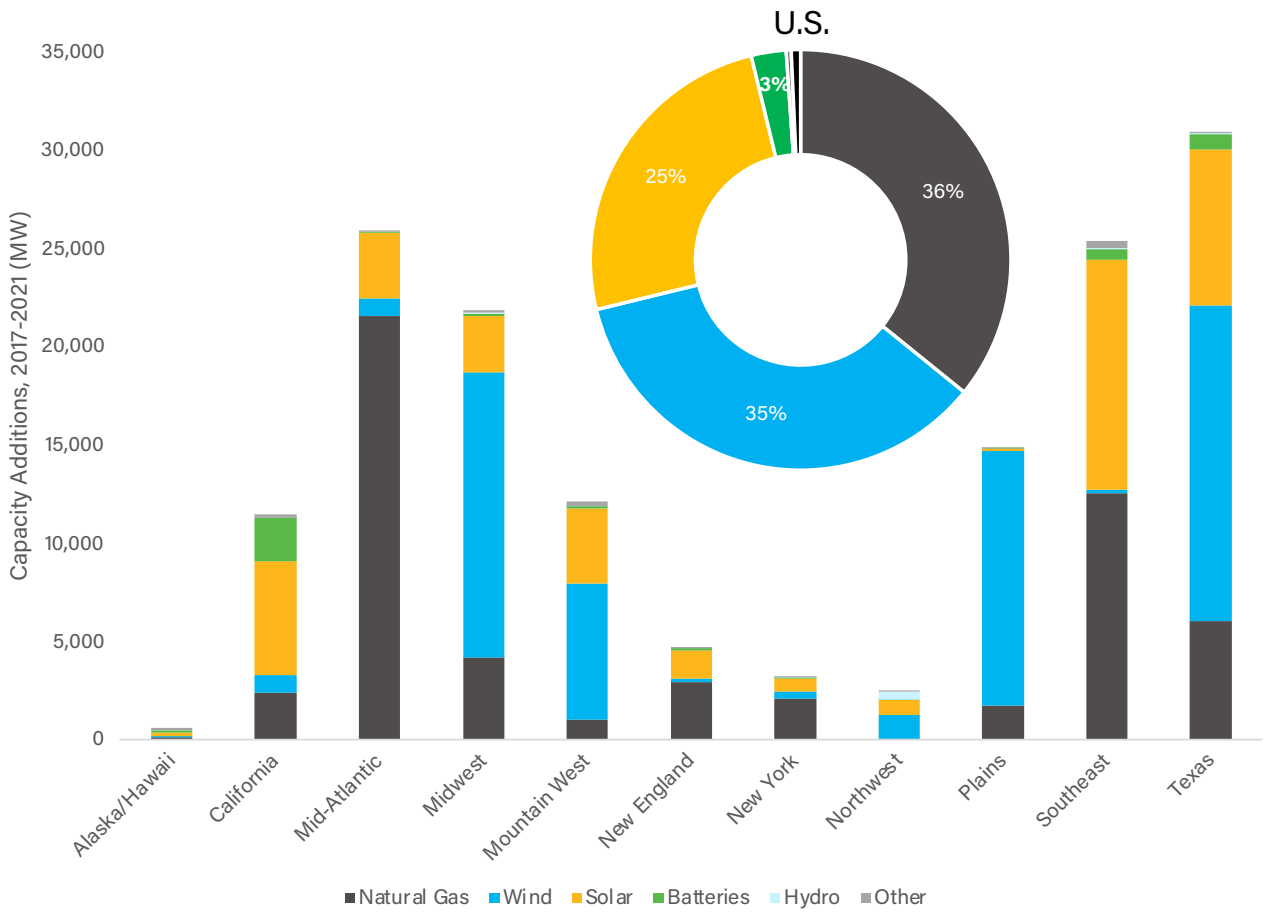
U.S. Electricity Sector

Clean power represents majority of 5-year market

Most regions opt for clean power

- Utilities and power customers across the country increasingly prefer clean power resources over other generation technology. In 7 out of 11 regions, clean power represents the majority of capacity installations over the past five years.
- Mountain West states lead the charge with wind, solar, and battery storage representing 90% of the 12 GW added in the region since 2017. Plains states are close behind at 88% and Northwestern states find their way on the podium with 84%.
- The Southeast barely missed the cut with clean power resources representing 49% of new build. New England and New York opted primarily for natural gas, seeing clean power resources only capture 37% and 33%, respectively. And Mid-Atlantic states saw the lowest clean power share with wind, solar, and battery storage capturing only 16% of the market over the past five years. Natural gas was the overwhelming technology of choice in that region.
- Wind was 87% of new installations over the past five years in Plains states, while solar captured 50% of new installs in California. Battery storage captured the most market share in California at 19%.

Regional Power Capacity Additions, 2017-2021



Source: ACP, EIA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+ Transmission

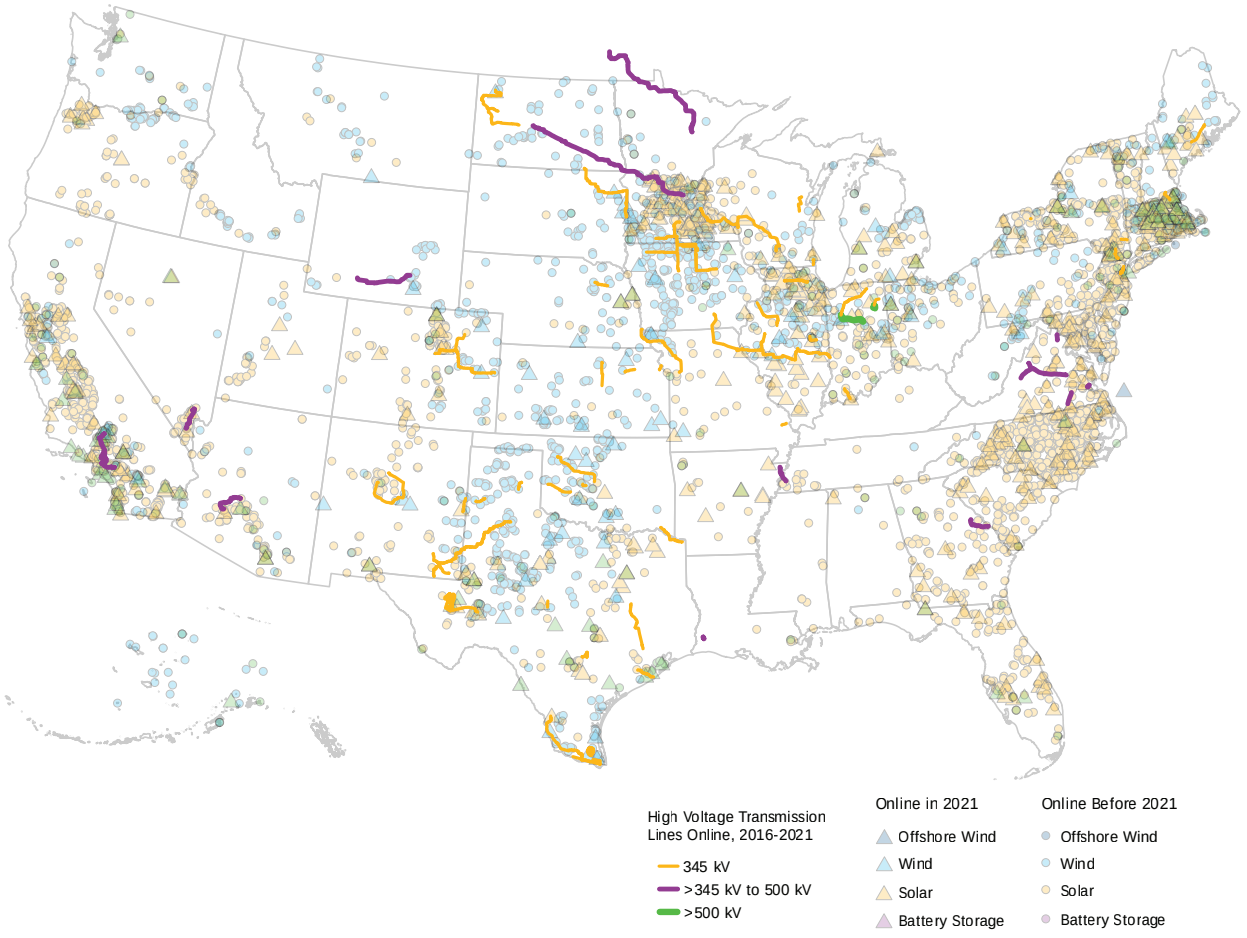
Clean Power + Transmission

Clean Power Projects and Transmission Built Since 2016

In 2021, less than 300 miles of high-voltage transmission lines were brought online across the U.S.

- Since 2016, over 5,700 miles of high-voltage (345kV or higher) transmission lines have been constructed across the U.S. Many of these projects were constructed with the goal of moving electricity generated from renewable sources to load centers.
- However, transmission development remains a key bottleneck to the deployment and interconnection of low-cost, renewable generation resources. In 2020, over 1,400 miles of high-voltage transmission lines were brought online compared to less than 300 miles in 2021.
- The Western Spirit Transmission line, developed jointly by Pattern Energy and the New Mexico Renewable Energy Transmission Authority, was the largest transmission line brought online in 2021 at 155 miles. This line was designed to enable more than 800 MW of new wind power to connect to the New Mexico grid. The line had been under development since 2010, highlighting the long timelines that many of these projects face.

High-Voltage Transmission Lines Built 2016-2021



Source: ACP, S&P Global

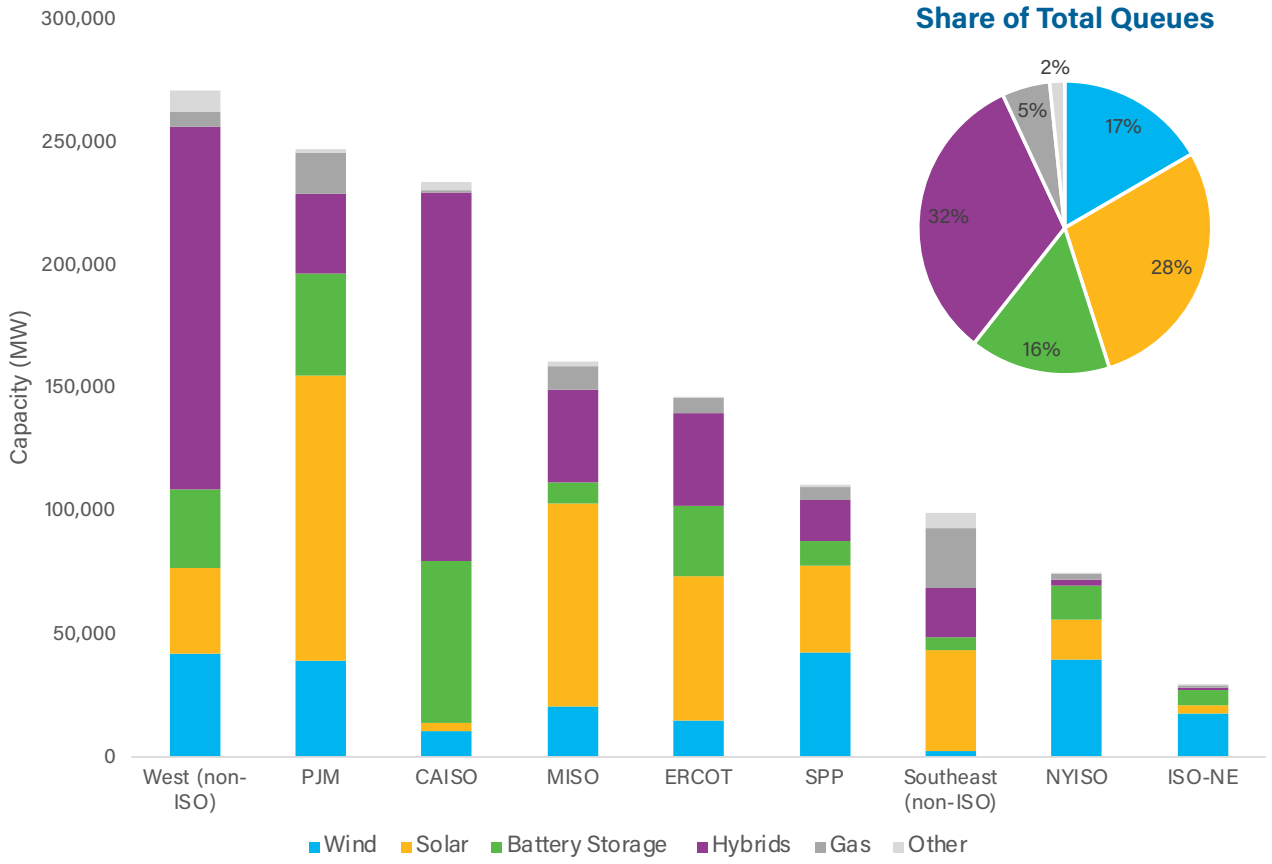
Clean Power + Transmission

Interconnection Queues

Hybrid and standalone solar projects dominate the queues

- Interconnection queues are essentially a waiting list of proposed power projects seeking a grid connection in the coming months and years. While most projects that apply for interconnection are not subsequently built, data from these queues provide a good general indicator for mid-term trends in market, developer, and investor interest.
- Hybrid projects make up 32% of all capacity in interconnection queues across the U.S., while standalone solar projects represent roughly 28%. Solar combined with battery storage makes up 90% of hybrid projects in the queues.
- Hybrid solar plus battery storage projects represent the largest share of the queue in CAISO. This is most likely driven by the fact that California already has a high solar penetration rate and developers are seeking to shift electricity generated by solar to other periods of the day.
- Solar makes up the majority of the queue in MISO and a plurality in PJM and ERCOT. Wind makes up the majority of the queue in NYISO and ISO-NE, primarily due to offshore wind projects.

Interconnection Queue Backlog



Source: LBNL

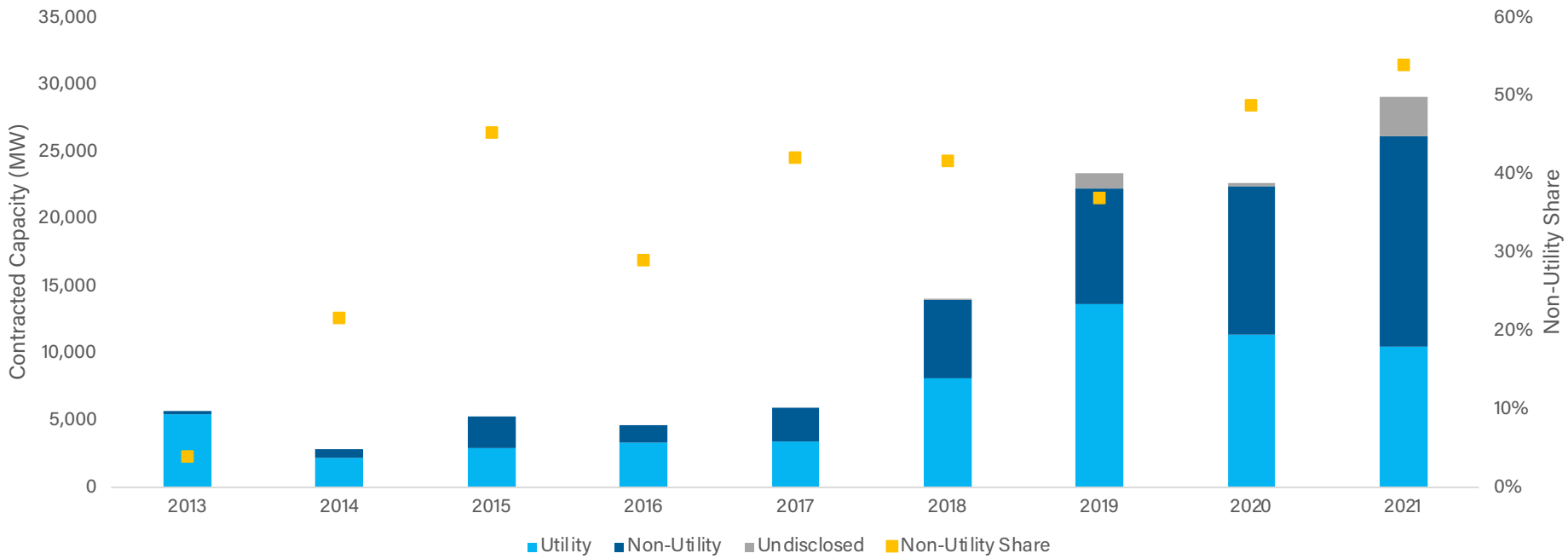
Clean Power Procurement

Clean Power Procurement

Power Purchase Agreement Announcements by Buyer Type

For the first time non-utility buyers account for more than half of PPA announcements in 2021

Power Purchase Agreements Signed Over Time, by Power Purchaser Type



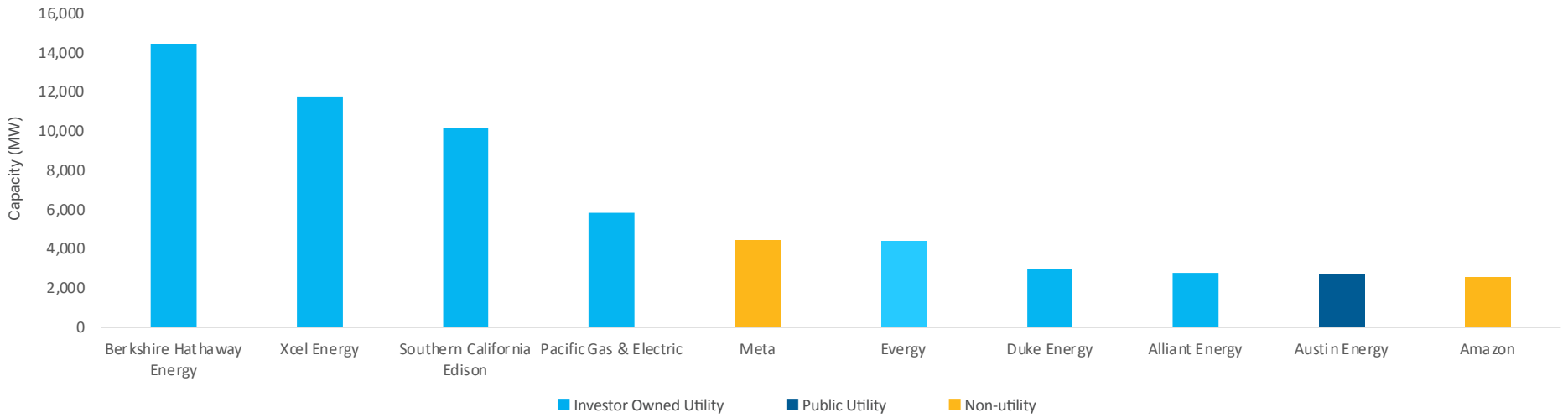
- ACP tracks clean power offtake agreements as they announced and analyzes procurement trends for operational clean power projects. This chart tracks the capacity of clean power purchase announcements made per year, by the type of purchaser (utility or non-utility). Many of the projects represented in this chart are still in development.
- Utility and non-utility purchasers alike continue to favor long-term power purchase agreements (PPAs) for clean power offtake. The 29,081 MW of PPAs announced in 2021 was record setting, outpacing 2020 announcements by 28%.
- For the first time, utilities did not lead clean power announcements in 2021, accounting for only 36% of announcements. This represents a 14% decrease from the utility share of 2020 announcements. 50 different utilities announced new PPAs in 2021.
- Non-Utility purchasers, which are mainly corporate customers, made up 54% of announcements. Undisclosed purchasers make up the remaining 10% of announced PPAs. Purchasers are undisclosed in cases where the terms of the PPA are not yet public.

Clean Power Procurement

Top Buyers of Operating Clean Power

Berkshire and Xcel maintain top clean power purchaser positions

Top Purchasers with Operating Clean Power



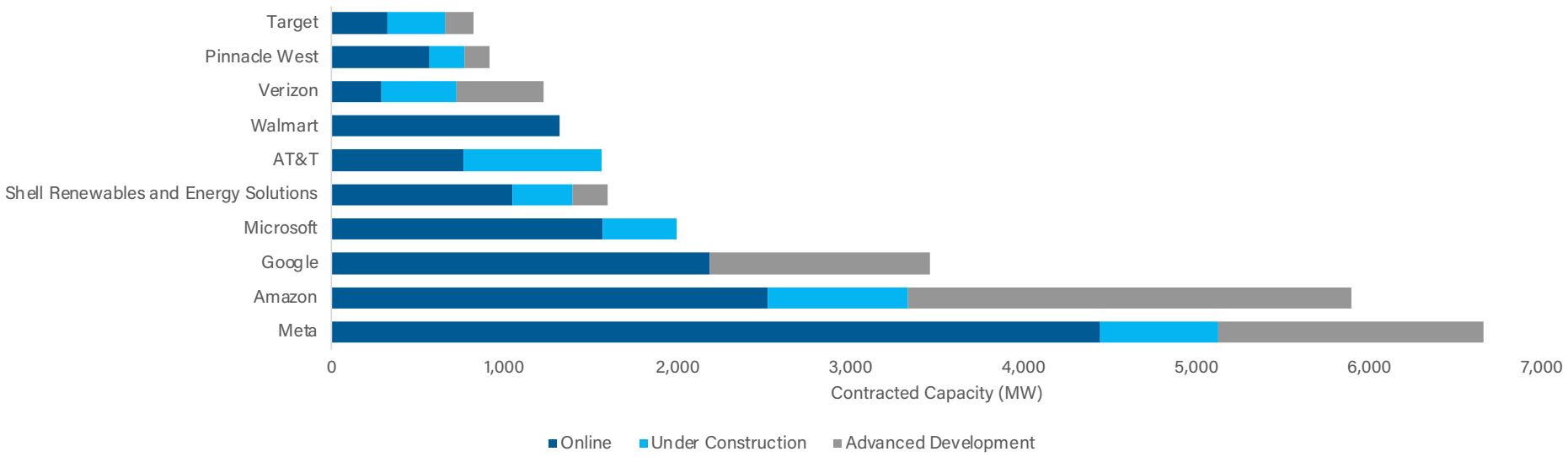
- These are the ten largest buyers of wind and solar power capacity in the country. They procure these clean resources either through offtake contracts or by directly owning the assets.
- Demand for wind, solar, and battery storage continues to grow across the utility and non-utility sectors alike. Investor-owned utilities are the top purchasers of operating clean power, along with one public utility, Austin Energy, and a few corporate customers whose recent clean power purchases have moved them into the top 10 rankings.
- Berkshire Hathaway Energy and Xcel Energy maintained their top rankings as number one and number two buyers, respectively, of operating clean power as of the end of 2021. Berkshire Hathaway Energy delivers over 14.4 GW of clean power to its customers across the West and Midwest regions of the country. Xcel Energy has nearly 11.8 GW of operating clean power available for its customers. Southern California Edison rounds out the top three with over 10.1 GW of operating clean power purchases.
- Meta and Amazon are the only two corporate entities that make the top ten list. In recent years both companies, along with many other corporations across the country, have ramped up clean power purchases in order to meet goals to power their operations with 100% renewable energy.

Clean Power Procurement

Top 10 C&I Purchasers of Total Clean Power

65% of C&I offtake commitments online

Top C&I Purchasers of Clean Power by Status



- Commercial and industrial customers have committed to purchasing over 47,800 MW of clean power (not limited to just power purchase agreements). Of that, almost 65% is operational and is providing clean power to these companies' operations. The remaining capacity is still under development.
- The rankings of top C&I purchasers in terms of online capacity and total committed capacity do not vary much, though Verizon ranks in the top ten here but not for online projects, while Apple falls out of the top ten.
- Meta has committed to almost 6,700 MW of clean power offtake, followed by Amazon with almost 5,900 MW, and Google with nearly 3,500 MW. It should be noted that C&I customers also use distributed generation projects located on company sites and behind-the-meter to power their activities. Those types of projects are not included in the totals here.

Economic Benefits

Clean Power Projects Deliver Economic Benefits

Explore the benefits that an average utility-scale wind, solar, and energy storage project provide to American communities.

Jobs

200 MW WIND PROJECT

SUPPORTS

850 jobs during construction

30 operations and maintenance jobs for the life of the project

100 MW SOLAR PROJECT

SUPPORTS

350 jobs during construction

10 operations and maintenance jobs for the life of the project

50 MW, 4-HR STORAGE PROJECT

SUPPORTS

120 jobs during construction

10 operations and maintenance jobs for the life of the project

Investment

DELIVERS

$292 million in capital investment

During Construction: **$35 million** in sales, payroll, income & other taxes

Once Complete: **$2.6 million** in annual property tax and land lease payments

DELIVERS

$142 million in capital investment

During Construction: **$14 million** in sales, payroll, income & other taxes

Once Complete: **$1 million** in annual property tax and land lease payments

$115 million in capital investment

During Construction: **$4.5 million** sales, payroll, income & other taxes

Emissions Savings

AVOIDS

445,000 metric tons (MT) of CO_2 Emissions each year

That's like taking **100,000 cars** off the road or planting **20 million trees**

AVOIDS

139,000 metric tons (MT) of CO_2 Emissions each year

That's like taking nearly **30,000 cars** off the road or planting **6 million trees**

Health Benefits

PREVENTS

the release of

290 MT of NOx, **260 MT** of SO_2

20 MT of PM 2.5.

Preventing over **100 work loss** days each year

PREVENTS

the release of

90 MT of NOx, **80 MT** of SO_2

6 MT of PM 2.5.

Preventing over **30 work loss** days each year

Water Savings

PREVENTS

250 million gallons of water use

at thermal, fossil-fueled power plants

That saves **1.9 billion** water bottles from being consumed

PREVENTS

80 million gallons of water use

at thermal, fossil-fueled power plants

That saves **600 million** water bottles from being consumed

Electricity Needs

CAN POWER

65,000 American Homes

equivalent to **5 million** LED light bulbs

CAN POWER

20,000 American Homes

equivalent to **1.6 million** LED light bulbs

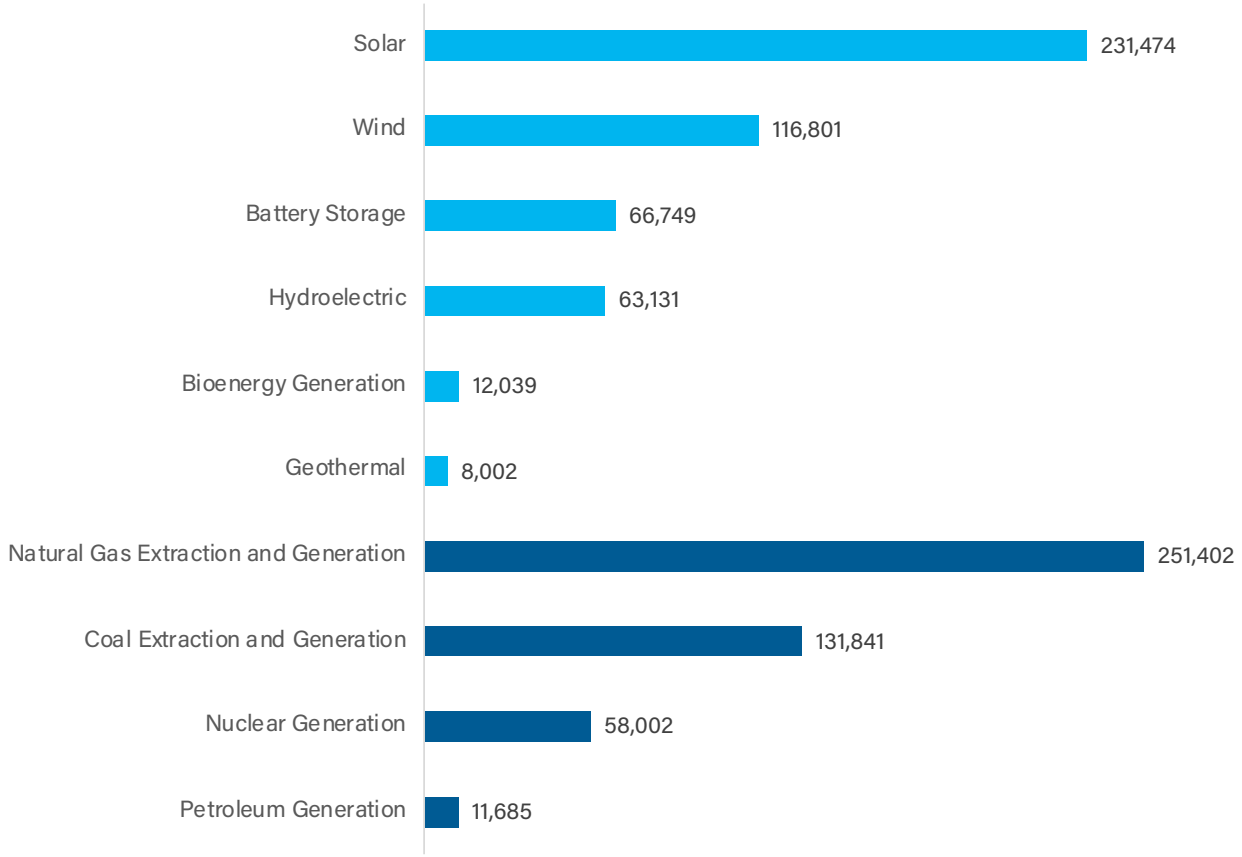
Economic Benefits

Clean Power Jobs

Wind, solar, and energy storage industry employs 415,000 Americans

- According to BW Research and ACP's Clean Energy Labor Supply 2021 report, wind, distributed and utility-scale solar, and battery storage sectors employed over 415,000 at the end of 2020 supporting project development and operations, construction, maintenance, manufacturing, and other supply chain activities.
- The solar sector makes up the largest share of clean power employment with 231,474 estimated majority-time workers. The wind sector employed 116,801 workers in 2020, while battery storage employed 66,749. These estimates include both direct and indirect (supply chain) employment.
- There are currently more workers employed by U.S. clean power than in the coal extraction and generation, natural gas extraction and generation, and petroleum generation sectors combined.
- The 2021 version of the Department of Energy's U.S. Energy and Employment Report is due to be released in July 2022.

Energy Sector Jobs in 2020



Source: DOE USEER

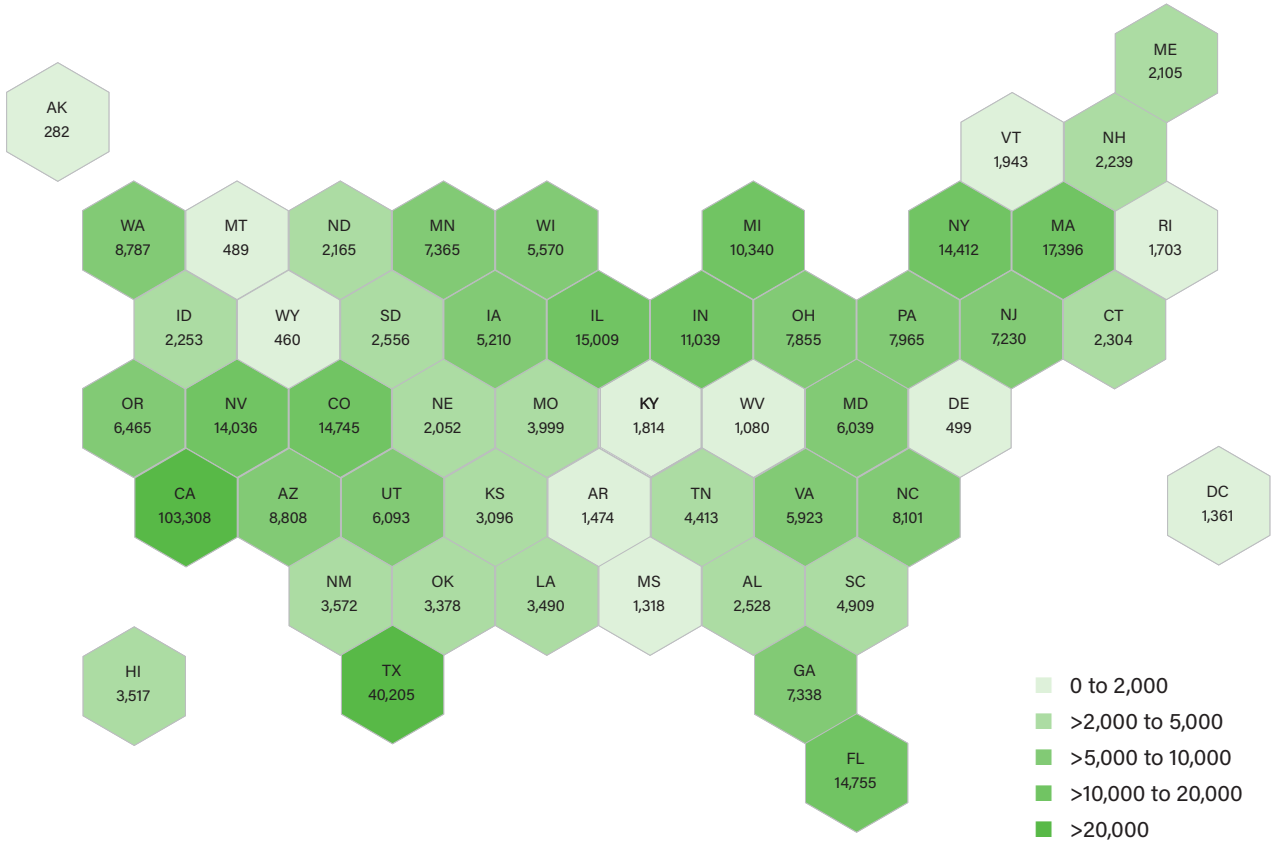
Economic Benefits

Clean Power Jobs by State

Clean power employs workers in all 50 states

- The clean power workforce is spread across the country, in politically red states and blue states.
- While jobs are often concentrated in states with high solar and wind resources, such as California and Texas, clean power employment is distributed fairly evenly across the states on a per capita basis. More than a third of total solar industry employment is found in California—roughly 82,600 full-time jobs. As a proportion of total state employment, solar employment in California is comparable to many other states including Hawaii, Nevada, Vermont, Utah, Massachusetts, and New Mexico.
- Similarly, Texas hosts roughly 22% of total wind energy employment, or more than 25,400 jobs. However, per capita, South Dakota, North Dakota, Colorado, Iowa, and Indiana have a greater share of wind energy jobs.

Clean Power Jobs



Source: DOE USEER

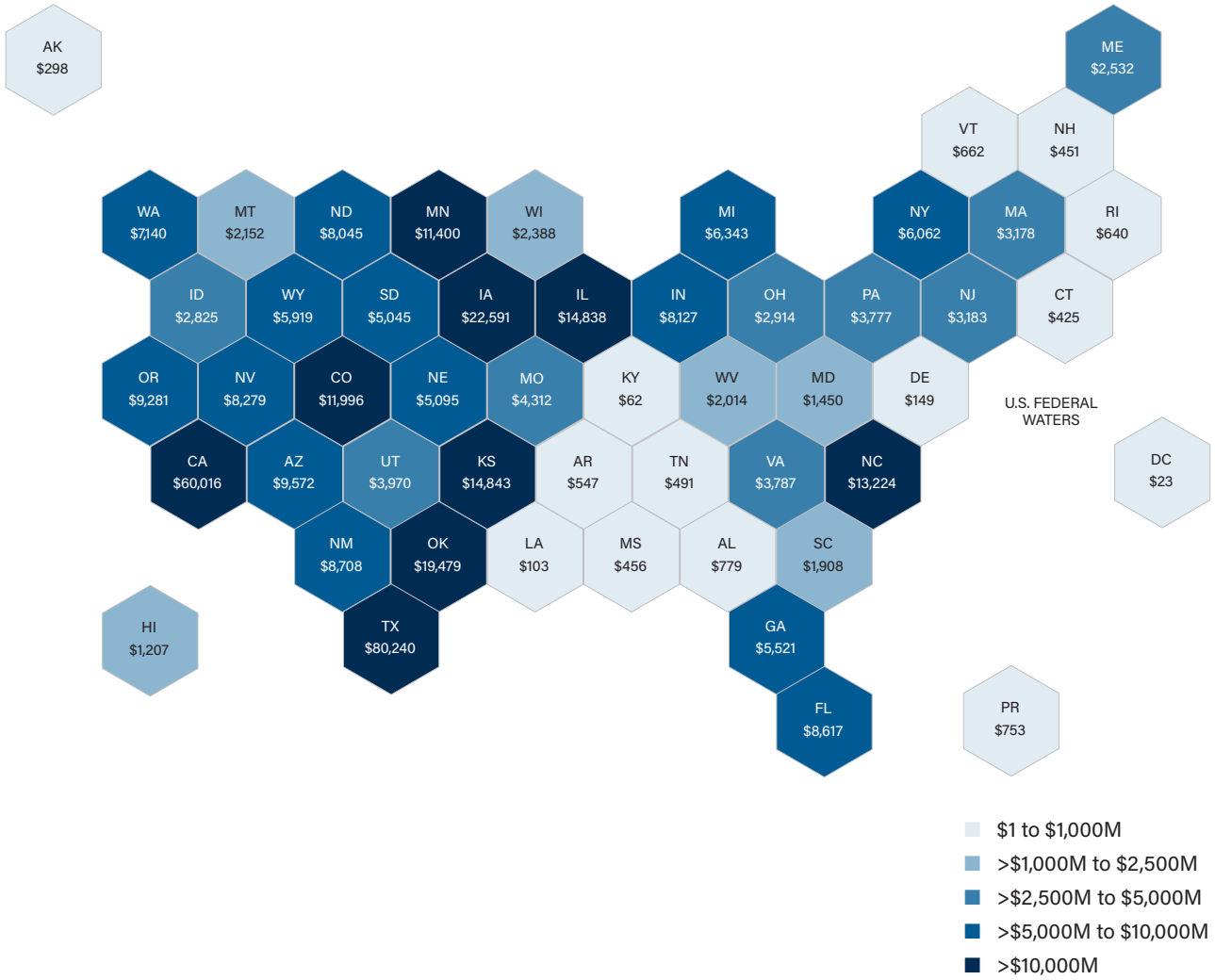
Economic Benefits

Capital Investment by State

Texas is home to the largest amount of clean power project investment of any state at nearly $80 billion

- Texas led the nation at over 7.6 GW of clean power capacity installed in 2021, representing over $10 billion in project investment. More than half of this was driven by solar development with $5.3 billion of total project investment in that state. Wind project investment was slightly lower at nearly $4.9 billion, while storage project investment came in at $665 million.
- California, at nearly $3.7 billion of total clean power project investment in 2021, follows Texas. This was driven largely by solar and storage capacity additions; just under $1.7 billion worth of solar projects and nearly $1.6 billion worth of storage projects came online in 2021 in California, in addition to over $420 million in wind projects.
- Ten other states had more than $1 billion worth of clean power projects come online in 2021.

Cumulative Capital Investment ($millions)



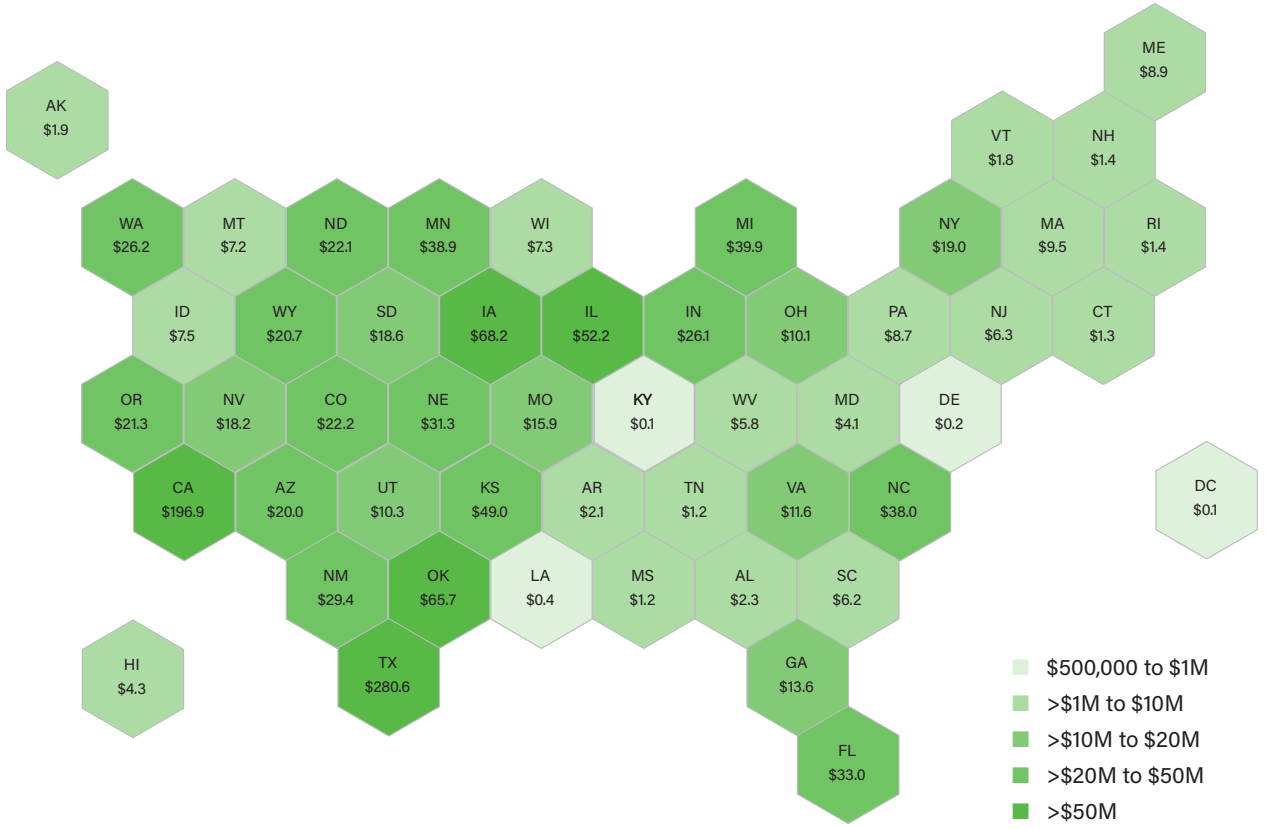
Economic Benefits

Annual Land-Lease Payments

The clean power industry provides nearly $1.3 billion in annual land-lease payments

- Clean power projects also contribute directly to local communities through annual tax payments and landowner lease payments.
- In 2021, the clean power industry paid an estimated $1.2 billion in state and local taxes and nearly $1.3 billion in land-lease payments to landowners across the U.S. That means each year, the industry contributes at least $2.5 billion to local communities.
- In 2009, The Lawrence Berkeley National Laboratory collected data on almost 7,500 home sales of single-family homes near 24 existing wind facilities across nine U.S. states and found that if property values are impacted by the presence of wind farms, the impacts are too small and/or infrequent to result in a statistically observable impact.
- Similarly, a 2018 study from the LBJ School of Public Affairs at the University of Texas at Austin that surveyed residential property assessors found a majority of assessors estimated zero value impact from being located near a utility-scale solar installation.

Land Lease Payments in 2021 ($millions)



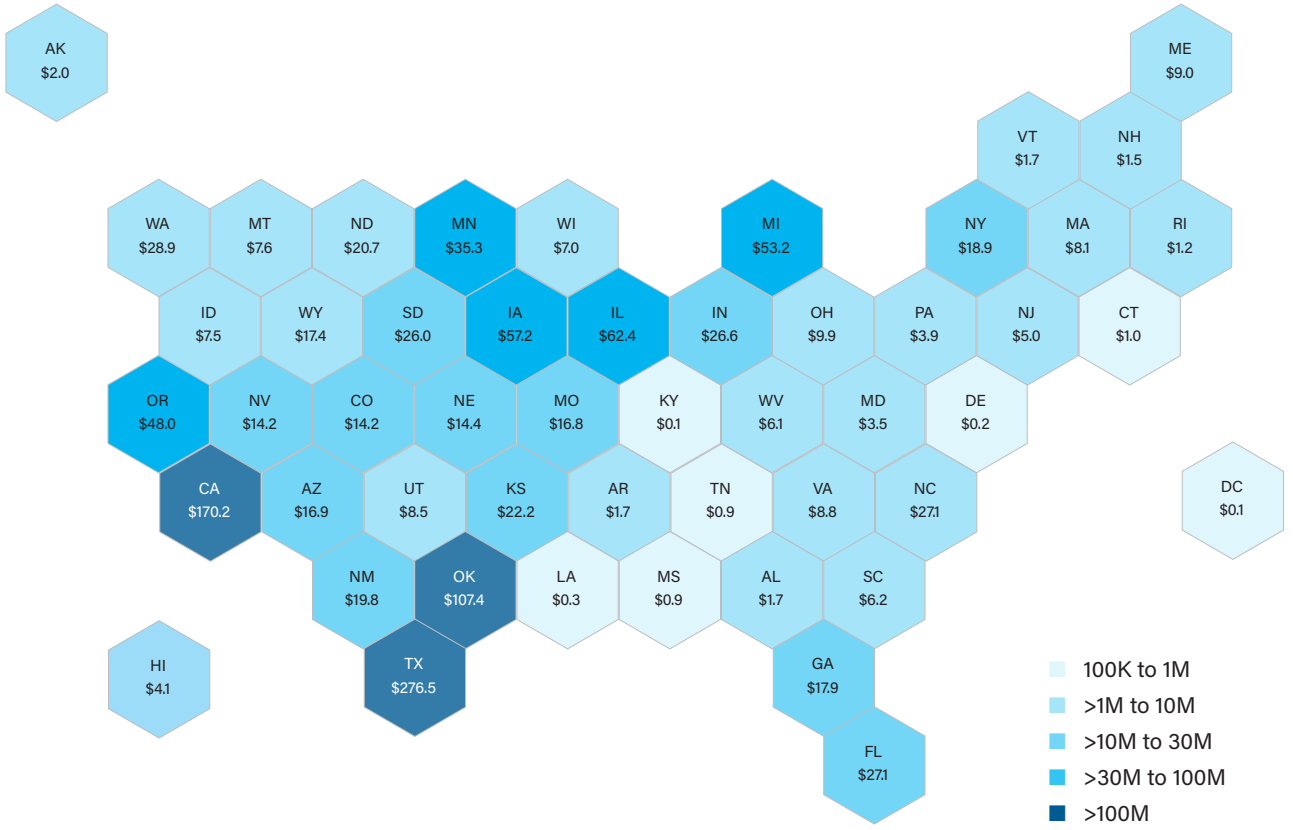
Economic Benefits

State and Local Tax Payments

In 2021, the clean power industry paid an estimated $1.2 billion in state and local taxes

- Texas leads all states with an estimated $276.5 million in estimated state and local taxes paid in 2021. California follows with $170.2 million.
- There are four other states with estimated state and local tax revenues from clean power exceeding $50 million.
- In addition to capital investment and lease payments, annual property, income, and sales tax payments provide valuable revenues for local school districts and other government services.
- For example, the 1,056 MW Western Spirit Wind project is projected to provide nearly $3 million per year in new property tax revenues for the three counties and two school districts in the project area, contributing to improved quality of education, services, roads, and first responder capabilities for the entire community.
- Mammoth Solar, a 400 MW solar project under construction in rural Indiana, is expected to bring an additional $1 million to $2 million each year for two counties. As less-populated, rural counties, that new funding will represent nearly one-fifth of each county's annual budget.

State and Local Taxes Paid in 2021 ($millions)



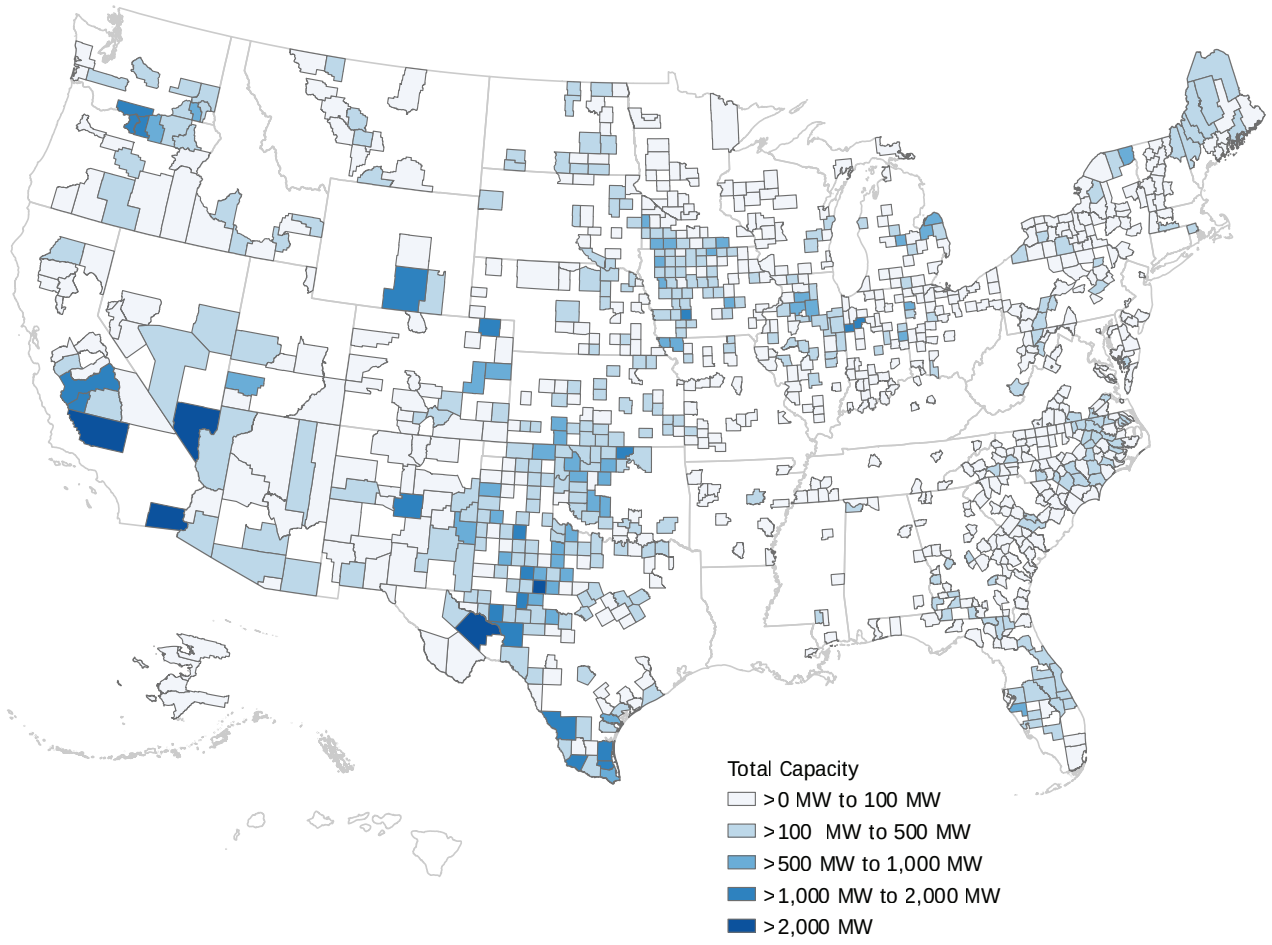
Economic Benefits

Clean Power Installed in Low-Income Counties

Nearly 80% of U.S. clean power installed in low-income counties

- Nearly 80% of U.S. clean power capacity is installed in low-income counties, or counties where the median household income falls below the national median household income. These projects create economic opportunities in the communities that need it most, providing local employment, land-lease payments, as well as property, income, and sales tax revenues.
- Online clean power projects in low-income counties delivered an estimated $1 billion in lease payments to landowners in 2021, providing a steady source of income for ranchers, farmers, and other landowners.
- These projects represent a cumulative $307 billion in private capital investment.
- Clean power development is expected to continue in low-income areas. Approximately 64% of land-based wind, solar, and battery storage capacity under construction or in advanced development is in low-income counties, representing an additional $97 billion in new project investment.

Clean Power Installed in Low-Income Counties



Clean Power Environmental Benefits

Clean Power Delivers Environmental Benefits

Clean Power Technologies Help Our Economy and our Planet

Clean energy sources like wind and solar are critical parts of reducing greenhouse gas emissions and combating climate change.

Clean Power Reduces Carbon Emissions

Wind and solar power avoid emitting **398 million metric tons** of carbon dioxide per year.

That amount is the equivalent of:

407 million one-way trips down scenic Route 66.

The amount of carbon sequestered by planting **18.3 billion** trees.

Driving **998 billion miles** in your average car. That's the emissions equivalent of:

trips around the Earth.

football fields long.

trips around the bases on a baseball diamond.

Not using more than **45 billion** gallons of gasoline.

Preventing over **$20 billion** in future climate-related damages each year.

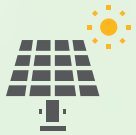
Clean Power is a Cost-Effective Solution to Combat Climate Change

Wind and solar **costs have fallen 47% and 71%** over the last decade, making them the most affordable new electricity sources in most of the U.S.

CARBON EMISSIONS

When generating electricity, wind and solar power produce **zero carbon emissions,** the greenhouse gas primarily responsible for climate change.

A typical wind project repays its carbon footprint in **six months or less,** providing decades of zero-emission energy.



The carbon footprint of a typical solar pv plant is **11x smaller** than a natural gas plant and **21x smaller** than a coal plant.

Clean Power Makes Communities Healthier by Improving Air Quality

Wind and solar power avoid **285,000 metric tons** of nitrogen oxides from being emitted into the Earth's atmosphere.

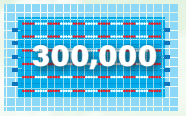
That's the same amount of NOx emitted by an average tractor trailer driving nearly **31 billion miles.**

Wind and solar power prevent **256,000 metric tons** of sulfur dioxide from being emitted into the Earth's atmosphere.

Clean Power Saves Water

Because clean power does not require water for cooling like conventional power plants, wind and solar projects save **200 billion gallons** of water each year.

That amount of water is enough to fill:



Olympic-sized swimming pools

Water bottles

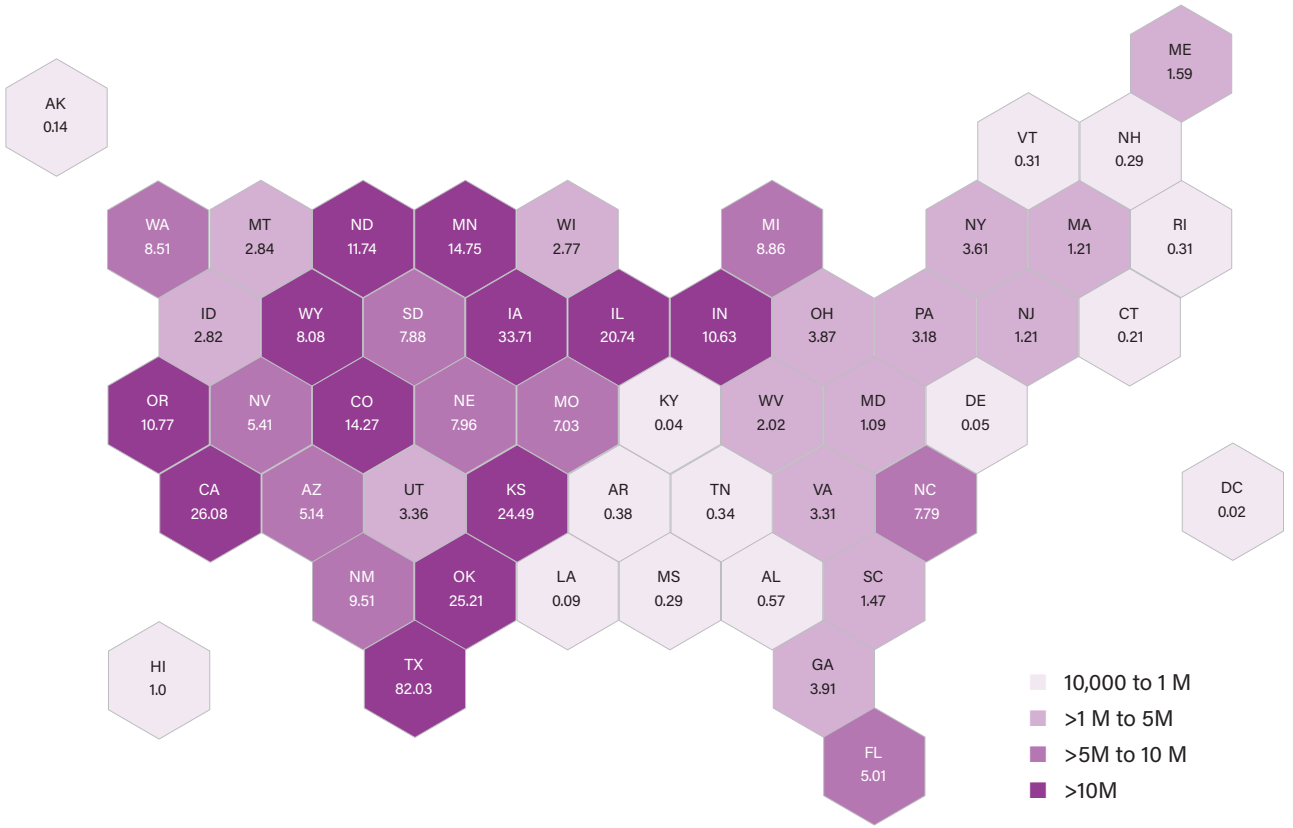
Clean Power Environmental Benefits

Carbon Dioxide Emissions Avoided by Wind and Solar Power in 2021

Installed wind and solar capacity can avoid the equivalent of 86 million cars' worth of carbon emissions

- Wind and solar power have some of the lowest environmental impacts of any source of electricity generation. These technologies do not burn fuel and therefore do not emit any air pollution such as carbon dioxide (CO_2), sulfur dioxide (SO_2), nitrogen oxides (NO_x), or particulate matter (PM2.5).
- The electricity generated by wind and solar often results in an equivalent decrease in electricity production at another power plant. Due to low marginal costs, wind and solar energy typically displace generation from fossil-fuel powered plants.
- Wind and solar capacity installed through 2021 can reduce annual CO_2 emissions by an estimated 398 million metric tons, or roughly 86 million cars' worth of carbon emissions.
- The roughly 38 GW of wind and solar power capacity under construction at the end of 2021 can reduce CO_2 emissions by an additional 70 million metric tons once operational. That would bring total emissions reductions from U.S. wind and solar energy to around 470 million metric tons per year.

Avoided CO_2 Emissions (Million Metric Tons)



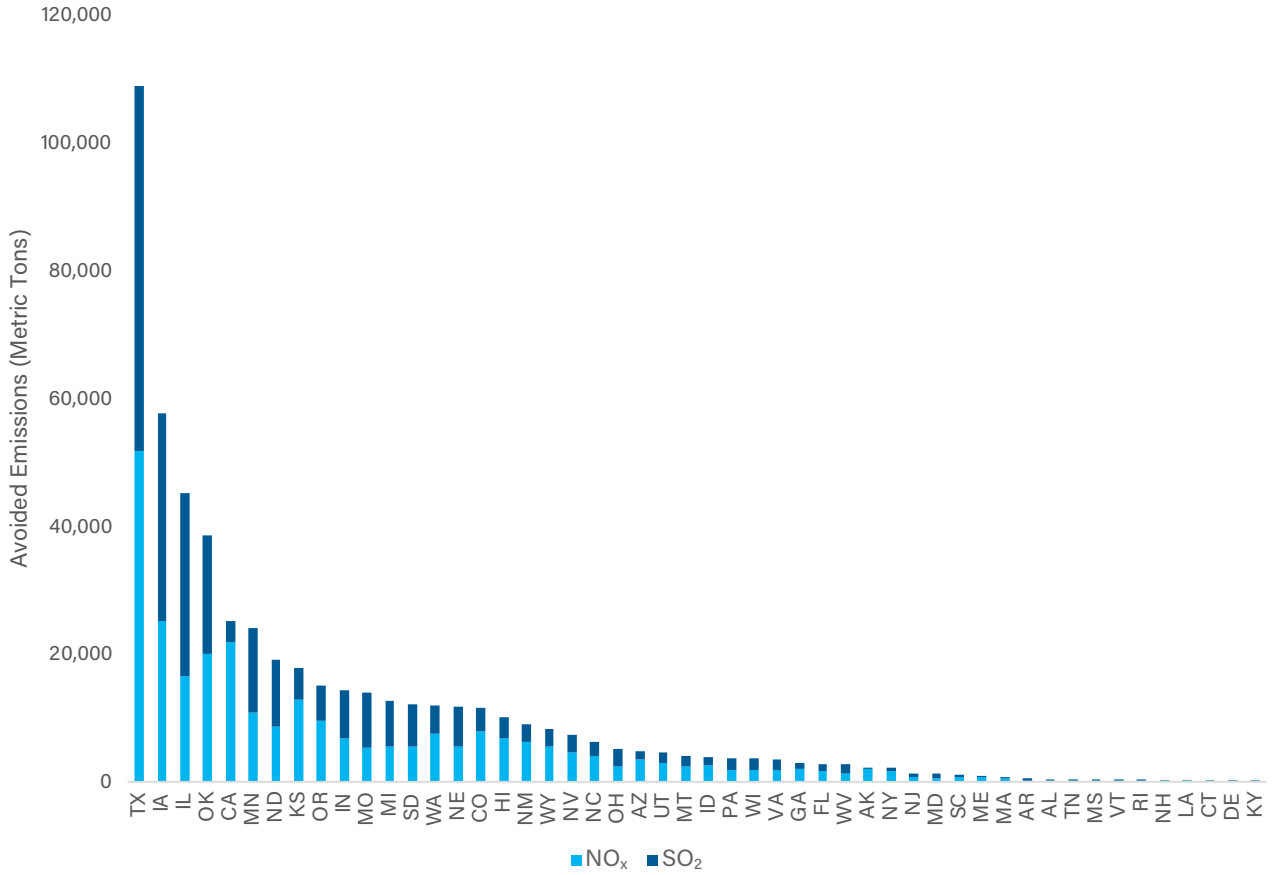
Clean Power Environmental Benefits

NO_x and SO_2 Emissions Avoided by Wind and Solar Power in 2021

Nearly 537,000 metric tons of NO_x and SO_2 emissions avoided by installed wind and solar

- Installed wind and solar capacity as of 2021 can prevent the release of roughly 15,000 metric tons of PM2.5 on an annual basis.
- The U.S. Environmental Protection Agency (EPA) defines PM2.5 as fine inhalable particles that are generally 2.5 micrometers or smaller. In addition to causing haze, these particles can get deep into the lungs, and some may even enter the bloodstream.
- Additionally, wind and solar power can prevent the release of roughly 283,000 metric tons of NO_x and 254,000 metric tons of SO_2.
- According to the EPA, when NO_x and SO_2 are emitted into the atmosphere, they undergo chemical reactions to form tiny solid particles that can travel long distances. Both NO_x and SO_2 contribute to death and serious respiratory illness such as asthma and chronic bronchitis. These emissions also acidify surface water, killing fish, and can damage forest ecosystems via soil acidification and depletion of soil nutrients.

NO_x and SO_2 Emissions Avoided by Wind and Solar in 2021, by State



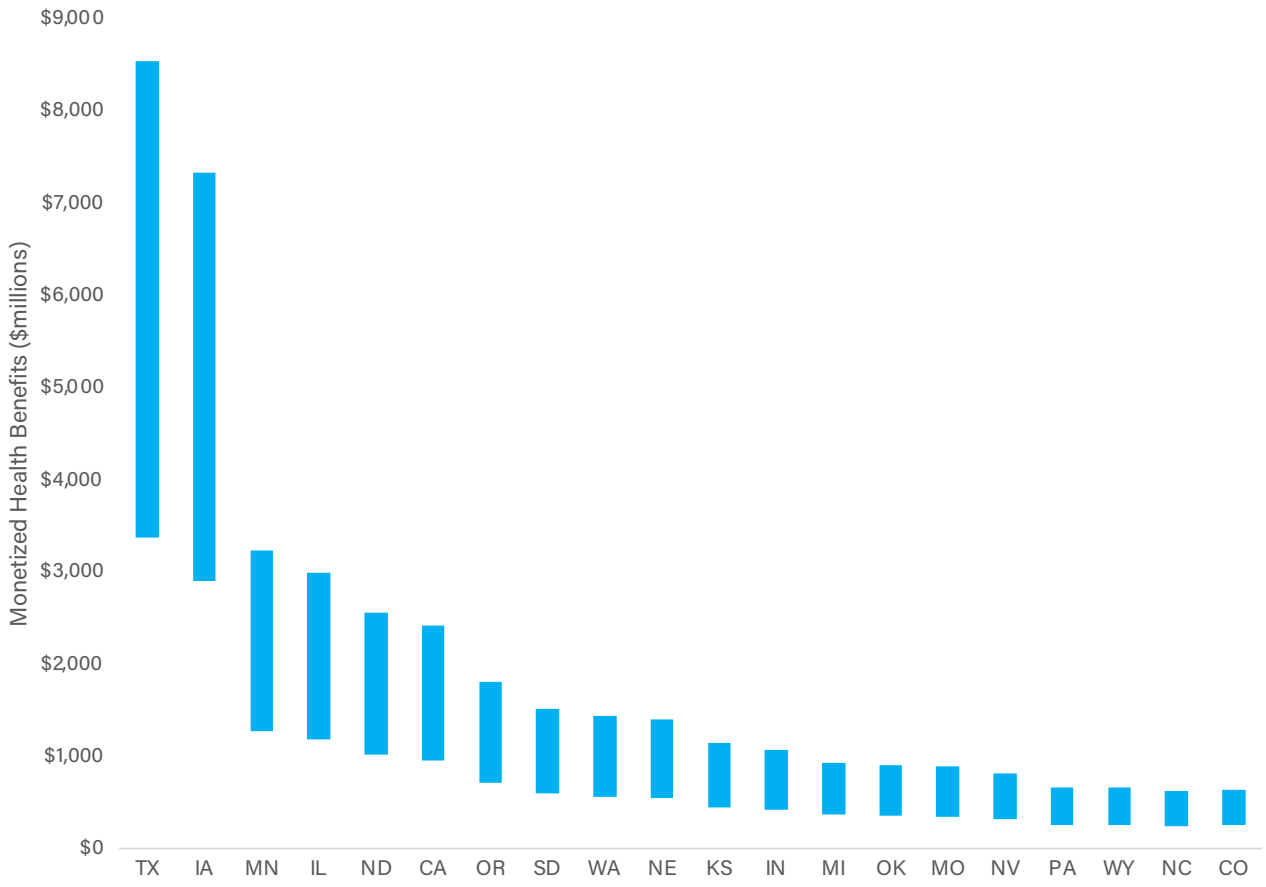
Clean Power Environmental Benefits

Health Benefits

Emissions that are prevented by clean power generate health impacts with an economic value between $18-$47 billion

- The EPA's CO-Benefits Risk Assessment (COBRA) model estimates the economic value of the health benefits associated with reductions in PM2.5, SO_2, and NO_x, among other pollutants. Health benefits include avoided deaths, asthma-related emergency room visits, work loss days, and other pollution related health impacts. The model estimates the present value of the benefits that accrue over 20 years due to a single-year reduction in emissions.
- Emissions of PM2.5, SO_2, and NO_x that can be avoided due to the total wind and solar capacity installed through 2021 are expected to generate health benefits with an economic value between $18-$47 billion, based on EPA COBRA modeling using a 3% and 7% discount rate.
- As part of the monetized benefits, the model predicts a decrease in mortality between 1,900 and 4,300 cases, as many as 3,100 fewer non-fatal heart attacks, 54,000 fewer cases of asthma exacerbation, and 256,000 fewer work loss days.

Estimated Range of Health Benefits from Emissions Reductions, 2021



Source: EPA Cobra

Manufacturing and Trade

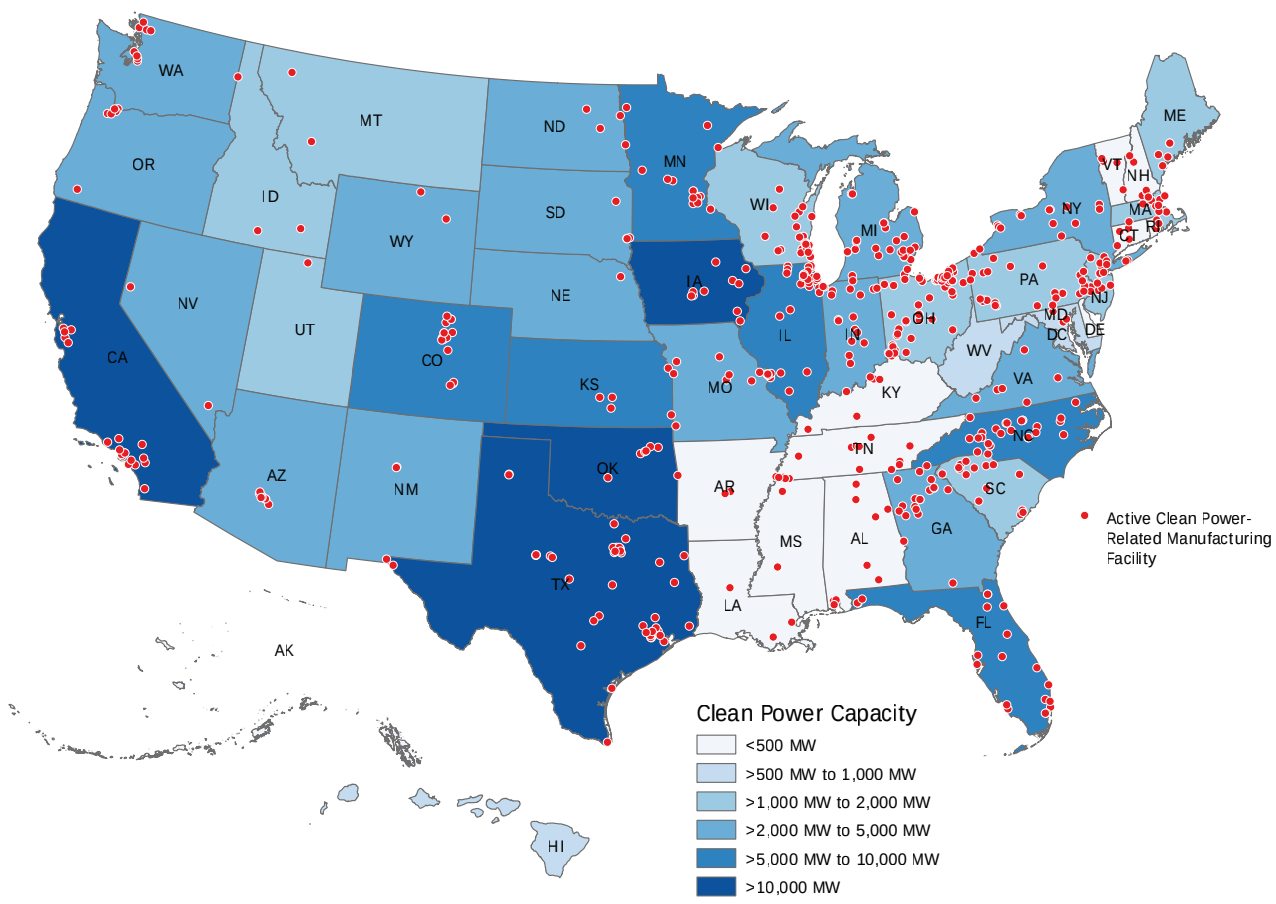
Manufacturing and Trade

Clean Power Manufacturing and Capacity

There are over 575 active clean power-related manufacturing facilities across the U.S.

- As the most mature clean power sector in the U.S., there are over 500 wind-related manufacturing facilities in the U.S. Aside from providing major components such as blades, towers, and nacelles, there are hundreds of smaller manufacturers providing other components such as coatings, lubricants, power transmission components, and other raw materials to the wind sector.
- There are over 60 utility-scale solar-related manufacturing facilities in the U.S. including 11 module manufacturers, 20 racking manufacturers, and dozens more manufacturers of other components. In addition, there are nine major battery manufacturing facilities across the country.
- As the solar and battery storage sectors continue to grow, more manufacturers of major and minor components will continue to develop.

Clean Power Manufacturing and Capacity by State



Cost and Pricing

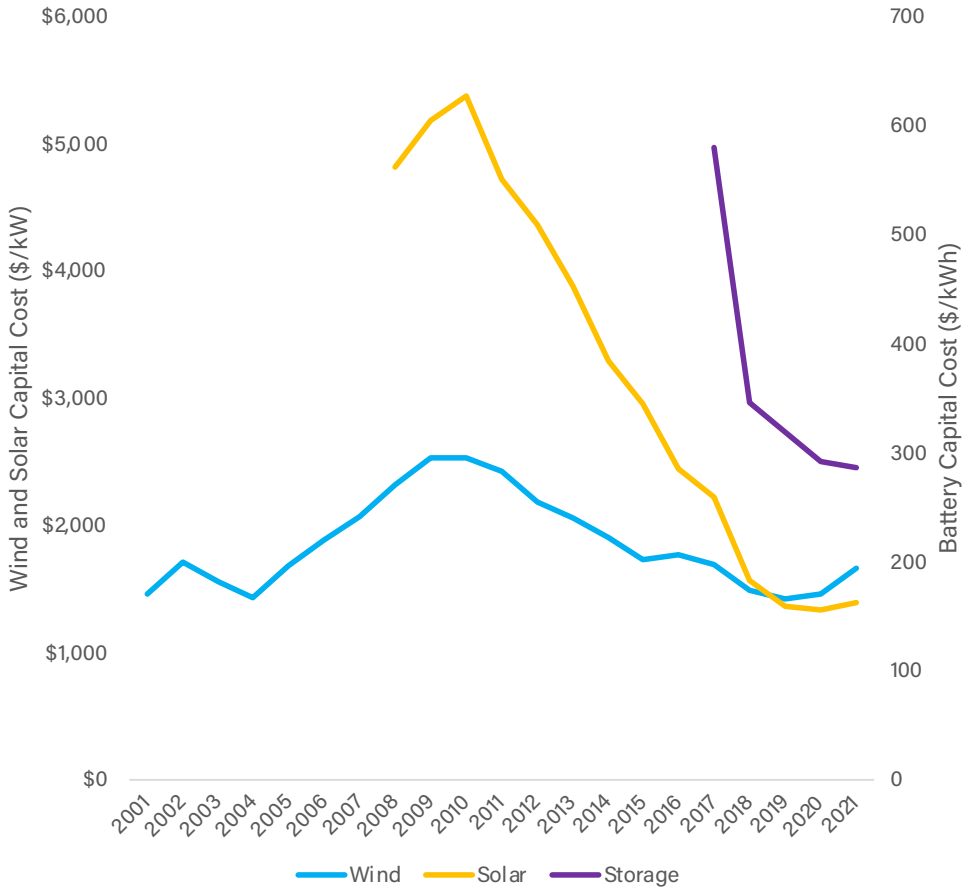
Cost and Pricing

Inflation and Supply Chain Pressures Led to Capital Cost Increases

Storage technological advances outpace inflationary pressures

- The national average cost to build a utility-scale wind or solar project increased in 2021 as a result of increasing commodity prices, higher maritime shipping rates, trade restrictions, and macroeconomic inflation. The average cost of a wind project in 2021 stood at $1,670/kW, while the average solar project required $1,402/kW. Nevertheless, wind and solar remain the lowest cost forms of new power generation in most parts of the U.S.
- Technological progress and efficiency gains helped battery storage project costs outrun inflationary pressures. While more modest than recent years, battery storage costs continued their downward trajectory in 2021. The average cost of a four-hour storage facility was $287/kWh. At four hours of duration, that puts capacity capital costs at $1,148/kW.
- Renewable energy projects inherently require heavy capital cost investments up front to achieve a power generation source without ongoing fuel costs. These are hardware intensive power plants. In the case of wind, comprised of large volumes of valuable steel for towers and drivetrain parts, high tensile strength fiberglass- or carbon-fiber-reinforced polymers for oversized blades, miles of copper cabling and balance of plant, and hundreds, if not thousands of other material and component inputs. Solar has copper intensive cabling, balance of plant, and heavy expenditures on solar modules, inverters, and racking/tracking hardware. Battery storage units are chemically intensive requiring metals such as nickel and lithium-ion in addition to steel and aluminum for the enclosures.
- Declining capital costs for renewables, combined with operational efficiency and productivity advances, have enabled these technologies to achieve a competitive levelized cost of energy (LCOE).

Clean Power Plant Capital Cost



Source: BNEF, LBNL

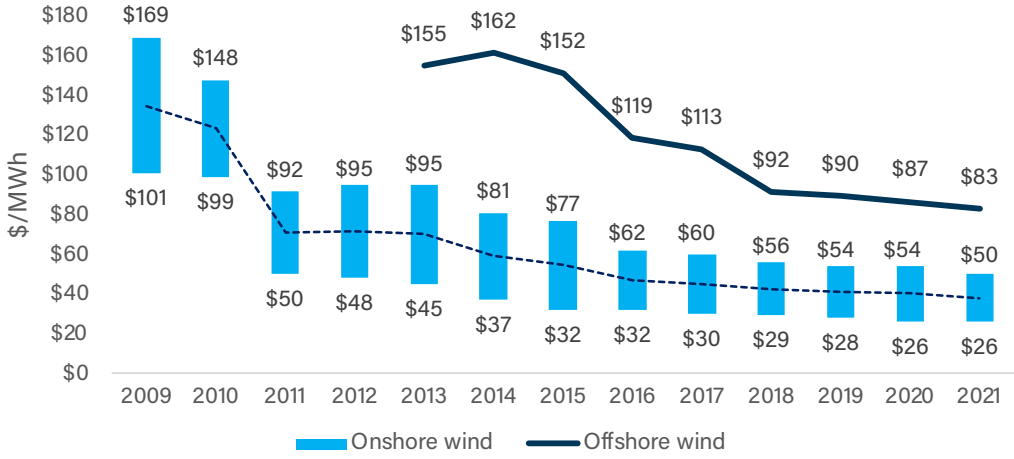
Cost and Pricing

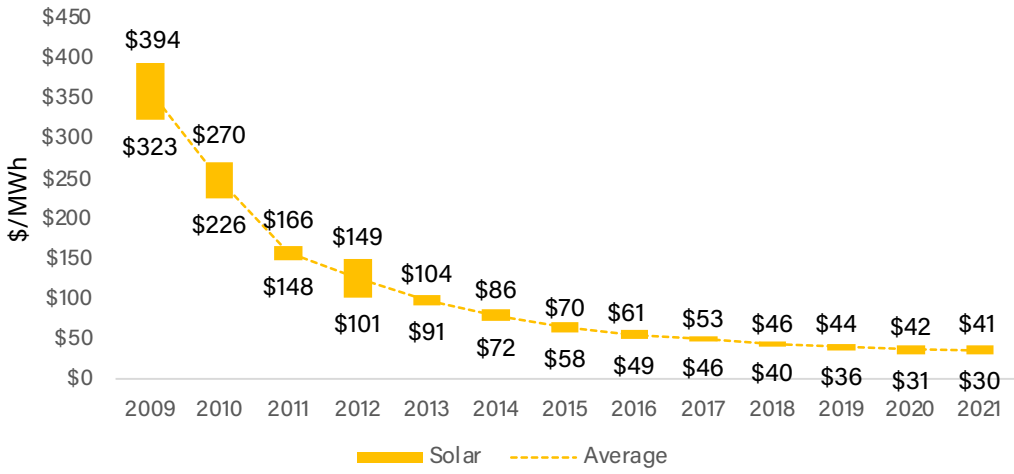
Wind and Solar Lowest Cost New Power Sources

Solar and wind cost down 71% and 47% in last 10 years, respectively

- Levelized cost of energy is the lifetime price level that developers/ owners of renewable energy projects need to secure to cover project and operational costs and receive a reasonable profit margin for their work bringing the project to market. As generation technologies that do not rely on fuel to produce electricity, technological advances that lead to falling turbine and solar module costs translate quickly to reductions in LCOE.
- The unsubsidized (not considering tax credits) LCOE of wind power plants has dropped 47% since 2012 to $38/MWh. Larger turbines and more efficient capture of blowing winds have contributed to an increase in the overall output of wind projects, bringing down the incremental cost of energy production. Operational expertise and efficiency complement capital cost reduction and performance improvements.
- The cost of producing electricity from solar has declined 71% in the last 10 years thanks to advances in module efficiency, increasing project size and scale, advances in operations and maintenance strategies, and better output performance.
- For both technologies, the rate of cost reduction slowed in 2021 due to an increase in capital costs. In some cases, projects were able to harness better performance to keep LCOEs low and mitigate some or all of the impact from higher capital costs.
- Offshore wind data points are not tracked earlier than 2013, but the technology has experienced a similarly steep drop in LCOE. The cost to produce electricity from offshore wind turbines fell 45% from an average of $155/MWh in 2013 to $83/MWh in 2021. These costs are expected to decline further as the nascent industry takes hold in the U.S., following a similar trend in Europe.

Wind and solar levelized cost of energy





Source: Lazard

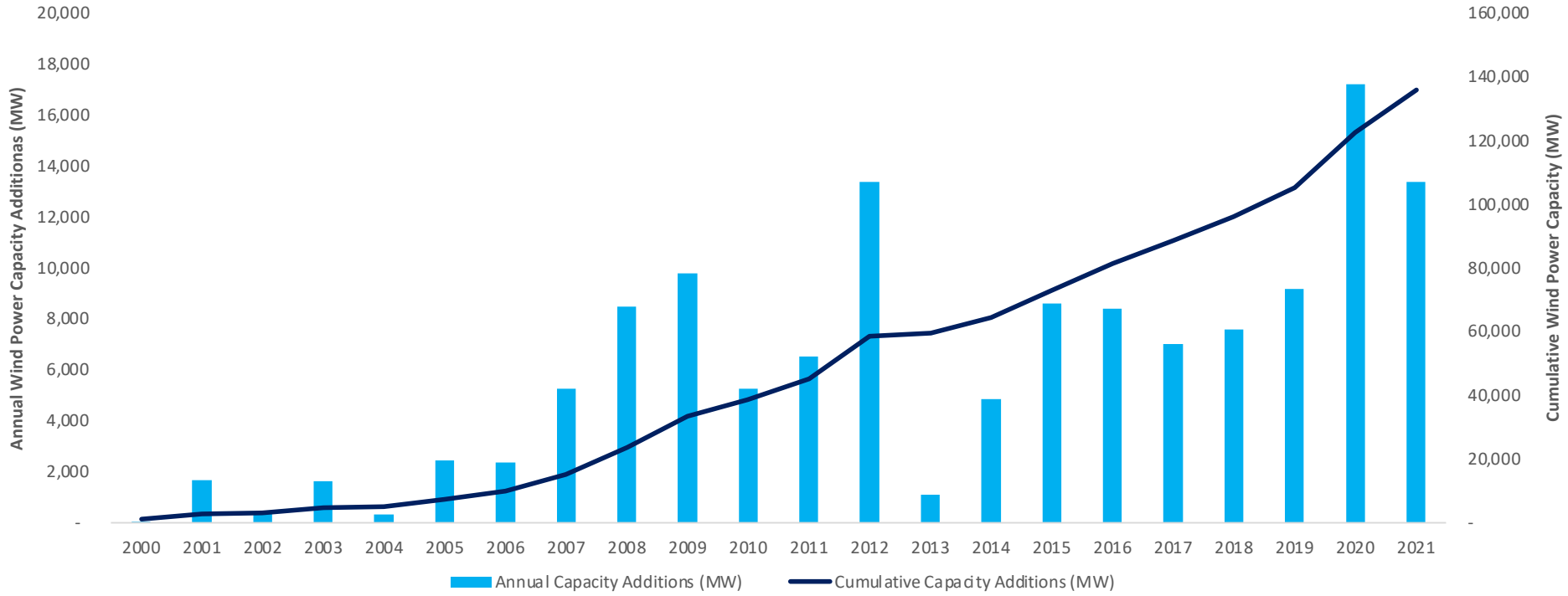
Land-Based Wind Market

Land-based Wind Market

Annual and Cumulative Wind Power Capacity

13,400 MW installed in 2021 brings cumulative year-end capacity to 135,843

U.S. Annual and Cumulative Wind Power Capacity Growth



Note: Online capacities for 2021 have been updated since the Q4 2021 Market Report to reflect updated data available to ACP.

- 2021 was the second biggest year for wind installations on record after 2020. The U.S. wind market installed 4,374 wind turbines totaling 13,400 MW.
- Cumulative operating wind power capacity stood at 135,843 MW as of the end of the year.
- Wind capacity installations were down compared to expectations in 2021 due to more than 5 GW of wind projects expected online in 2021 being delayed. There are many potential reasons for projects being delayed, including inflation causing rising commodity prices, policy uncertainties, such as expiration of tax credits for wind projects and the fate of the Build Back Better Act, and interconnection queue delays.

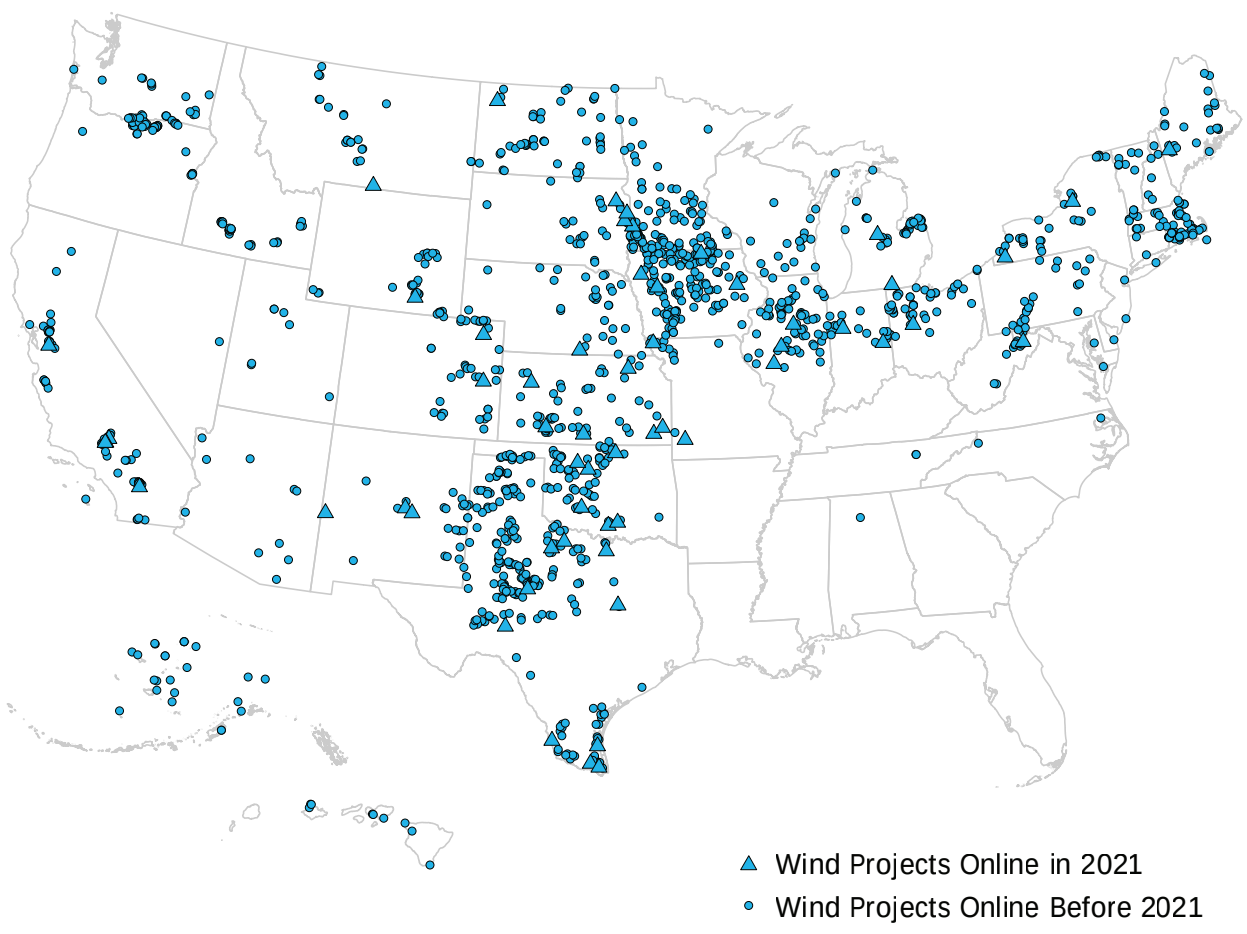
Land-based Wind Market

Land-Based Wind Projects

Over 60 wind projects added to the grid in 2021

- Wind developers brought 63 project phases online, including repowers, totaling nearly 13.4 GW in 2021. These projects were spread across 21 states, including nine states that added 500 MW or more.
- Texas led all states in new wind power, installing nearly 3 GW. Oklahoma followed with over 1.5 GW, and New Mexico placed third, adding nearly 1.4 GW.
- The three largest wind projects built in 2021 were the 1,056 MW Western Spirit Wind project built in New Mexico, the 508 MW White Mesa project built in Texas, and 384 MW Isabella I & II project built in Michigan.
- Developers commissioned over 4.1 GW less wind power in 2021 compared to a record 2020, representing negative 24 percent year-over-year growth. Two reasons for this decrease are that Production Tax Credit expiration drove a record year in 2020 and supply chain issues forced many projects set to come online in 2021 to be delayed until 2022.
- U.S. wind power capacity has increased nearly three-fold in the last 10 years and is 51 times larger than it was in 2001.

Land-based Wind Power Projects



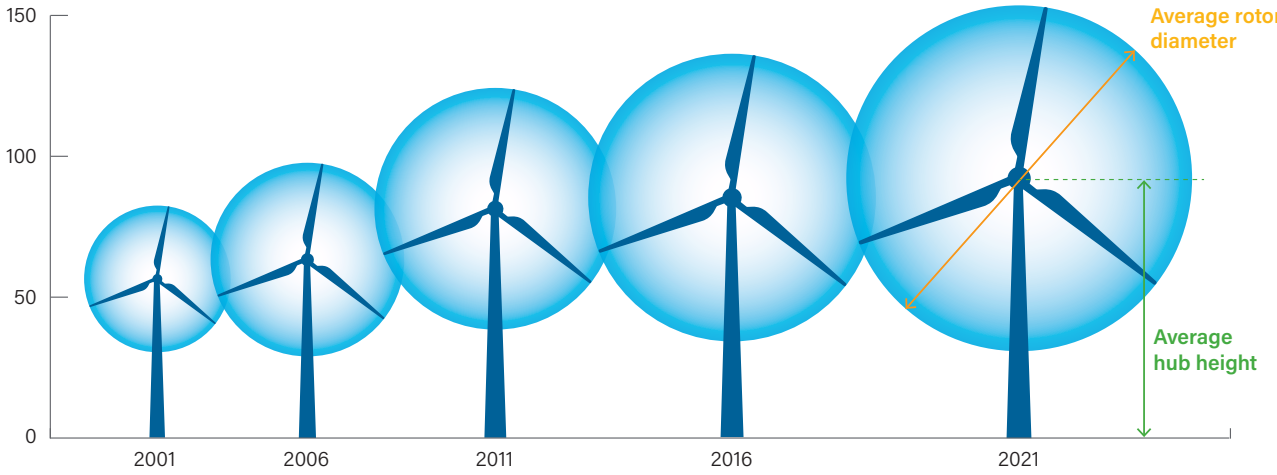
Land-based Wind Market

Average Wind Turbine

Average 2021 wind turbine: 90-meter hub height, 133-meter rotor diameter and 2.9 MW capacity

- In 2021, the U.S. wind industry added 4,374 turbines, bringing the total operating fleet to 69,855 wind turbines. The average hub height of turbines installed in 2021 reached 91 meters and the average rotor diameter spanned 124 meters. The average wind turbine size increased in 2021 to 2.9 MW, up from 2.7 MW last year.
- Over the past two decades the growth in average rotor diameter and turbine capacity has outpaced growth in the average hub height. Since 2001, the average rotor diameter grew over 130% and the average turbine capacity grew over 222%, while hub heights grew by 60%. The increase in the average turbine size over the past years is the result of more turbine options ranging from 4 MW to 5+ MW.

Evolution of the "Average" Utility-Scale Turbine



YEAR	2001	2006	2011	2016	2021
Average Hub Height	57m	63m	80m	84m	91m
Average Rotor Diameter	53m	70m	87m	104m	124m
Homes Powered	297	478	614	695	958

Offshore Wind Market

Photo courtesy of Dominion Energy

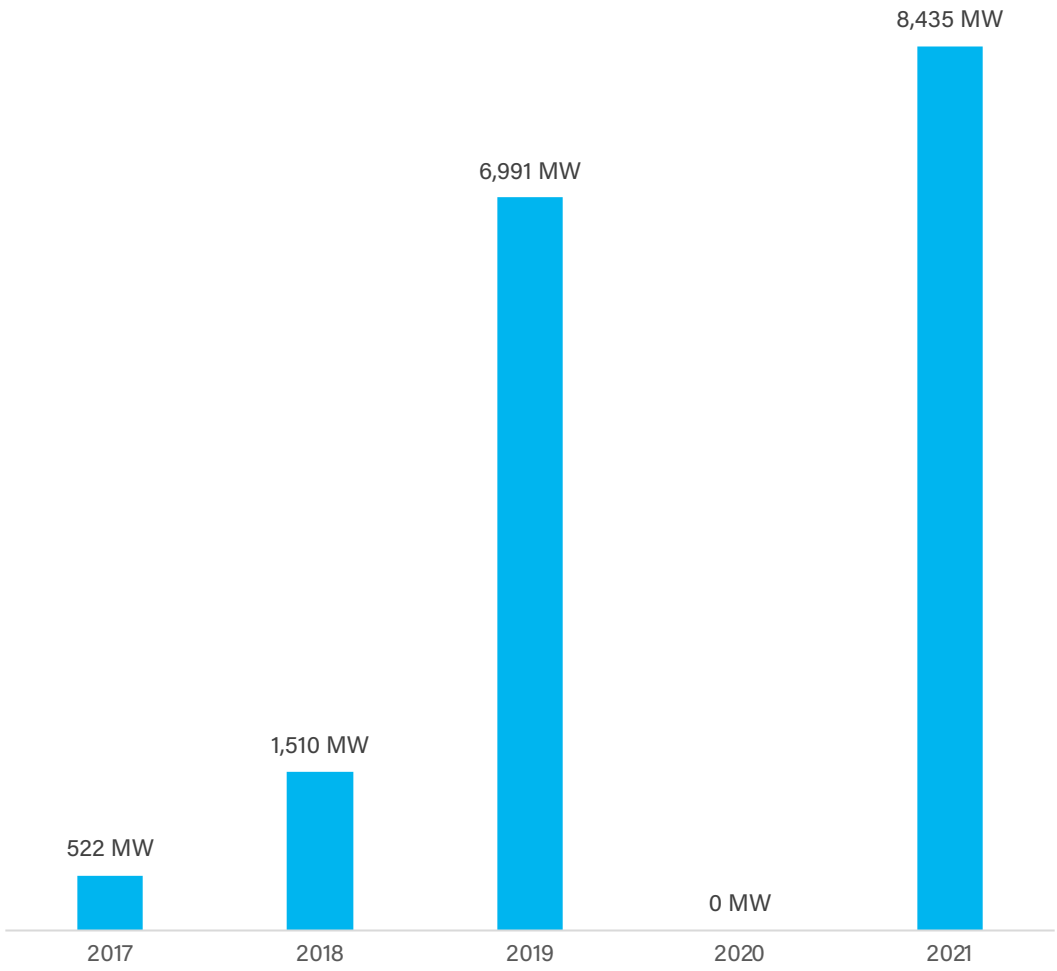
Offshore Wind Market

Offshore Wind Procurement

2021 was a record year for offshore wind procurement

- In March 2021, the Biden Administration announced a goal to deploy 30 GW of offshore wind by 2030.
- Nearly 8.5 GW of offshore wind capacity was procured in 2021, beating out the previous record of roughly 7 GW achieved in 2019. Total offshore wind procured through 2021 sits at nearly 17.5 GW.
- In January 2021, New York announced Equinor's Empire Wind 2 (1,260 MW) and Beacon Wind (1,230 MW) projects as winners of the state's second offshore wind solicitation. These projects build upon Equinor's success in the state's first solicitation, where the company's Empire Wind 1 (816 MW) was selected. New York is scheduled to hold a third round of procurement in 2022.
- In June 2021, New Jersey announced the winners of the state's second offshore wind solicitation. Atlantic Shores (1,510 MW), a partnership between EDF and Shell, and Ørsted's Ocean Wind 2 (1,148 MW) were selected. New Jersey, originally scheduled to hold a third round of procurement in 2022 has delayed that procurement until the first quarter of 2023 as it awaits the results of an offshore transmission solicitation.
- In December 2021, both Maryland and Massachusetts announced the results of their latest rounds of offshore wind solicitations. In Massachusetts, Avangrid's Commonwealth Wind (1,232 MW) was selected. An additional 400 MW was also awarded to Ocean Winds and Shell's Mayflower Wind project. Ocean Winds itself is a partnership between EDP and ENGIE. Mayflower Wind was previously awarded 804 MW in a prior solicitation, bringing the project's total planned capacity to 1,204 MW. In Maryland, the state chose Ørsted's Skipjack Wind 2 (846 MW) and US Wind's Momentum Wind (808.5 MW).

Offshore Wind Procurement by Year



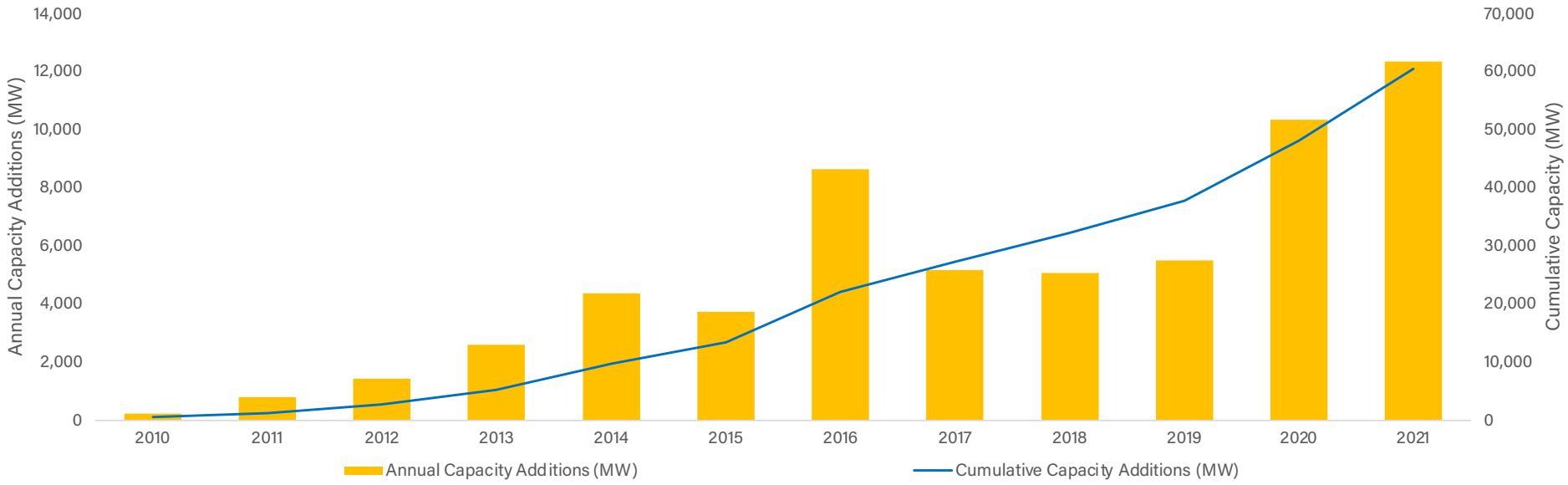
Solar Market

Solar Market

Annual and Cumulative Solar Power Capacity

Over 12,000 MW of new solar added to the grid

U.S. Annual and Cumulative Utility Solar Power Capacity Growth



- The U.S. solar industry installed a record 12,433 MW of utility-scale solar capacity in 2021. This brings total cumulative operating capacity to 60,733 MW.
- Year-over-year, solar capacity installations grew by 20% as the industry added more than 2,000 MW compared to 2020.
- While 2021 was a record year for utility-scale solar installations, over 6 GW of projects were pushed beyond their expected commissioning in 2021. Delays in commissioning were due to supply chain constraints and trade barriers and are expected to obstruct industry growth in future.

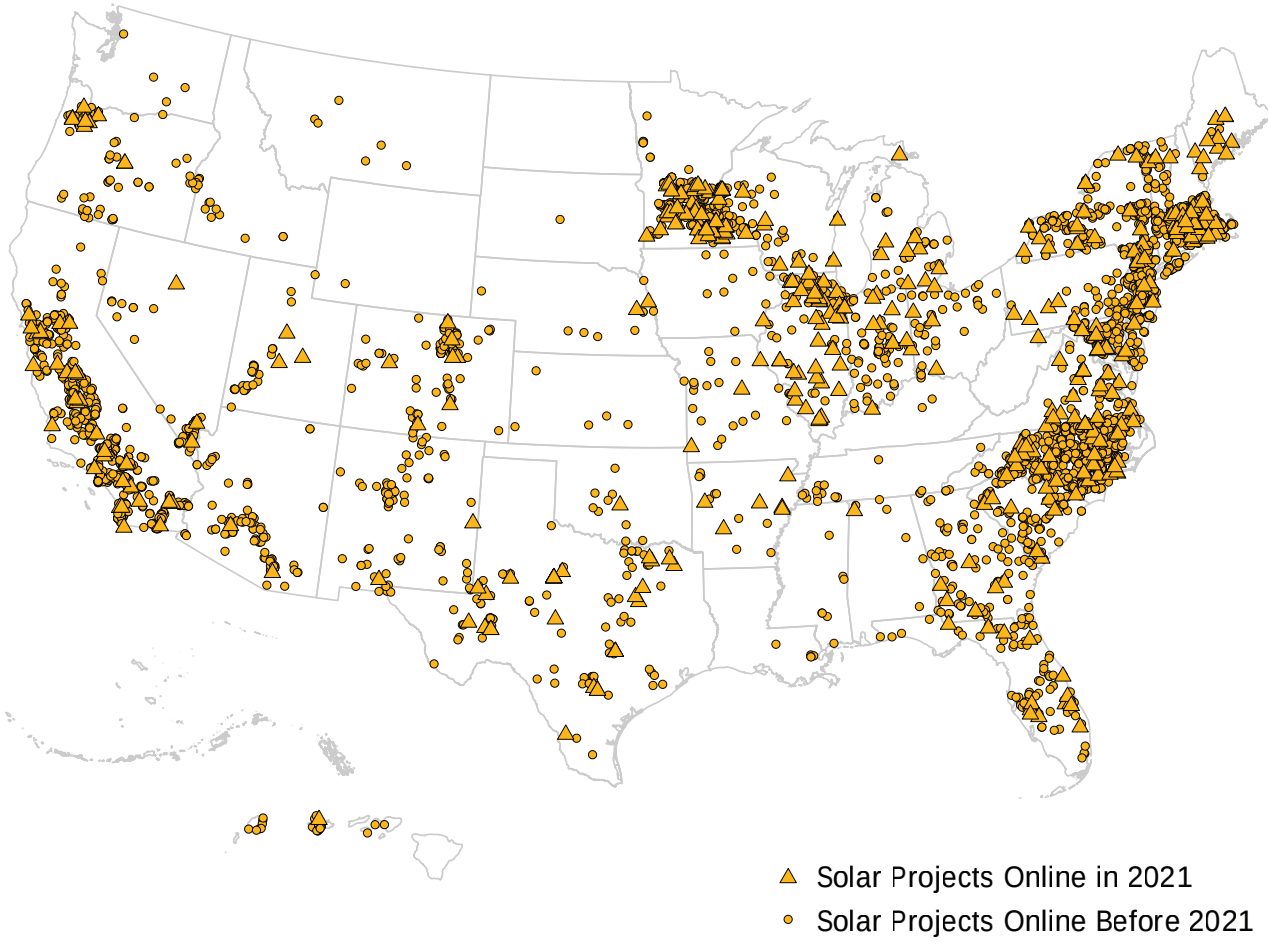
Solar Market

Solar Projects

Over 400 utility-scale solar projects added to the grid in 2021

- Solar power developers brought 428 utility-scale solar projects online, totaling 12.4 GW in 2021. These projects were spread across 35 states and the District of Columbia, including six states that added 500 MW or more.
- Texas led all states in new solar power, installing nearly 3.8 GW. California followed with nearly 1.2 GW and Florida placed third, adding just below 1 GW.
- There were four solar projects tied for the top 3 spots in terms of capacity for projects built in 2021. All four were built in Texas. These were the 420 MW Eunice Solar project, the 300 MW Juno Solar project, and the 255 MW Greasewood and Taygete projects.

Operating Utility Solar Projects



AMERICAN CLEAN POWER

Battery Storage Market

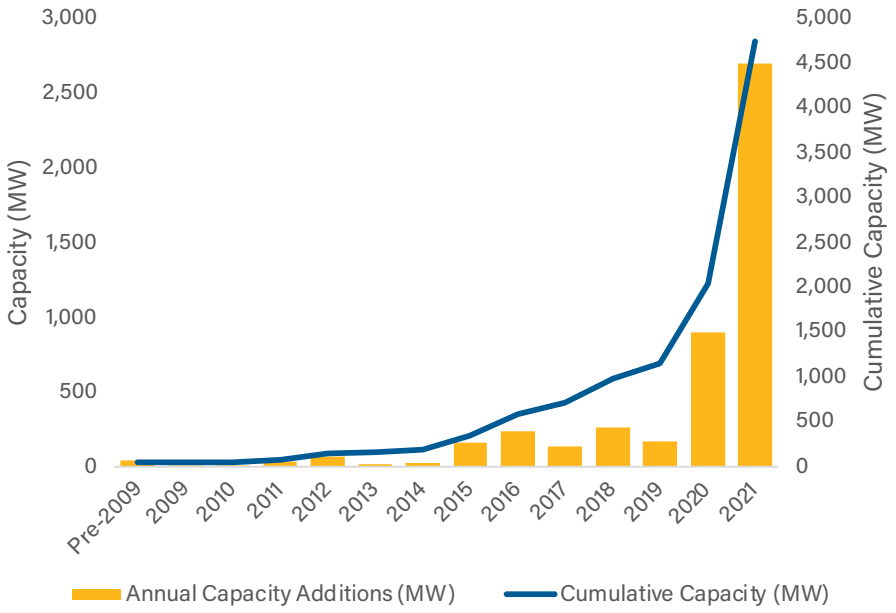
Photo courtesy of Enel Green Power

Battery Storage Market

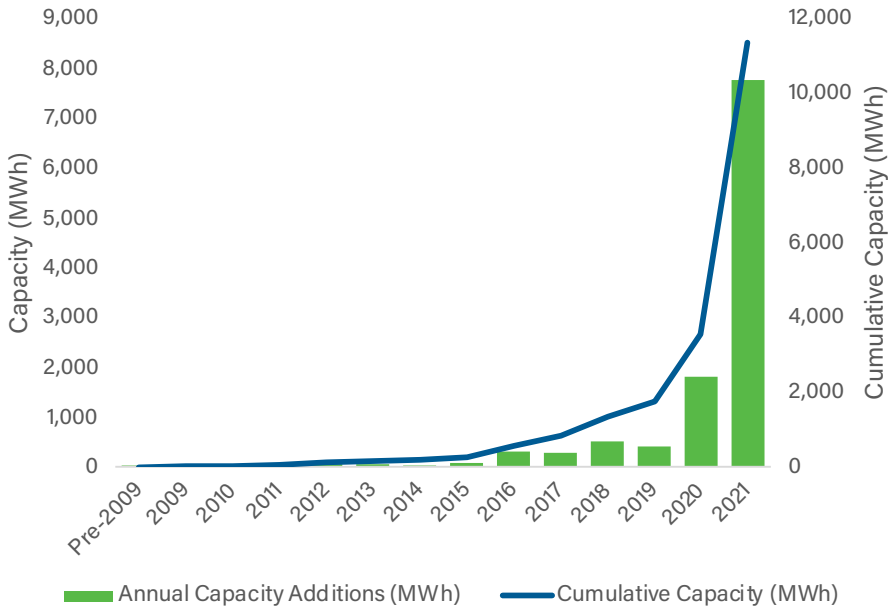
Annual and Cumulative Energy Storage Power Capacity

Over 4.7 GW and 11.3 GWh of battery storage capacity online

U.S. Annual and Cumulative Battery Storage Capacity Growth (MW)



U.S. Annual and Cumulative Battery Storage Capacity Growth (MWh)



- ACP tracks the U.S. utility-scale battery storage market in terms of power capacity (MW), which is the total possible instantaneous discharge capability, and energy capacity (MWh), which is the maximum amount of stored energy.
- 2021 was the largest year on record for battery storage installations. In 2021, 2,695 MW and 7,774 MWh of battery storage capacity came online. This is a 200% or 330% increase from 2020 installations.
- California was the lead installer in 2021, bringing 1,371 MW of battery storage capacity online. Texas again came in second (579 MW), followed by Florida (427 MW), and Massachusetts (75 MW).
- Cumulative online battery storage capacity is now over 4,700 MW and 11,300 MWh. For scale, 57% of total capacity online and 69% of total energy capacity online was installed over the past year.
- As of the end of 2021, there was over 5,000 MW of storage capacity in advanced development, and nearly 8,400 MW under construction.

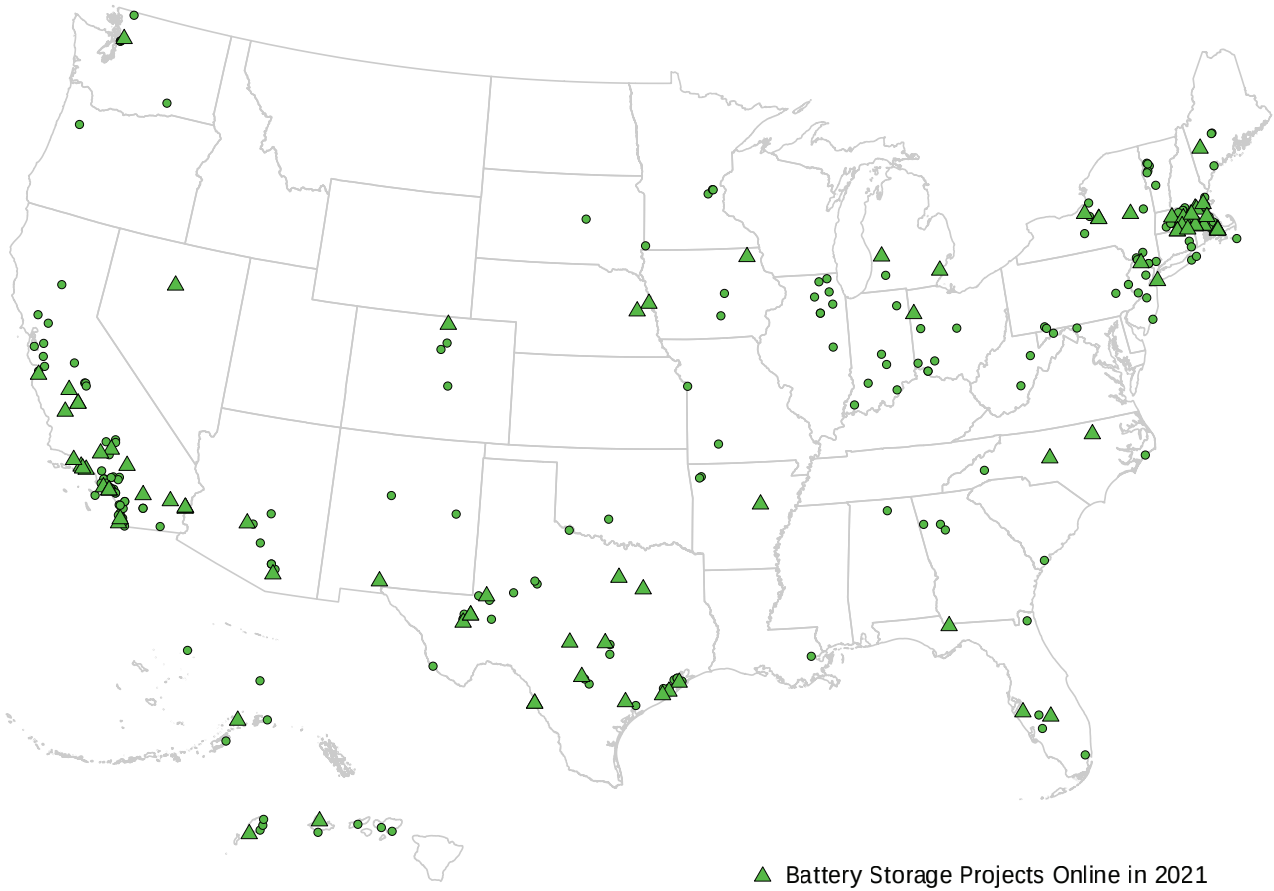
Battery Storage Market

Battery Storage Projects

2021 was the first year of multi-gigawatt battery storage capacity installations

- Battery storage developers brought 98 projects online, totaling nearly 2.7 GW in 2021. These projects were spread across 21 states, including three states that added 100 MW or more.
- California led all states in new battery storage capacity, installing nearly 1.4 GW. Texas followed with roughly 580 MW and Florida placed third, adding nearly 430 MW.
- There were four battery storage projects for the top three spots, in capacity terms, for projects built in 2021. These were the 409 MW Manatee Energy Storage Center project built in Florida, the 230 MW McCoy Storage project built in California, and a tie between the 115 MW Blythe II and Blythe III projects built in California. All four of these projects are part of larger solar plus storage hybrid projects.
- However, in energy terms, McCoy Storage (920 MWh) surpasses the Manatee Energy Storage Center (900 MWh) for the top spot. Both Blythe II and Blythe III can store 460 MWh of energy.

Operating Utility Battery Storage Projects

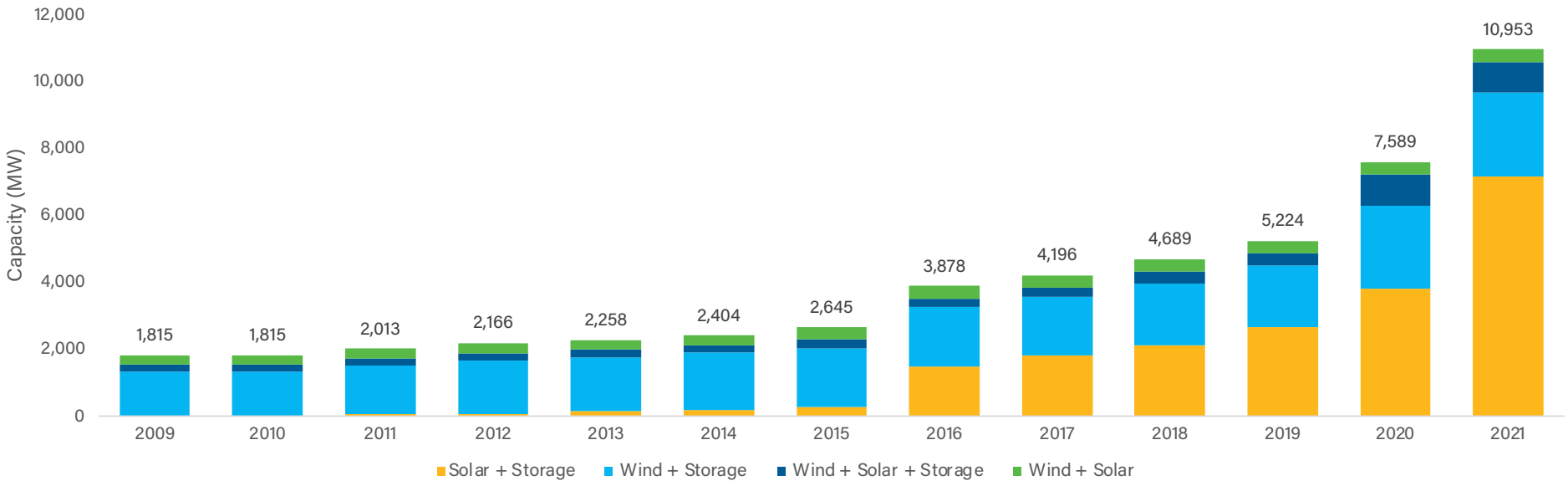


Battery Storage Market

Operational Hybrid Project Capacity

Nearly 11 GW of hybrid capacity online

Cumulative Operational Hybrid Capacity by Year



- As the cost of energy storage has continued to decrease, hybrid projects, which pair together wind, solar, or storage, have become more common. Hybrid projects provide many benefits, primarily the ability to store energy as it is generated and then redistribute it when it is needed.
- In 2021, 3,364 MW of new hybrid capacity came online. Almost all of that capacity came from solar + storage projects. Of the 99 battery storage projects that came online in 2021, 36 of them were standalone and 63 were part of hybrid projects.
- In total there is over 10.9 GW of hybrid project capacity online in the U.S. 65% of that capacity comes from solar + storage projects, 23% from wind + storage, 8% from wind + solar + storage and 3% from wind + solar projects.

ACP adjusted the methodology used to account for online hybrid project capacity. In previous market reports only fully operational hybrid projects were included. In this iteration, ACP is including all parts of hybrid projects that are online. For example, if the solar portion of a solar + storage project was online, but the storage portion was still under construction, then under the previous methodology none of the project capacity would be included as online. Now, the solar capacity would be included in the online hybrid capacity.

CLEAN POWER ANNUAL MARKET REPORT **2021**

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