

20  
23 | Q3

**CLEAN POWER QUARTERLY**

# Market Report



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# Clean Power Definitions & Acronyms

## 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.

## Acronyms

<b>AC</b>	Alternating Current
<b>C&amp;I</b>	Commercial & Industrial
<b>CAISO</b>	California ISO
<b>DC</b>	Direct Current
<b>ERCOT</b>	Electric Reliability Council of Texas
<b>GW</b>	Gigawatts
<b>GWh</b>	Gigawatt hours
<b>ILR</b>	Inverter Loading Ratio
<b>IOU</b>	Investor-Owned Utility
<b>ISO</b>	Independent System Operator
<b>MISO</b>	Midcontinent Independent System Operator
<b>MW</b>	Megawatts
<b>MWh</b>	Megawatt hours
<b>NE-ISO</b>	New England ISO
<b>NYISO</b>	New York ISO
<b>OEM</b>	Original Equipment Manufacturer
<b>PJM</b>	Pennsylvania-New Jersey-Maryland Interconnection
<b>PPA</b>	Power Purchase Agreement
<b>RTO</b>	Regional Transmission Organizations
<b>SPP</b>	Southwest Power Pool



Photo credit: Invernergy

# 2023 Q3 Highlights

# 2023 Q3 Highlights

## Solar leads the pack for Q3 installations

- Of the 5.5 GW of utility-scale solar, wind, and battery storage that came online in the third quarter, **more than 3 GW of that was from new solar projects.**
- **Solar also accounts for nearly 60% of clean power projects** currently in the pipeline.

## Battery storage sees strong quarter, more ahead

- **Battery storage installations surged 63% in Q3 2023** compared to Q3 2022, with 2,142 MW installed nationwide.
- **The amount of battery storage projects in the pipeline increased 50% year-over-year in Q3.**

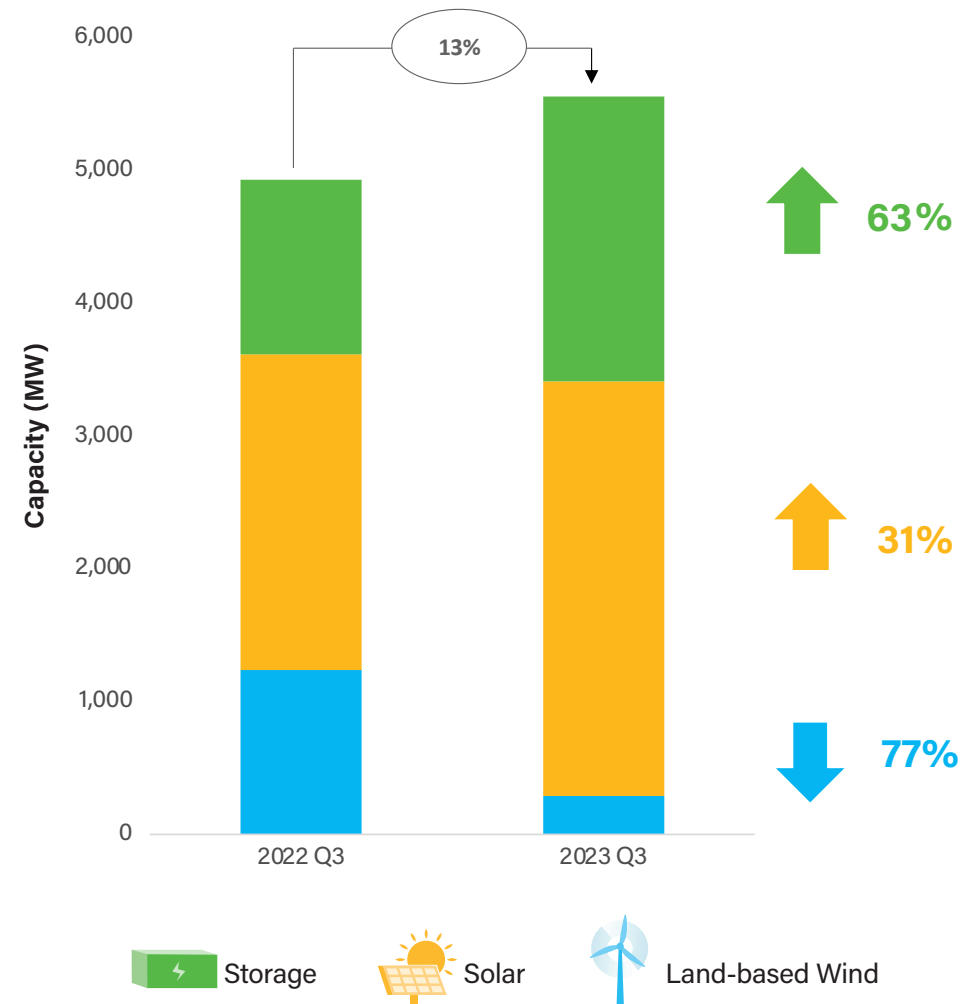
## PPA activity slows on lower C&I buyer activity

- **Clean power buyers announced 3,175 MW of new Power Purchase Agreements (PPAs) in Q3**, a 55% decrease year-over-year.
- The slowdown was driven by a drop in announcements from corporate & industrial buyers, continuing a year-long trend, while activity from utility buyers increased slightly in the third quarter.

## Clean power capacity reaches fresh milestone

- **Cumulatively, operating clean power capacity in the U.S. reached 243 GW in Q3 2023**, enough to power 65 million American homes.

Clean Power Capacity Additions by Quarter, Q3 2022 vs Q3 2023



Solar capacity is reported in MWac





Photo credit: NextTracker

# Clean Power Capacity Growth

# Highest Q3 Installations on Record

## 2023 Q3 installs

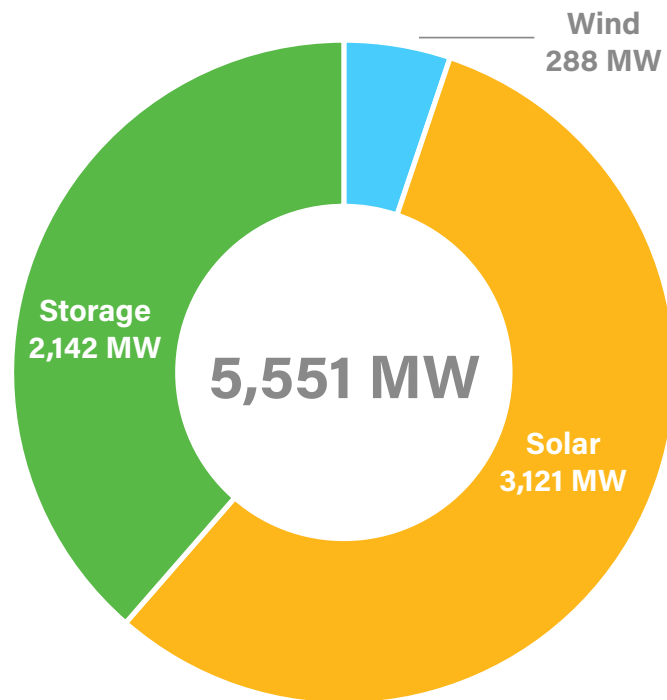
- Project developers commissioned 88 solar, battery storage, and wind projects in the third quarter, adding 5,551 MW of clean power capacity to the grid.
- Q3 capacity installations rose 13% compared to Q3 of 2022, making Q3 of 2023 the most productive third quarter on record. Despite a strong Q3 and Q2, a slow Q1 means that year-to-date installations are 6% lower compared with the same point in 2022.
- In the third quarter, solar continued to lead installations with 3,121 MW beginning commercial operations. Additionally, battery storage saw its

strongest third quarter ever, with 2,142 MW/6,227 MWh added to the grid. In a disappointing quarter, developers added just 288 MW of land-based wind capacity to the grid.

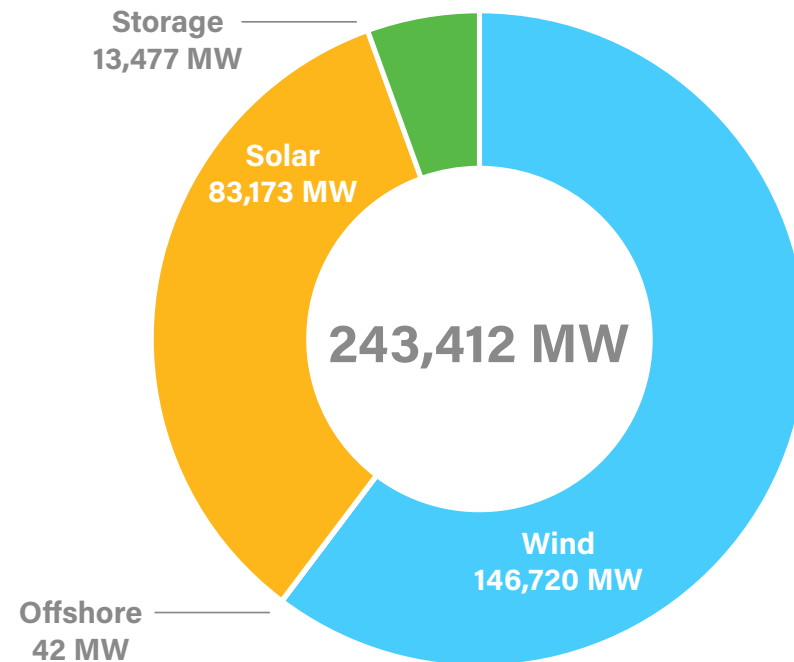
## Cumulative operating clean power capacity

- At the end of Q3 2023, there are 243,412 MW of online clean power capacity in the U.S., enough to power almost 65 million American homes.
- In terms of technology, land-based wind accounts for 146,720 MW of operating clean power capacity, followed by 83,173 MW of solar, 13,477 MW/38,337 MWh of battery storage, and 42 MW of offshore wind.

Q3 2023 Clean Power Installs by Technology

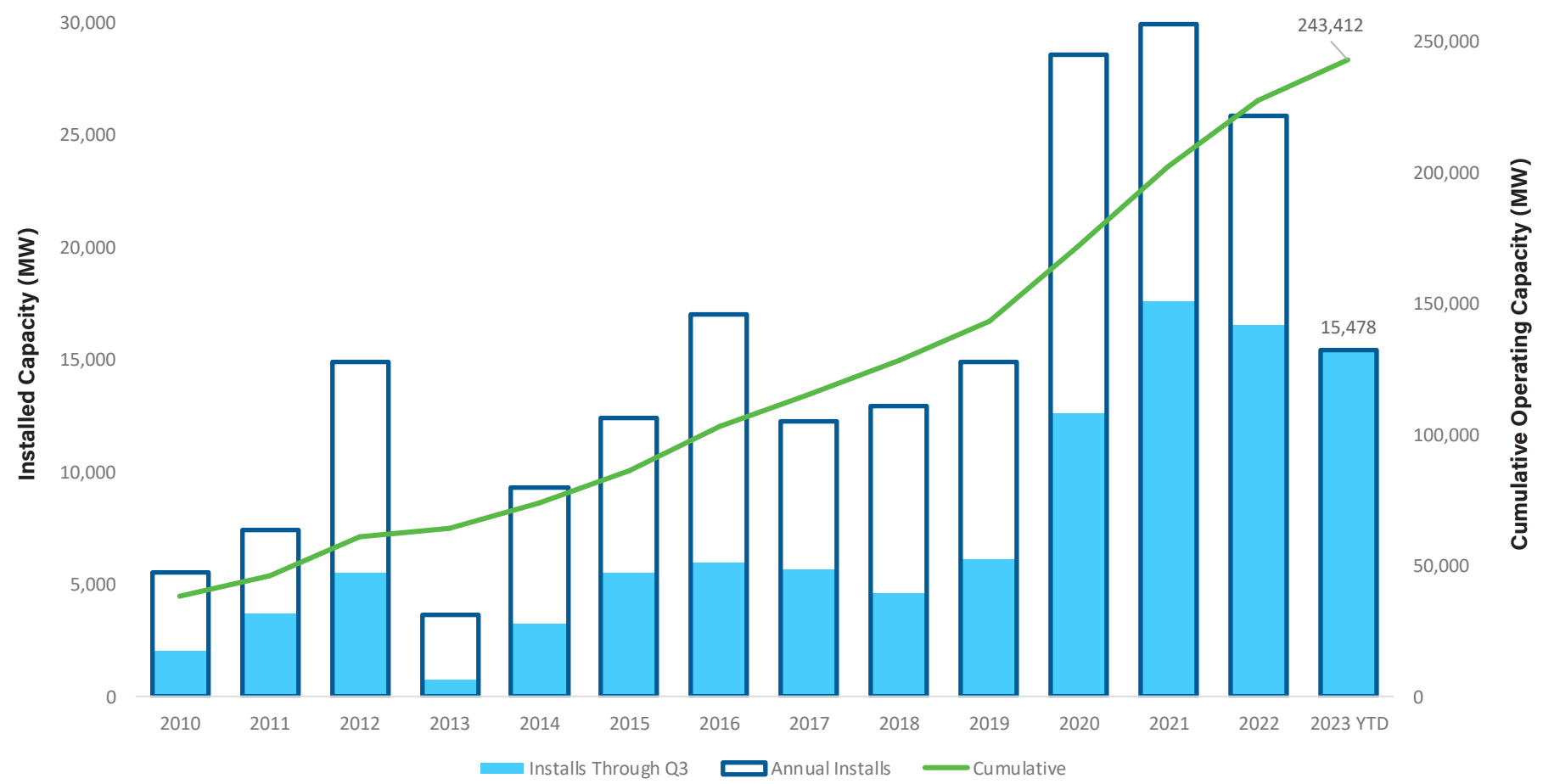


Total Operating Clean Power Capacity by Technology



# Highest Q3 Installations on Record (continued)

U.S. Annual and Cumulative Clean Power Capacity Growth



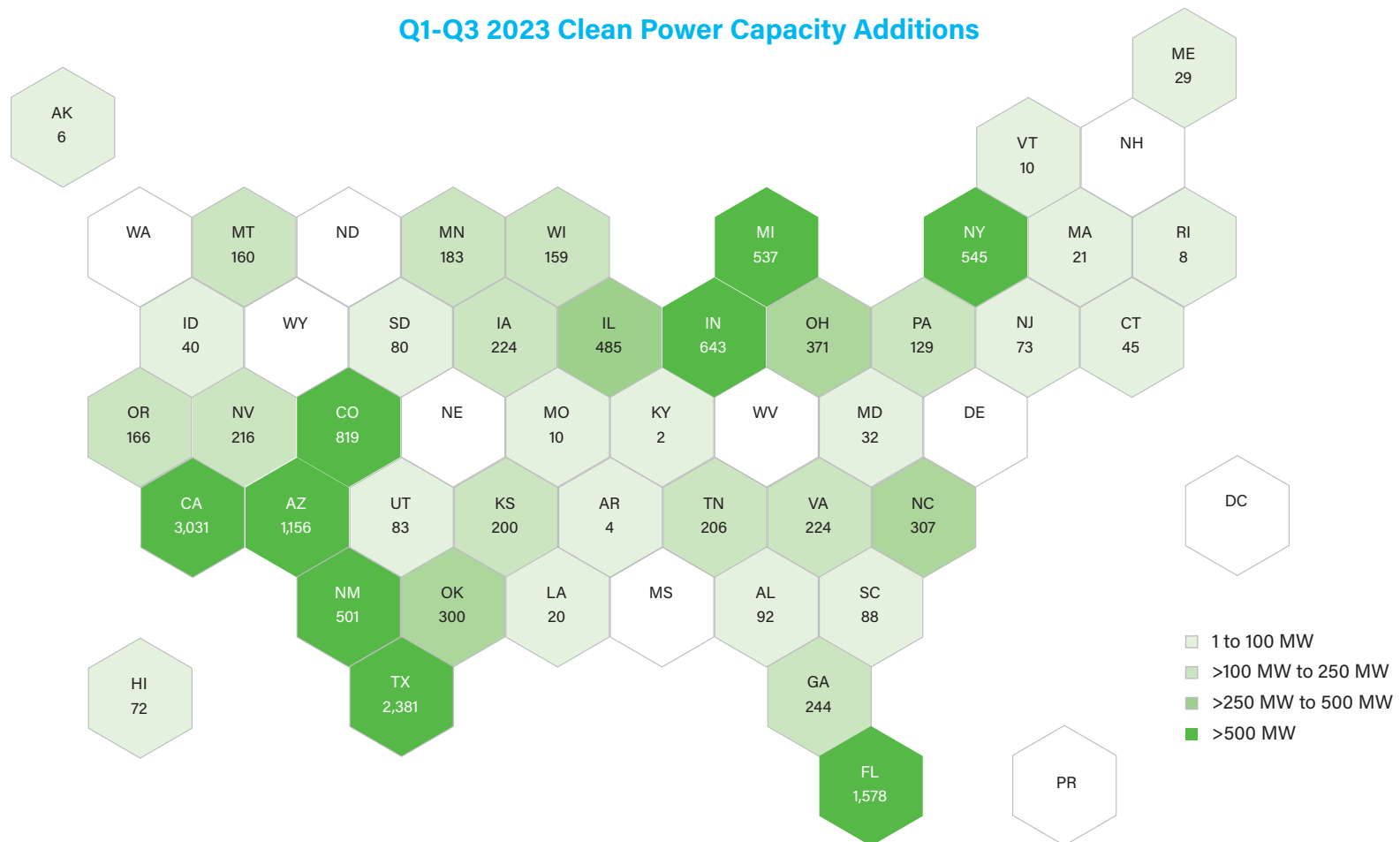


## CLEAN POWER CAPACITY GROWTH

# California Leads Quarterly and YTD Capacity Additions

- For the second quarter in a row, California led the nation in clean power installations, with 1,900 MW of solar and battery storage added to the grid in the third quarter. Texas maintains its spot in second place for Q3, with 949 MW of clean power commissioned. Arizona ranks third this quarter, with 516 MW of clean power installed.
- Year-to-date, California leapfrogged Texas to become the top state for clean power installations so far in 2023. California added 3,031 MW compared to 2,381 MW in Texas, and 1,578 MW in Florida.
- In Q3 of 2023, 28 states added clean power to the grid. Only three states added more than 500 MW, 10 added over 100 MW, and 17 states installed more than 100 MW.

### Q1-Q3 2023 Clean Power Capacity Additions



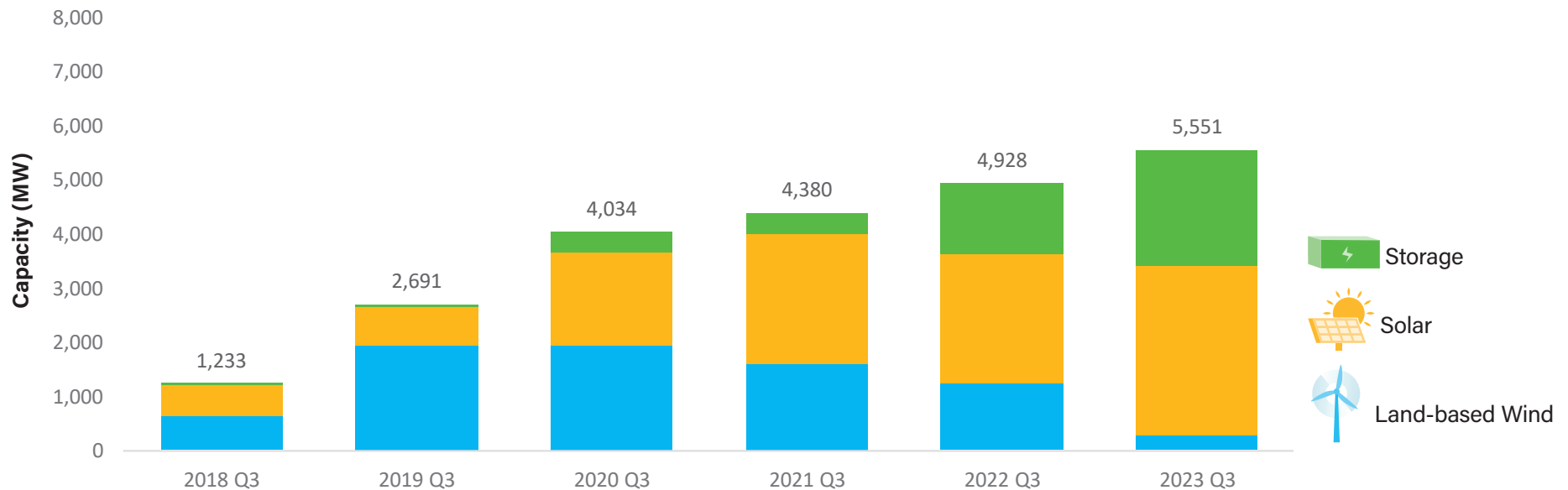
# Quarterly Clean Power Capacity Growth

- The addition of 5,551 MW of solar, wind, and battery storage to the grid this quarter marks the highest third quarter on record.
- Battery storage installations continued to grow at a rapid clip, with Q3 installations 63% higher than the same period in 2022. Solar installations also experienced a strong quarter, adding 31% more than Q3 of 2022. Land-based wind experienced a disappointing quarter, with installations falling by 77% compared to Q3 of 2022.
- With just two wind projects coming online in Q3 of 2023, Ørsted's 200 MW Sunflower Wind Farm in Kansas was the largest project to be commissioned.
- Of the 56 utility-scale solar projects brought online by developers in Q3, the 265 MW Dunns Bridge Solar I project in Indiana, developed by

NextEra Energy Resources and owned by the Northern Indiana Public Service Company, was the largest solar project to come online. Developers commissioned a total of 3,121 MW of solar capacity this quarter.

- Developers began commercial operations at 30 battery storage projects with a combined capacity of 2,142 MW/6,227 MWh in Q3. Standalone battery storage projects accounted for 38% of Q3 installed battery storage capacity.
- NextEra's 325 MW/1,300 MWh Desert Peak Energy Storage Project was the largest standalone battery storage project to come online this quarter. The largest hybrid project to be commissioned this quarter was Intersect Power's Oberon I Solar and Storage project, which consists of a 250 MW solar phase and a 125 MW battery storage phase.

Q3 Clean Power Installations, 2018-2023

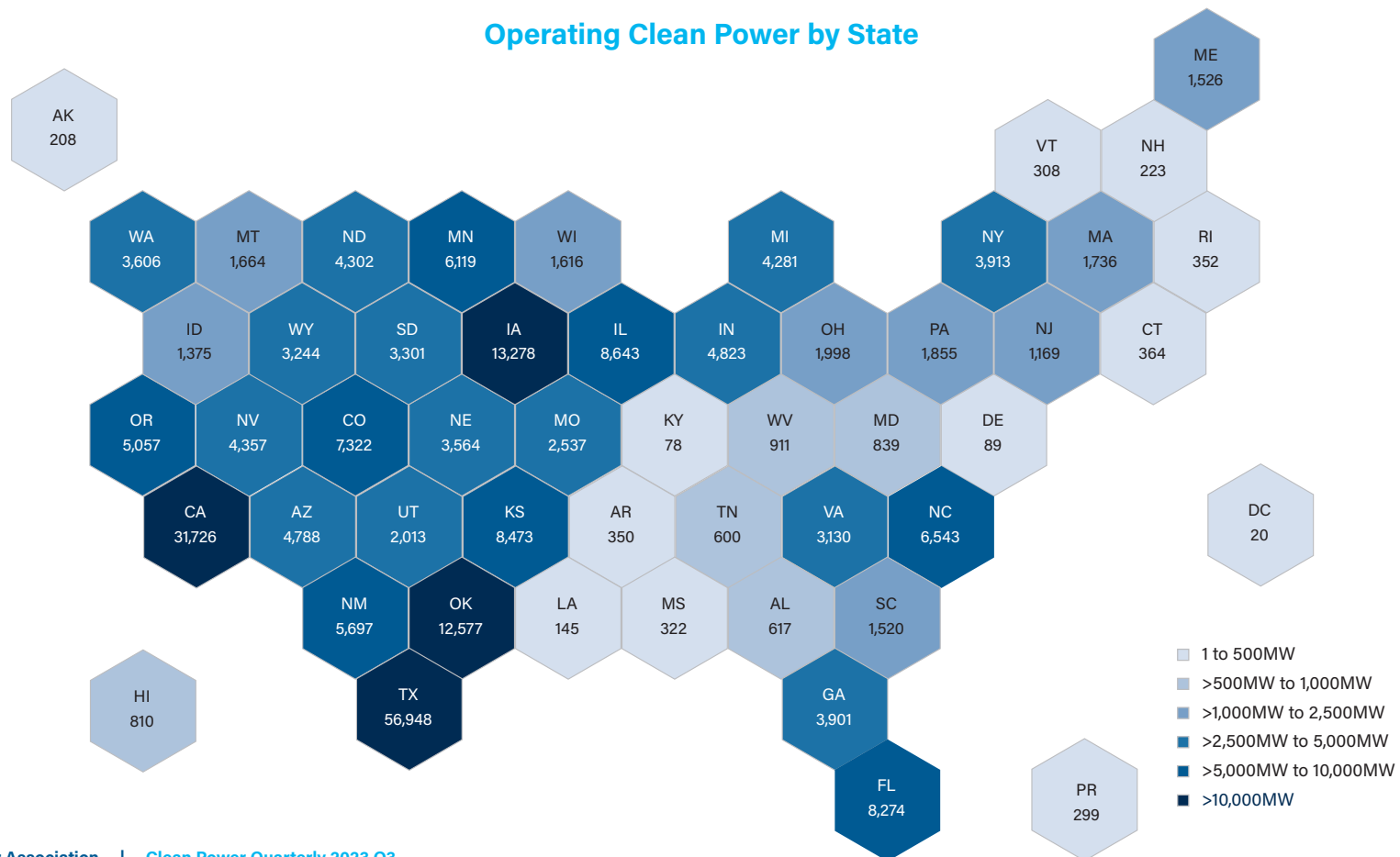


## CLEAN POWER CAPACITY GROWTH

# Operational Clean Power Capacity

- Operational utility-scale solar, wind, and battery storage capacity is present in all U.S. states as well as DC and Puerto Rico, powering American homes and businesses.
- Operational clean power capacity stands at 243,412 MW, enough to power almost 65 million homes.
- With 56,948 MW online, Texas continues to be the state with the largest operational clean power portfolio. Texas ranks first for total operating wind capacity and comes in second for solar and battery storage capacity.
- In second place for total operating clean power, California has 31,726 MW online and ranks first for online solar and battery storage capacity.
- Maintaining their third and fourth spots respectively are Iowa and Oklahoma. With 13,278 MW and 12,577 MW of clean power capacity, Iowa and Oklahoma are also the second and third wind power states respectively.
- Through the first three quarters of 2023, Tennessee's operational clean power capacity has continued to grow at a breakneck pace. The Volunteer State's operational clean power capacity has grown 52% since 2022.

Operating Clean Power by State



# Clean Power Pipeline Growth

## Wind

- As of the end of Q3 2023, the land-based wind pipeline consists of 103 project phases totaling 22,135 MW. Within the pipeline, 12,856 MW are under construction and 9,278 MW are in advanced development. This quarter, developers broke ground on 803 MW of wind capacity while 225 MW of wind capacity entered advanced development.
- After record installation levels in 2020 and 2021, the amount of new capacity entering the land-based wind pipeline has stalled, resulting in a decline in development. However, movement in the pipeline in Q1 and Q3 point to encouraging signs in the industry, with the pipeline expanding by 8% between Q1 and Q2 and by 2% between Q2 and Q3.
- With 4,874 MW in the pipeline, Wyoming remains the top state for wind capacity under development due to the presence of several large projects including the Chokecherry and Sierra Madre Wind Energy Project. With 3,870 MW under development, Texas is the second largest state for wind capacity under development.
- With the increase in state offshore wind targets and as more federal waters have opened up for lease sales, offshore wind power has become an important part of the clean power pipeline in many East Coast states. New York sits atop the leaderboard with 4,362 MW under development. New Jersey and Massachusetts hold the second and third spots respectively with 3,758 MW and 3,242 MW under development.

## Solar

- At the end of the third quarter of 2023, the solar pipeline stood at 84,646 MW, with 855 projects in development.
- The utility-scale solar pipeline shrank by 1% over the previous quarter but is up by 8% compared to Q3 of 2022. Solar capacity now accounts for 58% of the clean power pipeline.
- At the end of the quarter, every state except for Alaska and North Dakota had solar capacity under development. With 19,154 MW under development, Texas leads the nation in terms of solar capacity under development, followed by Indiana at 6,151 MW and California, which has 5,673 MW under development.
- Overall, 23 states had solar project pipelines exceeding 1 GW while five additional states have over 500 MW of solar capacity under development. Solar continues to be the most geographically diverse technology.

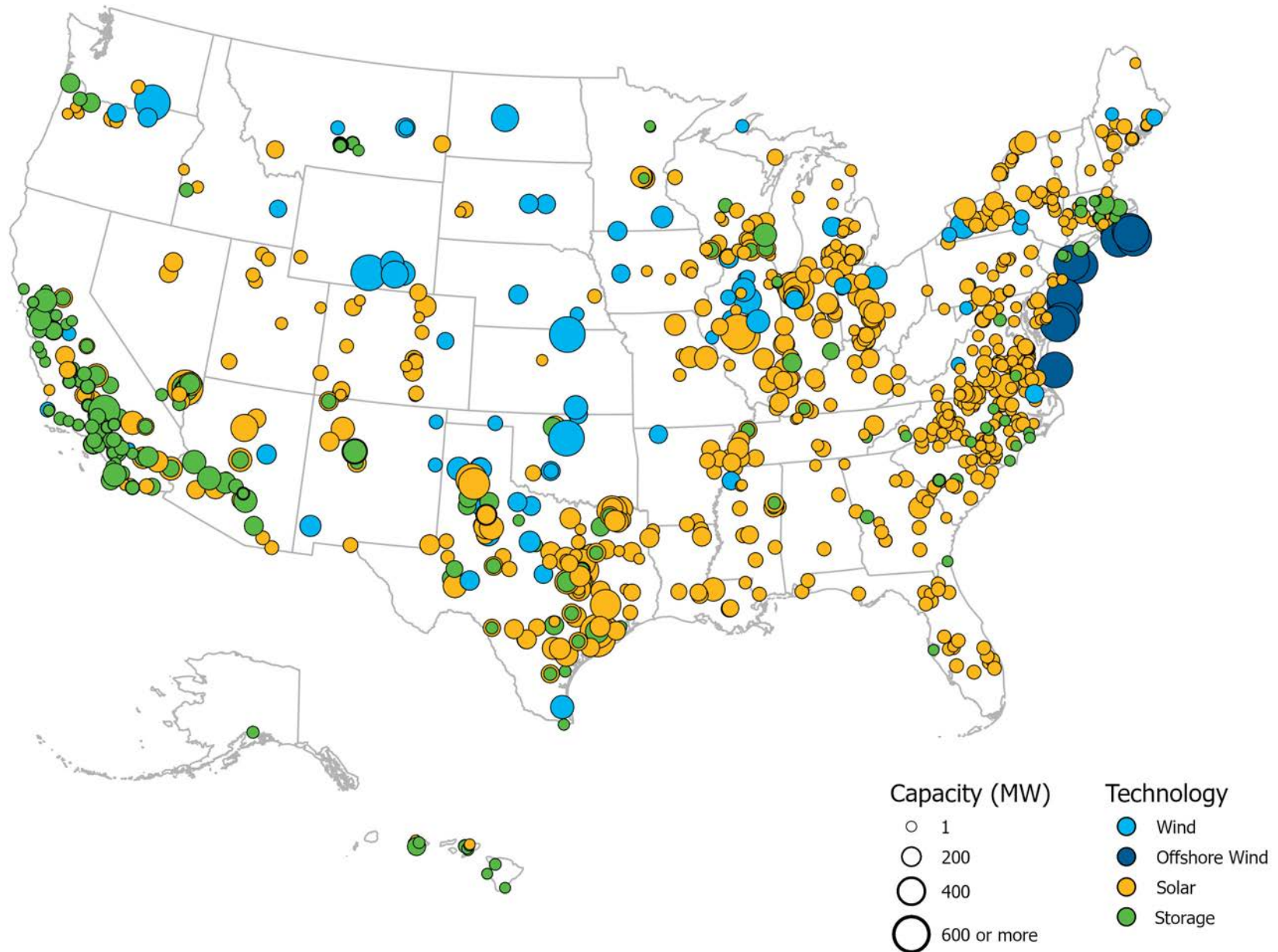
## Battery Storage

- The amount of battery storage capacity under development has soared over the past two years. At the end of Q3, the battery storage pipeline has expanded by 50% year-over-year, and has grown by an average of 10% each quarter.
- The battery storage project pipeline consists of 262 projects under construction or in advanced development, for a total capacity of 21,445 MW/62,109 MWh.
- At the end of Q3 2023, hybrid projects made up 51% of battery storage capacity in development, down from nearly 70% at the end of 2022. Out of the almost 2 GW of battery storage capacity to enter the project pipeline this quarter, standalone battery storage projects accounted for 54% of capacity. This indicates that standalone storage projects are growing in popularity likely because storage projects will become eligible for the Investment Tax Credit (ITC) following the passage of the IRA.
- California stands out as the top state for battery storage development, boasting 9,331 MW of capacity under development. Texas comes in at second place with 3,173 MW in development, followed closely by Arizona's 2,481 MW under development. Overall, 29 states have battery storage capacity under development, with seven states surpassing the 500 MW milestone.



## CLEAN POWER CAPACITY GROWTH

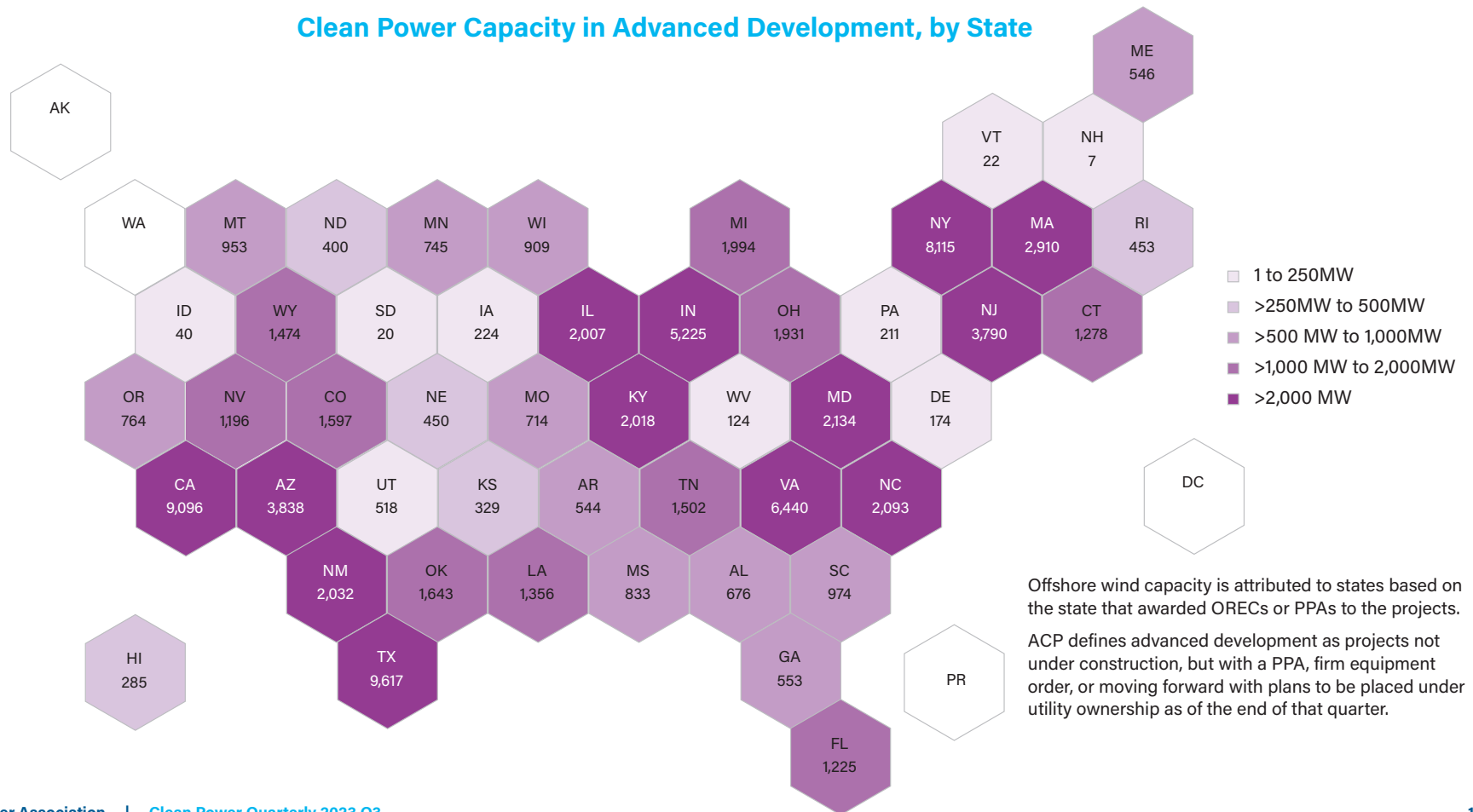
# Projects in Pipeline



# Clean Power Advanced Development Activity

- At the end of Q3, the advanced development pipeline totaled 85,977 MW of capacity across 48 states. The 760 clean power project phases span 48 states. Alaska and Washington are the only states with no clean power projects in advanced development.
- With 9,617 MW, Texas is the top state for clean power capacity in advanced development. California and New York follow closely behind with 9,096 MW and 8,115 MW respectively.
- Across the different technologies in the advanced development pipeline, Texas ranks first for solar power, while California leads the battery storage pipeline. Meanwhile, Wyoming continues to be the top state for land-based wind capacity while New York leads the offshore wind project pipeline.
- Within the advanced development pipeline, solar projects make up 54% of the total capacity while offshore wind projects account for 19% of the pipeline. Battery storage projects make up 15% of the pipeline while the remaining 11% is represented by land-based wind projects.

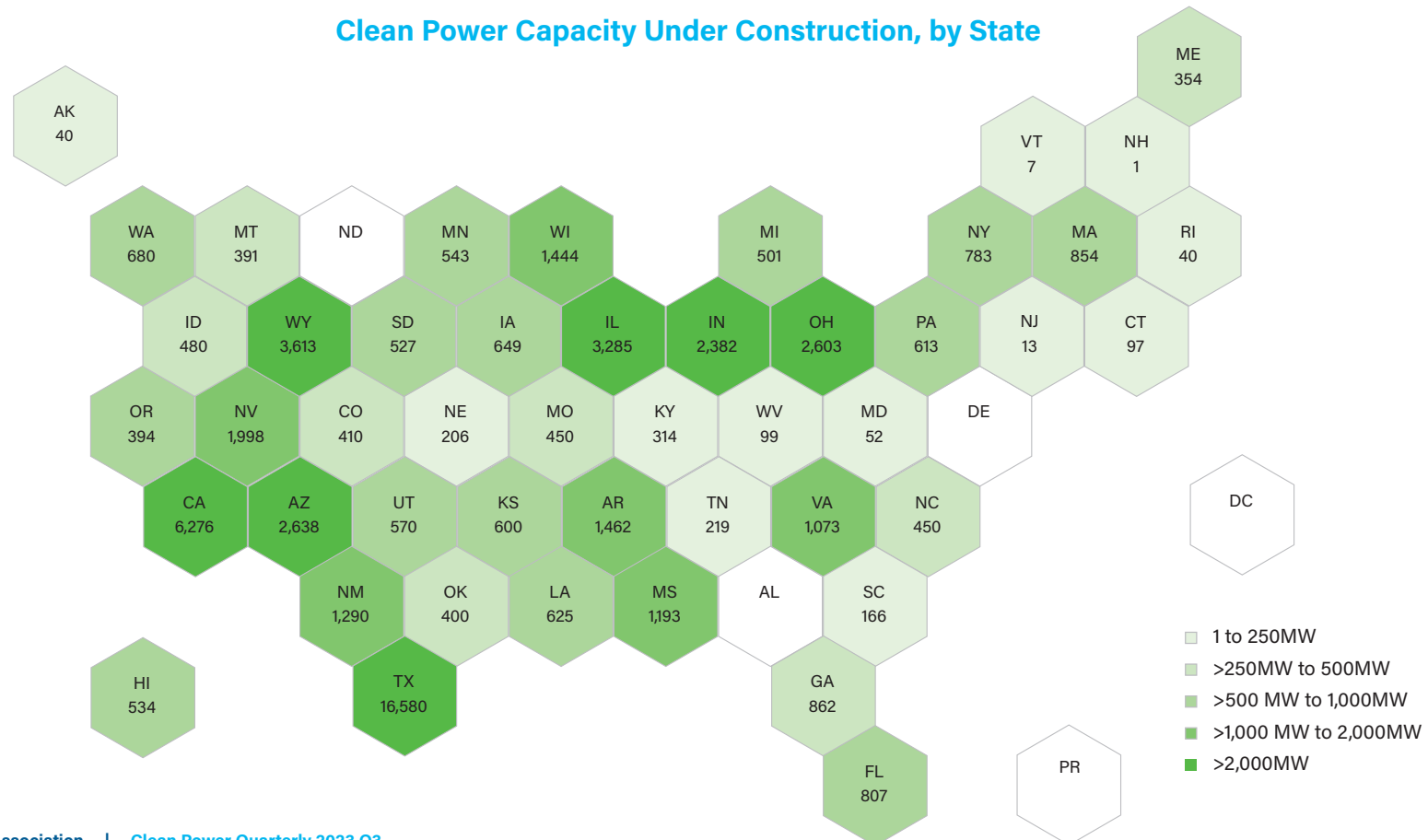
Clean Power Capacity in Advanced Development, by State



# Clean Power Construction Activity

- At the end of Q3, there were 478 clean power project phases under construction with a combined capacity of 59,689 MW. The under construction projects are located in 47 states in the U.S. Alabama, Delaware, and North Dakota are the only states without a clean power project under construction.
- At 37,639 MW, solar's share of the under construction project pipeline remained unchanged at 63%, compared to the previous quarter. The remainder of the pipeline is comprised of 12,856 MW of land-based wind, 8,134 MW of battery storage capacity, and, at a combined capacity of 938 MW, the South Fork Wind and Vineyard Wind offshore wind projects.
- In the third quarter, 36 project phases totaling 4,790 MW began construction, with solar accounting for 76% of capacity.
- Texas continues to be the top state in the nation for under construction clean power capacity, with 16,580 MW in the pipeline. California takes second place, with 6,276 MW of clean power capacity in the construction phase.
- Regionally, Texas is followed by the Mountain West (10,520 MW) and the Midwest (9,254 MW).

Clean Power Capacity Under Construction, by State

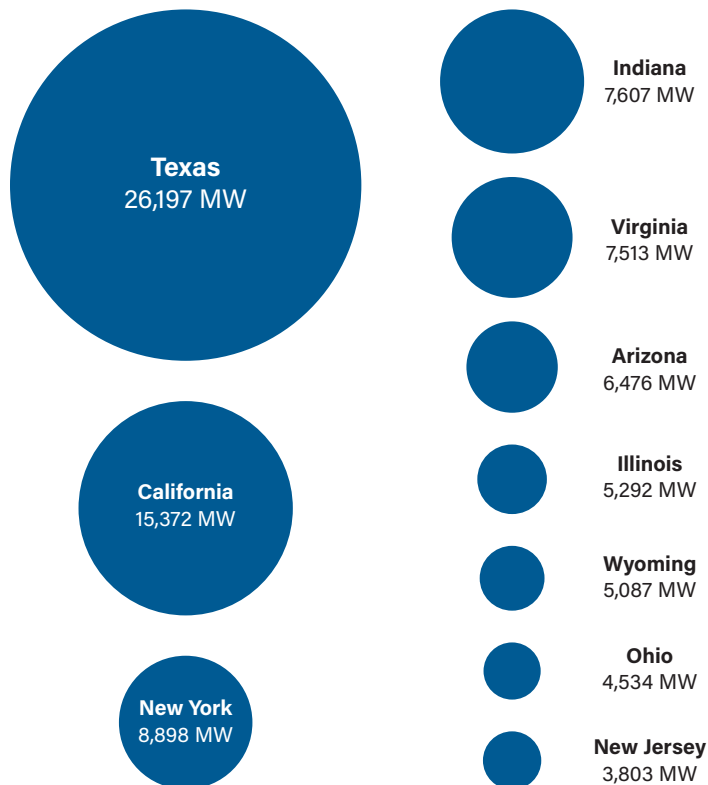


## CLEAN POWER CAPACITY GROWTH

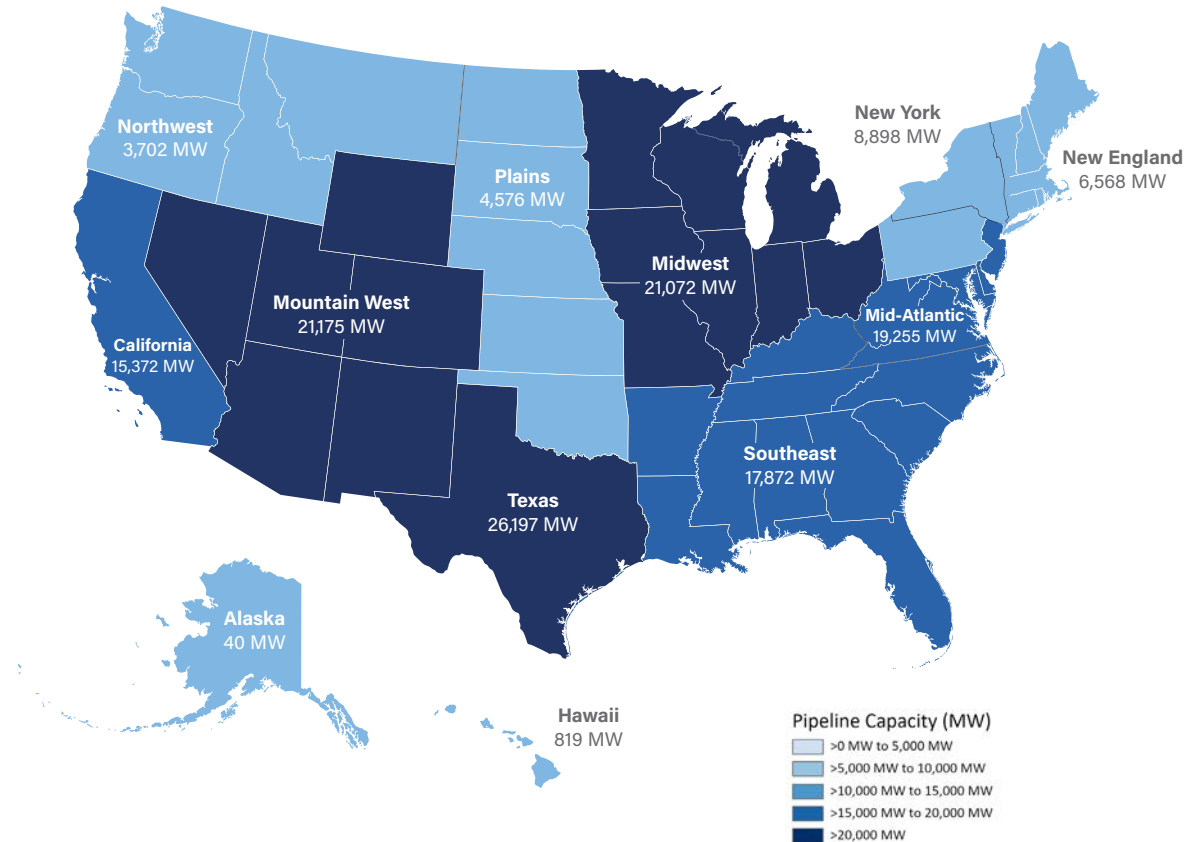
# Clean Power Pipeline by State and Region

- The clean power pipeline consists of 145,545 MW of capacity in development across all 50 states.
- Texas and California, the top states for operational clean power capacity, also lead the pipeline for under development projects. With 26,197 MW under development, Texas will grow its operating capacity by 46% when the projects are complete. Likewise, California's operating portfolio will expand by 50% once those projects come online.
- Kentucky and Louisiana are states to watch in the coming year. With less than 150 MW operating, both rank among states with the lowest amount of operating clean power. However, with over 2 GW of capacity in the pipeline, both states are set to drastically expand their operating capacities in the coming years.
- Regionally, Texas has the largest project pipeline, followed by the Mountain West and the Midwest. While the Plains has the third highest operating capacity, it ranks ninth in the pipeline.

### Top States, Clean Power Development Capacity



### Clean Power Development Capacity by Region



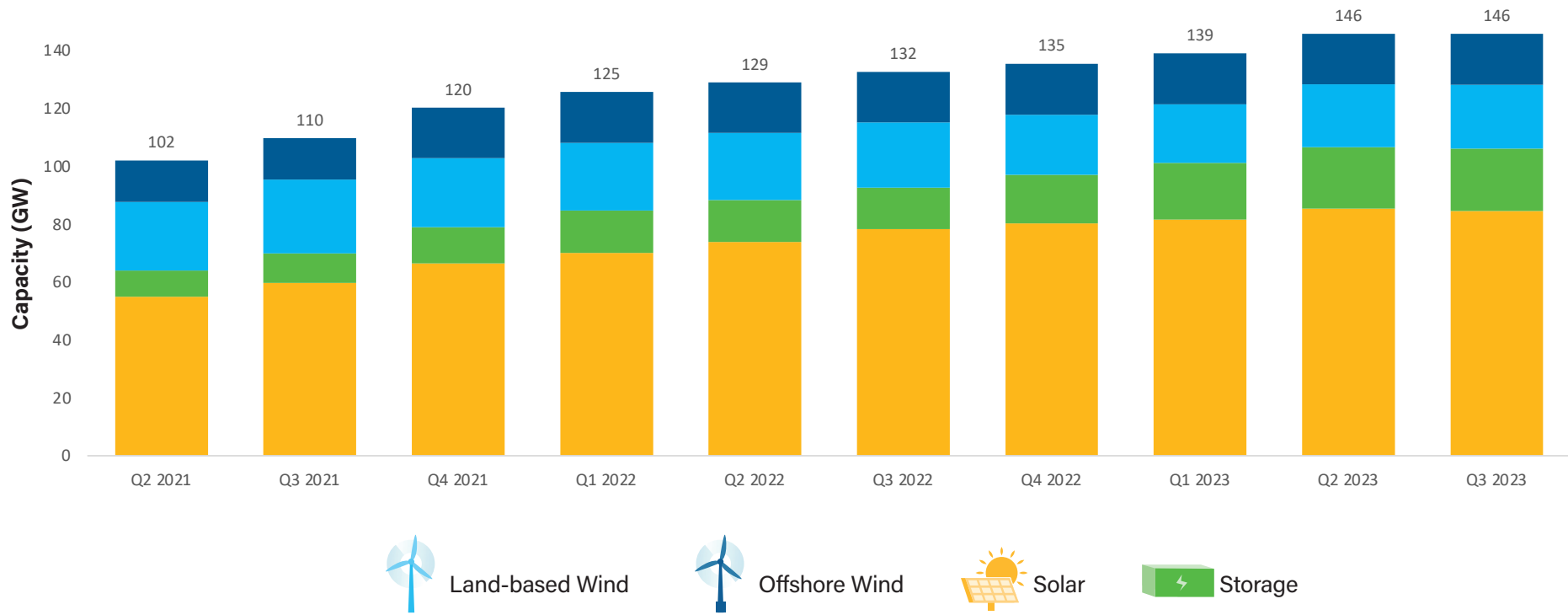


## CLEAN POWER CAPACITY GROWTH

# Clean Power Pipeline Over Time

- In Q3 2023, the clean power pipeline remained at the same level compared to the previous quarter. At 145,545 MW, the pipeline has grown 10% on a year-over-year basis, continuing an upward trend.
- The project pipeline has grown at an average rate of 4% per quarter over the past two years and now stands 33% higher compared to Q3 of 2021.
- The battery storage pipeline has grown significantly over the past two years, averaging a rate of 10% per quarter.
- The solar pipeline has also demonstrated consistent growth, averaging 5% per quarter over the past two years.
- The land-based wind pipeline has fallen by an average of 2% per quarter over the past two years, although the pipeline has grown for two consecutive quarters since Q1 2023.

Clean Power Development, Q2 2021 to Q3 2023

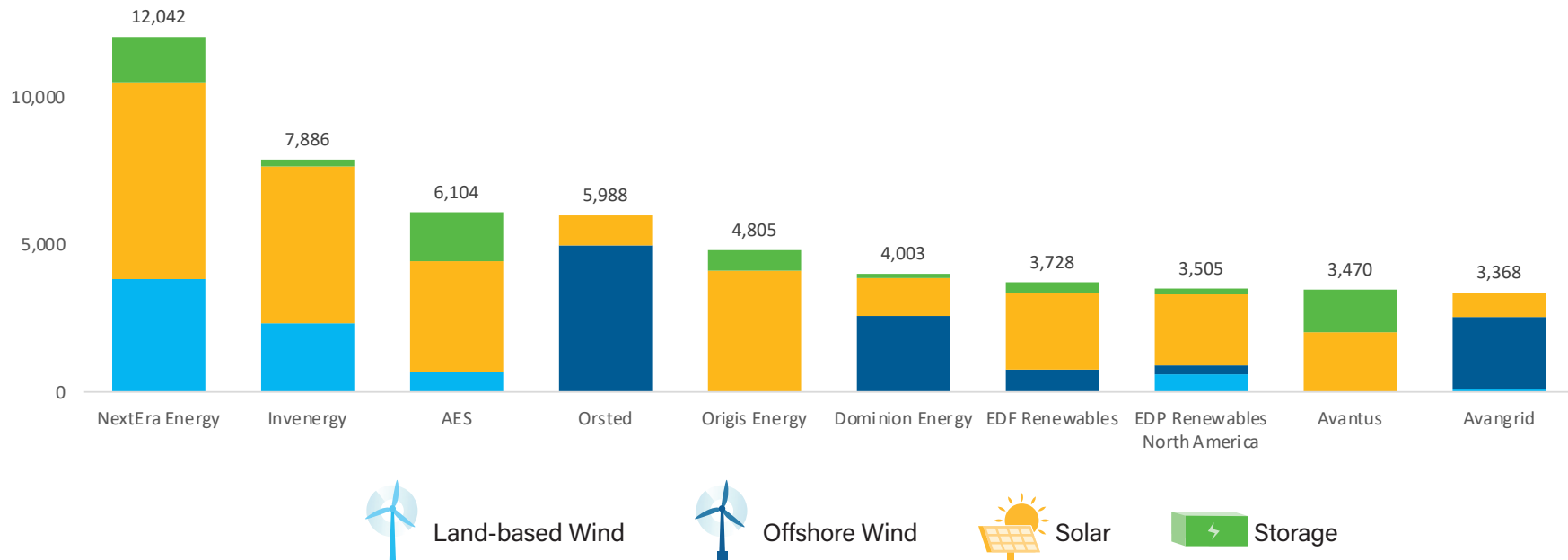


## CLEAN POWER CAPACITY GROWTH

# Top Clean Power Developers

- With 12 GW under development, NextEra leads the rankings for developers with the most clean power capacity in development. NextEra's project pipeline accounts for 8% of the total capacity under development. NextEra is a leader in land-based wind, solar, and battery storage development.
- Invernergy holds the second place in the rankings, with almost 7.9 GW in development. Invernergy's pipeline features solar prominently but also includes land-based wind and battery storage capacity.
- In fourth and sixth place respectively, Ørsted and Dominion Energy's project pipelines are predominantly offshore wind, also both companies have more than one gigawatt of solar capacity under development.
- Out of the top ten project developers, seven companies have pipelines primarily focused on solar capacity while the remaining three primarily favor offshore wind. Avantus stands out for having the highest share of battery storage capacity within its project pipeline.

Top 10 Developers with Clean Power in the Pipeline

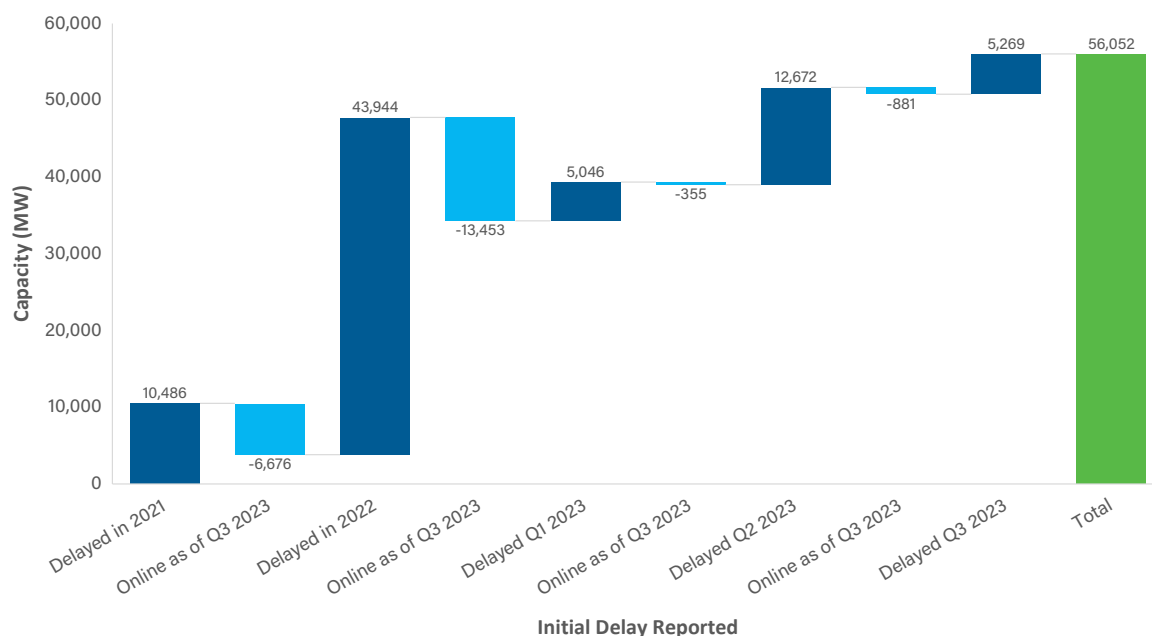


The pipeline includes projects under construction or in advanced development as of the end of the quarter. ACP defines advanced development as projects not under construction, but with a PPA, firm equipment order, or moving forward with plans to be placed under utility ownership as of the end of that quarter.

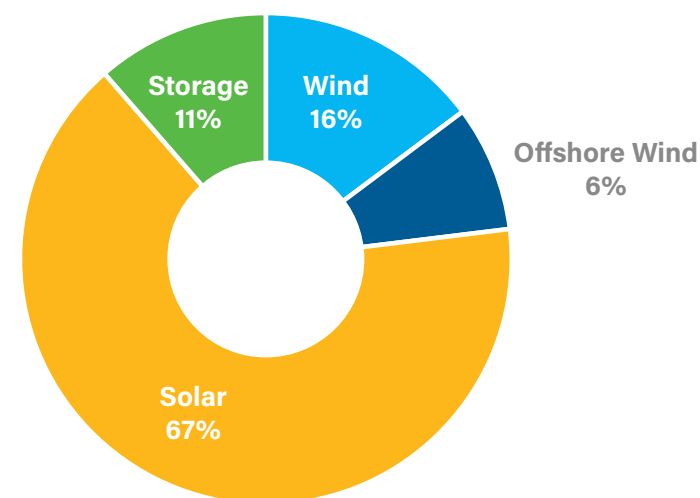
# Clean Power Project Delays

- A growing number of project delays have led to clean power installations falling below expectations in 2023.
- Through Q3 of 2023, developers have reported almost 23 GW of project delays. Factoring in delays from 2021 and 2022, overall clean power project delays have exceeded 56 GW.
- Projects delayed from 2021 are beginning to come online, but 36% remain to be completed. Just 31% of projects delayed in 2022 have been completed.
- Over the course of 2023, 5.0 GW of projects were delayed in Q1, 12.6 GW were delayed in Q2, and Q3 reported 5.3 GW of delays.
- Of the 56 GW of projects experiencing delays, 16.6 GW was initially scheduled to begin commercial operations prior to the end of Q3. 51% of these projects are expected to come online by the end of 2023.
- 39% of projects that have experienced delays have been delayed multiple times, with some projects being delayed as many as five times.
- On average, projects experiencing delays lasting 14 months from the original expected online dates. Wind projects experience average delays of 15 months while solar and storage projects experience shorter delays of 13 months and 11 months respectively.

Clean Power Project Capacity Delayed



Total Clean Power Capacity Delayed, by Technology

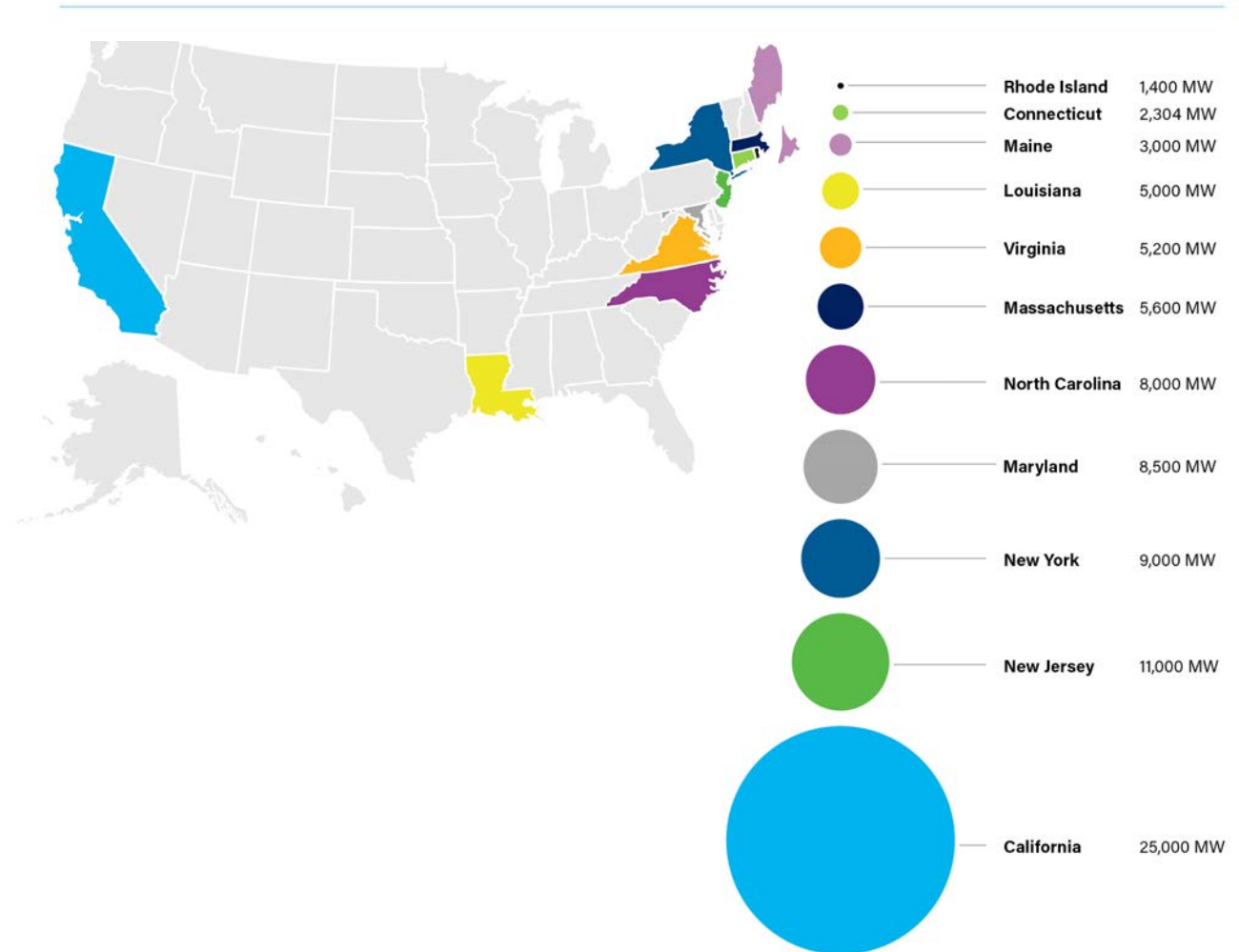


ACP has updated its delay analysis to account for projects experiencing more than two delays.

# State Activity

- As the OSW industry shoulders headwinds, governors from Connecticut, Maryland, Massachusetts, New Jersey, New York, and Rhode Island have organized to urge the federal administration to provide updated guidance on IRA. In addition to urging for updated IRA tax credit guidance, these six governors also call for establishing a revenue sharing program and expediting clean energy permitting. Their letter was circulated on September 13<sup>th</sup>, and can be found [here](#).
- California advanced policy support for OSW in the form of AB1373. The bill aims to centralize state wind procurement processes and recommends solutions to any interconnection issues. This new legislation was officially adopted on October 7<sup>th</sup>.
- On July 27<sup>th</sup>, Maine lawmakers approved an *Act Regarding the Procurement of Energy from Offshore Wind Resources*. This new piece of legislation sets state procurement goals of 3 GW of OSW capacity by 2040. To support OSW wind target efforts, Maine anticipates new port development and construction efforts across its coastal communities.
- To date, eleven states have set offshore wind targets totaling more than 84,000 MW.

## State Offshore Wind Targets



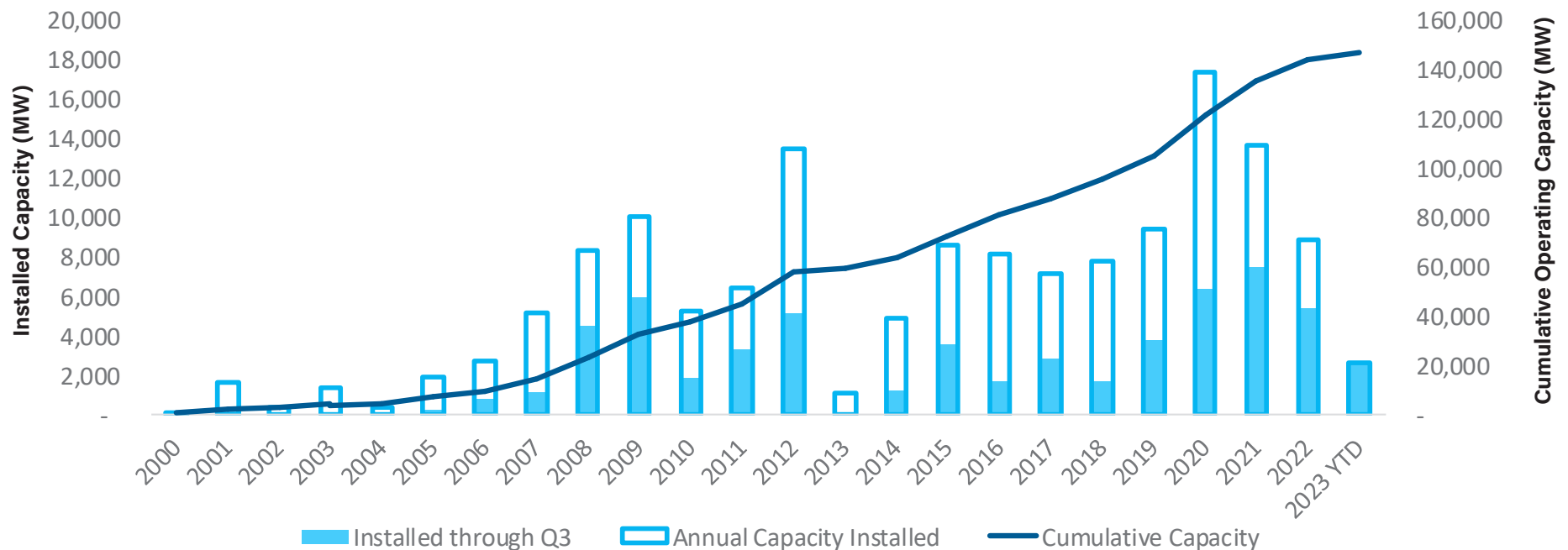


## LAND-BASED WIND ACTIVITY

# 288 MW of Land-based Wind Capacity Commissioned

- In the third quarter of 2023, developers commissioned two land-based wind project phases, adding 288 MW of wind power to the grid.
- Installations in the third quarter of 2023 came in 77% lower compared to the third quarter of 2022, when 1,244 MW were added. This was the slowest third quarter the wind industry has experienced since 2013. In addition, land-based wind installations decreased 70% compared to the previous quarter, when 968 MW were brought online.
- The capacity-weighted average size of projects added in the third quarter of 2023 is 166 MW, a decrease from the capacity-weighted averages of 185 MW in the second quarter, 236 MW in the first quarter, and 360 MW in 2022.
- The largest project phase to start commercial operations in the third quarter was Ørsted's Sunflower Wind project in Kansas. The project has a nameplate capacity of 200 MW.

U.S. Annual and Cumulative Land-based Wind Capacity Growth

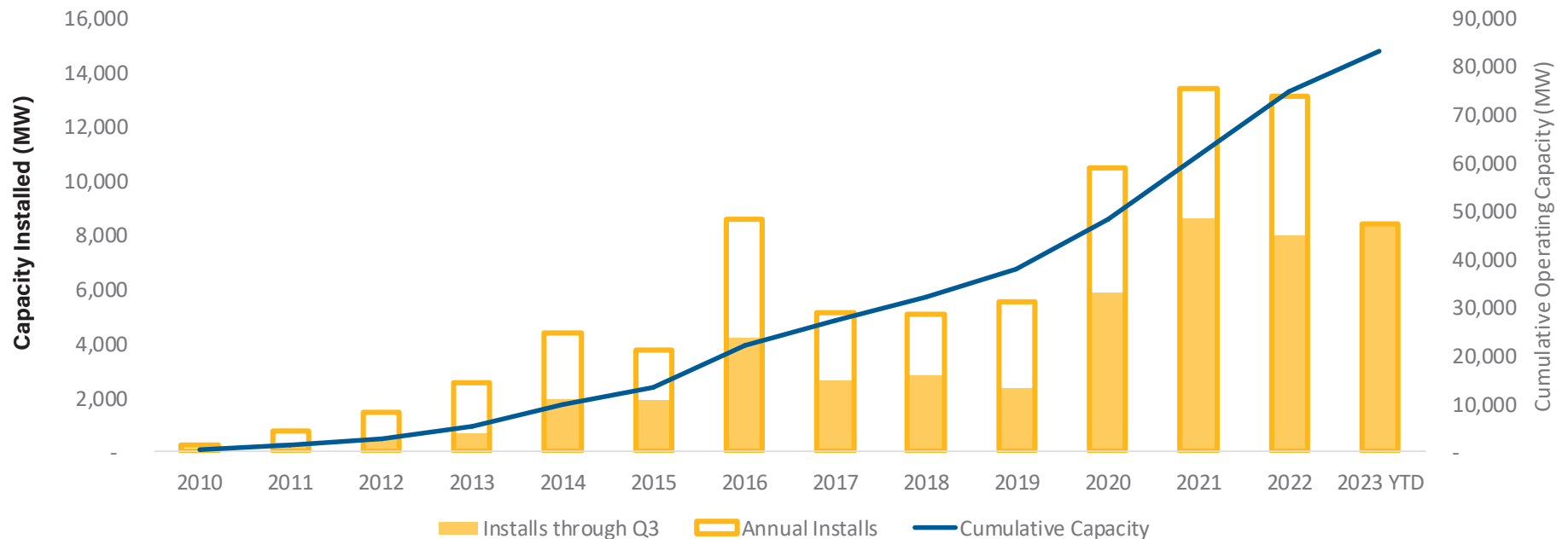


## UTILITY SCALE SOLAR

# Solar Additions Continue to Ramp Up in Q3

- Utility-scale solar capacity additions experienced an increase during the third quarter of 2023. A total of 3,121 MW of solar capacity was added to the grid in the third quarter, up from 2,991 MW in the second quarter, and 31% higher than the 2,374 MW observed in the same quarter in 2022.
- Cumulatively, there is now 83,173 MW of utility-scale solar operating in the U.S. All 50 states and the District of Columbia are home to at least one operating utility-scale solar project.
- The largest project that came online during the third quarter was the 265 MW first phase of NextEra's Dunns Bridge Solar in Indiana. This was followed by Intersect Power's 250 MW Oberon I Solar Project and 7X Energy's 203 MW Taygete II Solar Project in Texas.

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



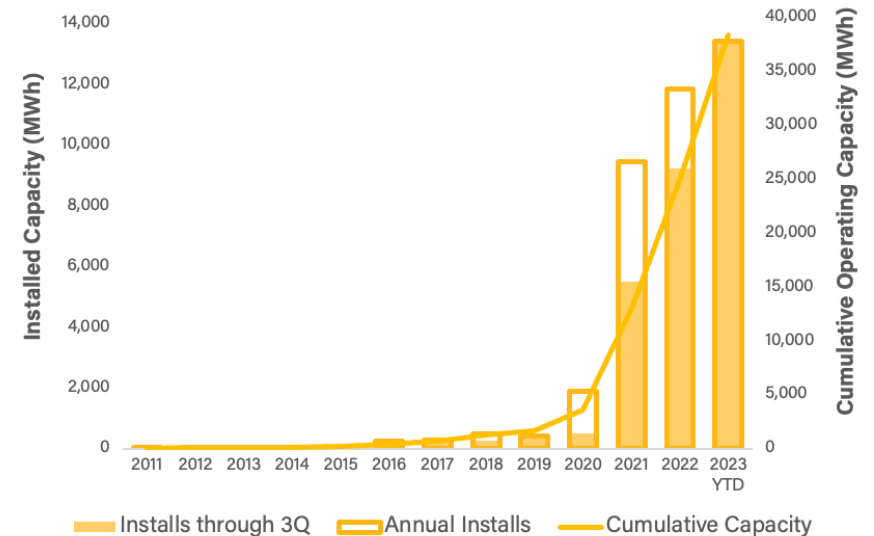
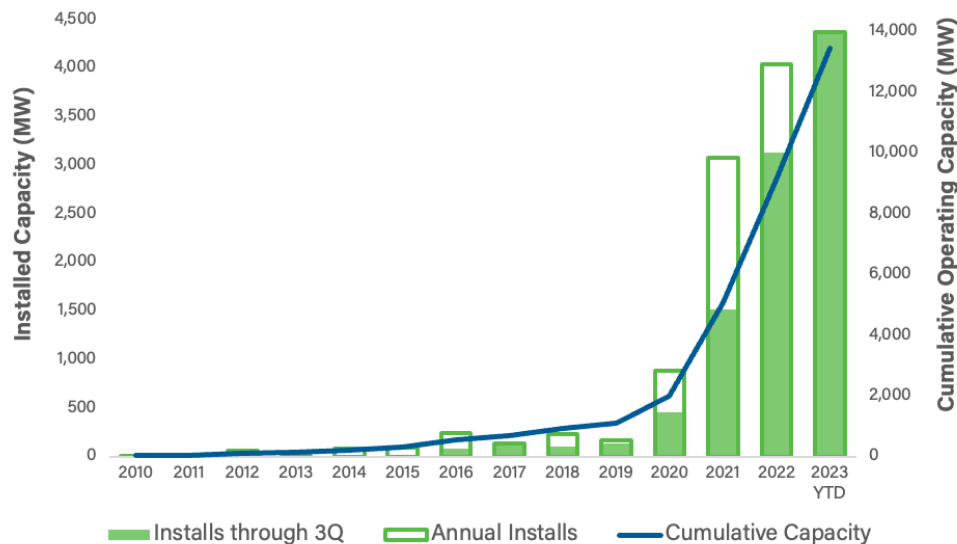
Solar capacity is reported in MWac

## UTILITY-SCALE BATTERY STORAGE

# Quarterly Storage Installation Soars

- Battery storage capacity is tracked in terms of rated power capacity (MW), the maximum possible instantaneous discharge, and energy capacity (MWh), the maximum amount of stored energy.
- Battery storage installations saw tremendous growth in the third quarter, with the 2,142 MW/6,227 MWh installed in Q3 representing a 21% increase from the second quarter and a 63% increase from the same period in 2022.
- Of the 30 battery storage projects that came online in the third quarter, 11 are standalone and 19 are paired with wind or solar.
- The first phase of NextEra Energy's Desert Peak Project was the largest standalone storage project phase to come online in Q3 at 325 MW/1,300 MWh. The 75 MW second phase of the project also came online in the third quarter.
- The first phase of Oberon Solar + Storage was the largest hybrid storage project to come online in the third quarter, with 250 MW of solar capacity and 125 MW of battery capacity.

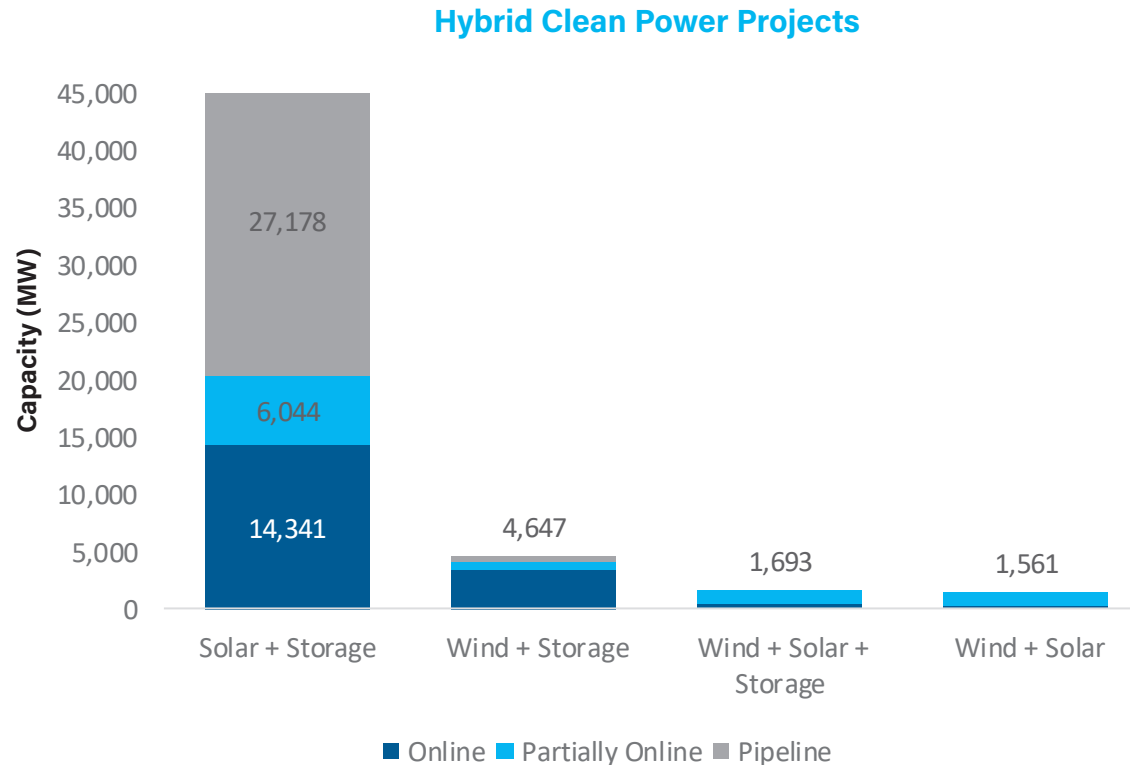
## U.S. Annual and Cumulative Utility Battery Storage Capacity Growth



## HYBRID PROJECTS

# Solar + Storage Reigns as Most Popular Hybrid Choice

- In the third quarter of 2023, 2,908 MW of new hybrid project capacity came online, a 30% increase from the same period last year.
- The bulk of the newly commissioned projects were solar + storage, representing 92% of third quarter hybrid additions.
- In total, 18,447 MW of hybrid projects are fully online, meaning that all phases and technologies included in the project are operating. Nearly 80% of those projects are solar + storage projects.
- Additionally, there are 9,358 MW of hybrid projects partially online, meaning one or more phases/technologies are operating, but other phases or technologies within the project are still in development.
- Finally, there are 27,178 MW of hybrid projects currently in the pipeline. The vast majority of that capacity, 98%, are solar + storage projects. The remaining 2% are wind + storage projects in development.





The American Clean Power Association (ACP) is the leading voice of today's multi-tech clean energy industry, representing over 800 energy storage, wind, utility-scale solar, green hydrogen and transmission companies. ACP is committed to meeting America's national security, economic and climate goals with fast-growing, low-cost, and reliable domestic power. Learn more at [cleanpower.org](https://cleanpower.org).



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