

# The 2021 US Renewable Energy Outlook

January 2021



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**S&P Global**

Market Intelligence

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## Overview

*By Lillian Federico, Research Director, Energy, S&P Global Market Intelligence*

The energy transition has become a keen focus of those following the energy sector in the United States. While this evolution includes broader initiatives, such as reducing carbon emissions and deploying advanced technologies that are changing the way energy users interact with the grid and with their local utilities, the cornerstone of the transition is the proliferation of renewable resources.

With the absence in recent years of a federal policy with respect to renewables, the drive to expanding renewables development has been led by the states, spurred on by grassroots support from individual utility customers, U.S. corporations seeking to reduce their carbon footprint and environmentalists.

During 2020, the COVID-19 pandemic presented challenges for the renewables industry globally, in the form of cessation of construction, job losses, limited access to capital and supply chain disruptions. These roadblocks, however, appear to have been overcome.

Even though the pandemic slowed state legislative momentum, several states adopted enhanced renewable portfolio or carbon-free standards in 2020. Looking ahead to 2021, S&P Global Market Intelligence expects the energy transition to again be a focus for state legislatures, as well as environmental, social and governance issues.

Additional momentum will be provided at the federal level, as U.S. President-elect Joe Biden has outlined climate change goals. Biden's plan includes achieving a 100% carbon-free power sector by 2035 and a net-zero carbon economy by 2050. Despite changes in the makeup of both chambers of the U.S. Congress, legislative support is probable for Biden's initiatives.

The new administration also will likely bring changes at the Federal Energy Regulatory Commission, and the commission's policies will likely become more supportive of the energy transition and clean energy resources.

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Utility CEOs have expressed concerns regarding the pace of the transition proposed by the Biden administration and the impacts that pace would have on reliability and the cost of service. Nevertheless, renewables spending by utilities, which has been on the rise over the last decade, is expected to expand further as companies move to comply with the new standards and as environmental and sustainability concerns drive strategic objectives.

There are currently 232 GW of wind and solar projects in the U.S. pipeline. Over 21 GW of wind and roughly 15 GW of solar capacity is expected to come online by the end of 2021. Battery storage development, estimated at 1,500 MW in 2020, is expected to grow by 15,000 MW over the years 2021 to 2024. Renewable natural gas and hydrogen are also seeing renewed interest in the U.S., driven by a need to balance variable renewable resources while reliably decarbonizing energy systems.

COVID-19 presented similar challenges for renewables developers in Europe during 2020, but the European Union's increasing focus on climate issues is expected to drive a new wave of development in 2021, with auctions to be held for more than 40 GW of solar and onshore and offshore wind capacity, in aggregate, across the 10 largest renewables markets.

Read on for a more detailed analysis of the factors driving renewables trends. As always, our team of experts is available for individualized sessions to explore these trends further.

## Renewable power forecast: 2021-2030

*By Adam Wilson, Research Analyst, Energy, S&P Global Market Intelligence*

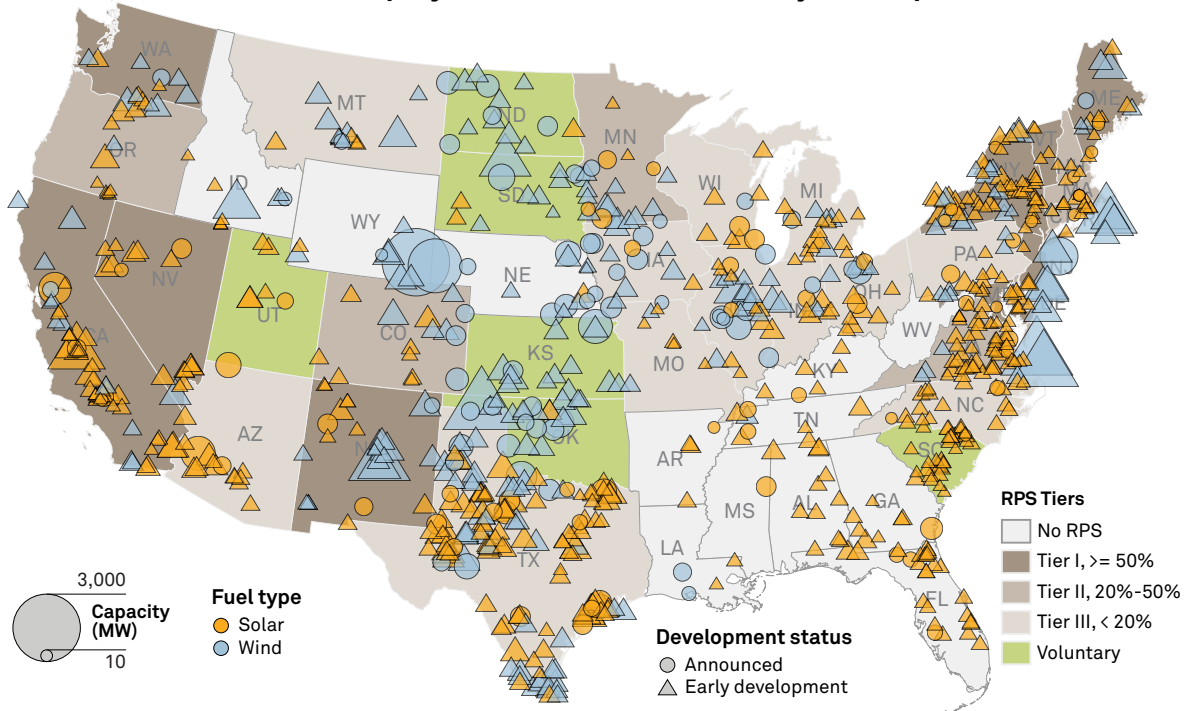
Momentum for renewable portfolio standards increased, and other renewable-related legislation was strong coming into 2020. Several states including Maine, Maryland, Nevada, New Mexico, New York and Washington updated their renewable energy requirements, with many implementing 100% renewable or carbon-free generation requirements. Multiple other states were taking actions to increase their clean energy requirements in the form of executive actions and legislative proposals. When the COVID-19 outbreak exploded in the United States in March 2020, however, this momentum was halted as all focus shifted toward addressing the pandemic and ensuing economic downturn.

Some actions were taken, including federal tax credit safe harbor extensions to address projects that were delayed due to the pandemic, and Virginia officially passed the Clean Economy Act that require investor-owned utilities Virginia Electric and Power and Appalachian Power Co. to supply 100% renewable generation by 2045 and 2050, respectively. This new legislation combined with existing RPS targets keep the demand for new wind and solar robust, as S&P Global Market Intelligence forecasts 148,000 MW of wind and solar needed by 2030 for all states to be compliant with their individual requirements. Thanks, in part, to offshore wind targets for several states along the east coast, forecast demand for wind outpaces solar at just over 80,000 MW compared to almost 68,000 MW of solar.

New York, with its 70% renewable target by 2030 along with specific targets for offshore wind, solar and energy storage, has the biggest uphill climb; the state needs to install over 30,000 MW of wind and solar by 2030 to reach this requirement, according to Market Intelligence's Power Forecast — nearly 10 times the renewable capacity currently operating in the state. California is second with just under 20,000 MW of renewable capacity needed by 2030 — 12,000 MW from solar and 7,500 MW from wind — to reach its 60% renewable mandate. Virginia, New Jersey and Maryland round out the top five states with the highest demand for new renewable capacity, each requiring between 12,000 MW and 15,000 MW of new wind and solar capacity by 2030.

The pipeline of new wind and solar projects in the U.S. is massive at 232,000 MW. The queue of solar capacity has swelled to 109,300 MW in 2020, from 76,000 MW in 2019, while 9,500 MW of new capacity came online. The project development pipeline for wind shrank nearly 10,000 MW year over year but still sat at an impressive 123,000 MW. Just over 13,500 MW of new wind capacity were installed between November 2019 and December 2020. 2021 is expected to be a very active year, with over 21,000 MW of wind and just under 15,000 MW of solar capacity in advanced development or under construction expected to come online by the end of the year. Solar plus storage projects are also gaining interest, with 9,500 MW of storage proposed to be added to 21,500 MW of solar across over 150 projects.

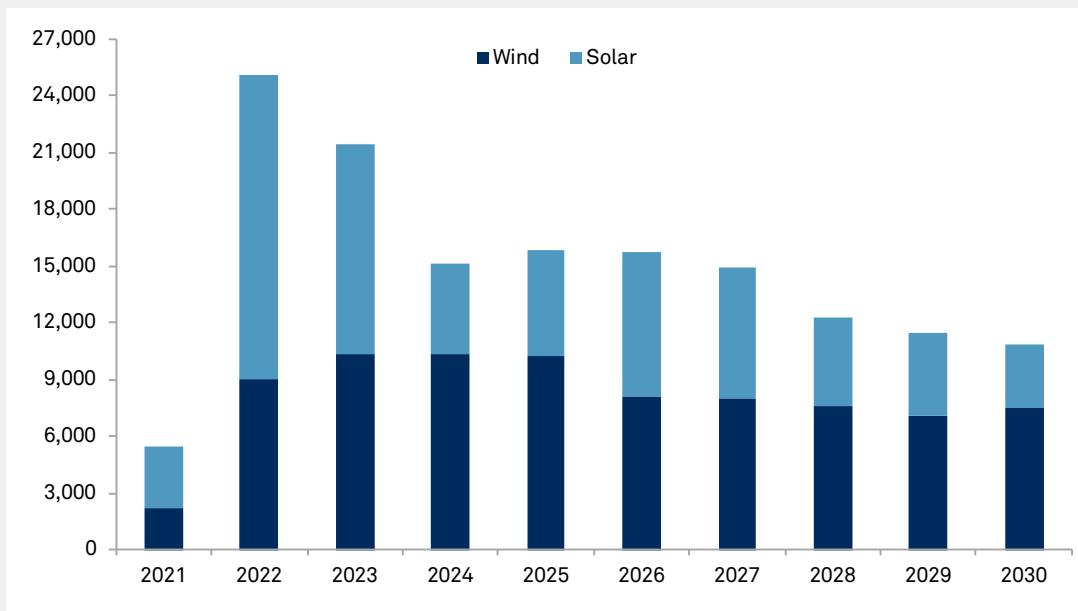
**Wind and solar projects announced or in early development**



As of May 6, 2020.  
Only includes wind and solar projects with a rated capacity of 10 MW or larger.  
Map credit: Jose Miguel Fidel C. Javier  
Source: S&P Global Market Intelligence

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Market Intelligence

**Total RPS-driven wind and solar capacity additions (MW), 2021-2030**



As of Oct. 15, 2020.  
Source: S&P Global Market Intelligence

As the effects of the pandemic and recession are addressed, RPS and other renewable legislation discussions are expected to ramp up quickly. Several states, including Connecticut, Rhode Island, Wisconsin among many others, have executive orders or other preliminary legislation in place that are expected to lay the groundwork for official implementation of 100% renewable or carbon free targets.

Further, President-elect Joe Biden has very ambitious goals for addressing climate change that include putting the country on an irreversible path toward a 100% carbon-free power sector by 2035 and a net-zero carbon economy by 2050. The administration is expected to be very active in its first year, taking steps to achieve these goals. Near-term legislation at the federal level could include rejoining the Paris Agreement, another extension of the federal investment and production tax credits, expansion of said tax credits to include other technologies such as battery storage, and investment toward nascent clean technologies like renewable hydrogen and carbon capture or carbon sequestration facilities. Long-term tasks will include the implementation of a nationwide enforcement mechanism that prompts the shift away from fossil fuels toward carbon-free generation. This could come in the form of a federal renewable portfolio standard, national carbon tax, or something else. Regardless, 2021 and beyond will be very active for renewables development and legislation.

## Renewable energy capital expenditure outlook

By Jason Lehmann, Research Analyst, Energy, S&P Global Market Intelligence

As environmental and sustainability considerations continue to come into alignment with utility sector investment plans and operational outlooks, renewable energy spending will remain a significant part of many utility capital expenditure programs in the coming years.

Such opportunities may accelerate via U.S. President-elect Joe Biden's sweeping climate and decarbonization plan that calls for \$2 trillion of investment in clean energy initiatives that would further displace fossil fuels and potentially spur a more rapid deployment of solar and wind.

### Utility spending cycle

The utility industry is now more than 15 years into a capital spending cycle that started in the early 2000s and grew rapidly as company managements embraced back-to-basics strategies focused on meaningful replacement of aging infrastructure. The genesis of the current spending spree can be pegged to an extent on the blackout of New York City and large portions of the east coast in the summer of 2003. A federal investigation into the issue brought the aging infrastructure in front of Congress; initiatives followed that provided financial incentives for construction of new transmission facilities. Meanwhile, remediation of emissions from dirty coal-burning facilities, stemming from heightened

Company	2020	2021	2022	2023	2024
ALLETE Inc.	585	275	5	5	10
Alliant Energy Corp.	265	485	750	635	320
Ameren Corp.	240	240	240	240	240
American Electric Power Co. Inc.	420	900	900	900	900
Avangrid Inc.	700	900	1,100	2,067	2,066
GMS Energy Corp.	350	350	350	350	350
Consolidated Edison Inc.	600	250	400		
Duke Energy Corp.	1,065	1,050	810	300	300
Entergy Corp.	280	280	280	280	280
Eversource Energy	350				
IDACORP Inc.	78	77	78	77	78
MGE Energy Inc.	108	91	11		
New Jersey Resources Corp.	139	126	126		
NextEra Energy Inc.	6,453	5,683	5,940	395	25
Otter Tail Corp.	178	50	53		
PNM Resources Inc.	27				
Portland General Electric	119	14			
Public Service Enterprise Group Inc.	55	130	200		
Sempra Energy	165	120	30	30	30
WEC Energy Group Inc.	654	820	820	820	820
Xcel Energy Inc.	1,760	310	75	15	
<b>Total multi-utility</b>	<b>14,599</b>	<b>12,231</b>	<b>12,348</b>	<b>6,194</b>	<b>5,499</b>

Data compiled Nov. 10, 2020.  
Blank cells indicate no capex value provided by company.  
Source: S&P Global Market Intelligence, company surveys and RRA adjustments

environmental awareness, also drove major capital investment into new generation facilities with the benefit of cleaner emissions profiles.

In a 2008 special study published by Regulatory Research Associates, a group within S&P Global Market Intelligence, total capex spending for the investor-owned utility group covered by RRA was tallied at \$36 billion. In the most recent update of the report, published Nov. 2, 2020, industry spending for energy utilities was expected to total roughly \$141 billion in 2020. We expect utility capital expenditure spending to remain robust in the coming years as companies identify opportunities to invest in new infrastructure to upgrade aging transmission and distribution systems, build new natural gas, solar and wind generation and implement new technologies, including smart meter deployment, smart grid systems, cybersecurity measures and battery storage.

### **Renewables spending up strong**

Renewables spending by the utility sector was only a small part — less than 5% — of total industry spending in 2008. More than a decade later, renewables play a much more significant role in utility capital agendas. Spending on renewables is forecast to total more than \$39 billion across the RRA coverage universe over the three years 2020 to 2022. By comparison, our Winter 2019 forecast projected approximately \$36 billion of renewables spending between 2019 and 2021.

Amid a broader energy utility sector transition from emissions-intensive operations, declining technology and installation costs, state renewable portfolio standards and customer demand for cleaner sources of electricity continue to be among the driving forces behind the addition of regulated and contracted wind and solar energy to utilities' generating portfolios. Federal production and investment tax credits also remain an important component of renewable energy development.

## **US renewable pipeline poised to add 172.5 GW through 2024**

*By Justin Horwath, Reporter, Power and Utilities, S&P Global Market Intelligence*

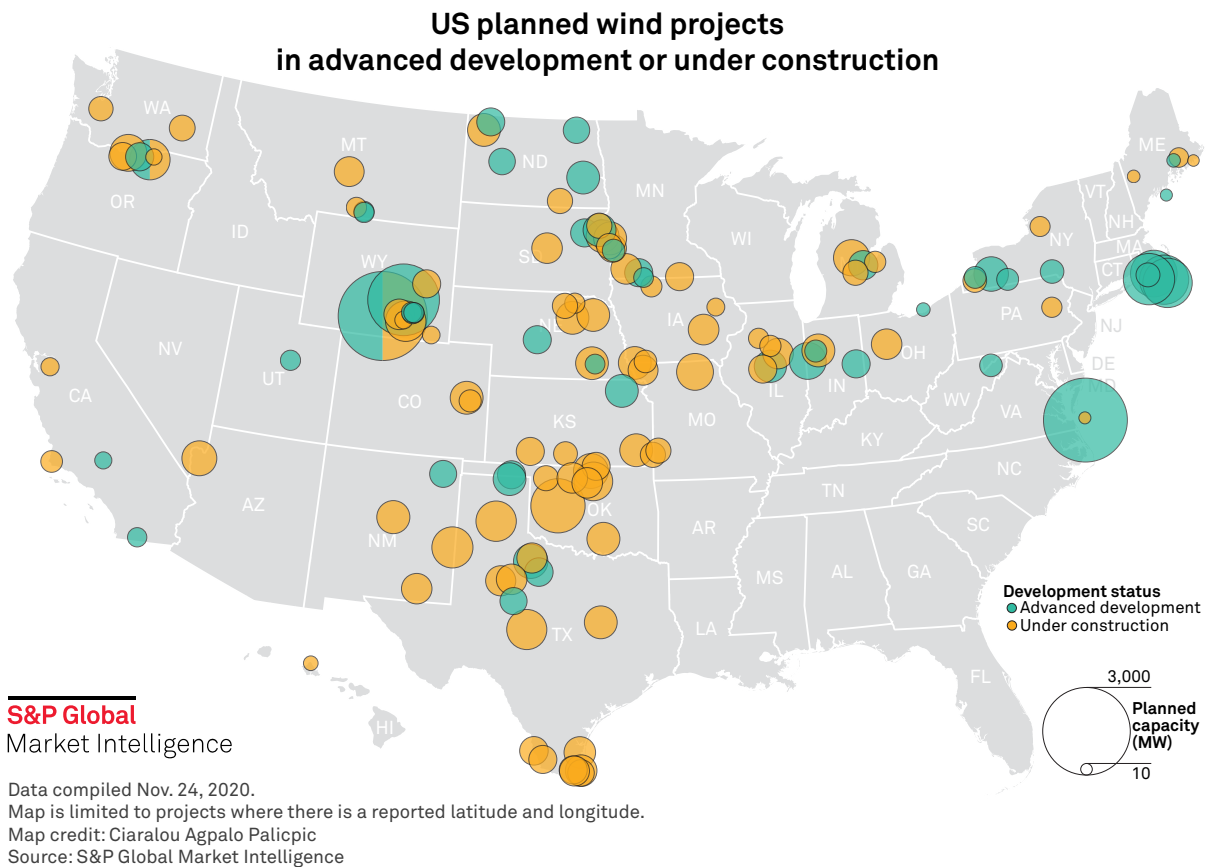
Despite the COVID-19 pandemic causing record job losses for the renewable energy industry, slowing construction activity and threatening developers' access to capital, the U.S. saw strong capacity additions for wind and solar power during 2020.

But questions remain about the long-term effects the pandemic will have on projects. An analysis by S&P Global Market Intelligence shows a pipeline of 172.5 GW of renewable capacity through 2024, with 75.7 GW of wind power projects and 96.8 GW of solar power projects.

While some of the projects may not cross the finish line, especially those in early development phases, wind and solar projects totaling 30.7 GW of capacity are now under construction. Meanwhile, 18.2 GW of projects are in advanced development, 109.3 GW are in early development, and developers have announced 14.1 GW of new projects. More than 5.4 GW of wind and 4.3 GW of solar projects under construction are scheduled for completion in 2021.

The U.S. Energy Information Administration said last November that wind's share of U.S. electricity generation increased to 8.8% in 2020, the highest of any renewable energy resource.

Most of the capacity in the pipeline for wind power projects, 40.6 GW, is in early development. Meanwhile, wind power projects totaling 18.7 GW are under construction, 10.1 GW are in advanced development, and developers have announced 6.1 GW of capacity for new projects.



Solar power in 2019 accounted for 1.8% of U.S. utility-scale generating capacity, according to the EIA. But solar has a more robust development pipeline than wind power as its use surges in the U.S. Southeast, Texas and California and as developers increasingly pair solar power with battery storage projects.

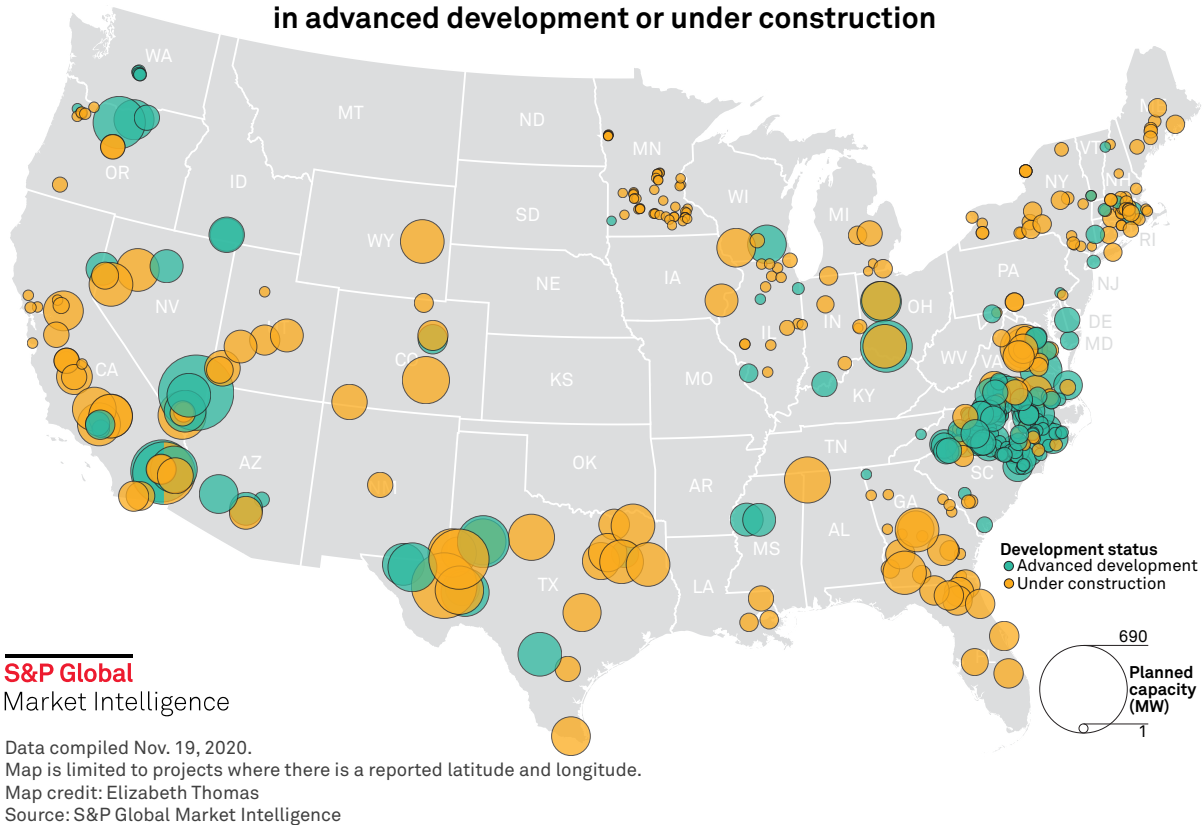
Like wind power, most of the capacity in the solar power pipeline, 68.6 GW, through 2024 is in early development. Projects totaling 11.9 GW are under construction, 8.1 GW are in advanced development, and developers have announced 8 GW of new solar projects.

NextEra Energy has the largest pipeline for U.S. wind and solar projects, with projects totaling 13.6 GW of capacity under development, 8.3 GW of which is solar. The Juno Beach, Fla.-headquartered company develops renewable energy projects through its competitive business, NextEra Energy Resources LLC. The company's 2020 renewable energy project pipeline grew by 21% from the previous year.

Apex Clean Energy Inc. has the next largest renewable energy project pipeline, with 12.2 GW of solar and wind power projects. It is the largest owner of wind power projects under development, with 9.5 GW of wind power capacity. The Charlottesville, Va.-based developer has been among the renewable energy developers capitalizing on growing corporate demand for renewable energy, especially from tech companies with data centers.

Chicago-based Invenergy LLC has 6.6 GW of wind power capacity under development and is also pursuing large-scale solar projects. The developer said last November that it plans to build the 1,310-MW Samson Solar Energy Center in Texas, which is expected to be the largest solar energy facility in the U.S. upon its completion in 2023.

**US planned utility-scale solar projects  
in advanced development or under construction**



EDF Group of France has 2.9 GW of solar power capacity in its development pipeline. Macquarie Green Investment Group, RWE AG and Engie SA have 2.5 GW, 2.44 GW and 2.2 GW of wind projects under development, respectively.

Wind and solar developers are hopeful that they will see a friendlier regulatory environment under President-elect Joe Biden. A bipartisan relief package signed into law by President Donald Trump included billions for federal energy research as well as a one-year extension of the land-based wind power production tax credit at 60% of its full value and a two-year extension of the solar energy investment tax credit at 26%.

## Utility CEOs, analysts wary of Biden’s timeline for carbon-free power sector

*By Darren Sweeney, Reporter, Power and Utilities, S&P Global Market Intelligence*

As several investor-owned utilities in the U.S. pursue a net-zero-by-2050 carbon emissions goal, executives and Wall Street analysts warn that pursuing a more rapid energy transition as proposed by President-elect Joe Biden could be detrimental to affordability and reliability.

Biden unveiled a \$2 trillion climate plan in July 2020 that aims to decarbonize the U.S. power sector by 2035.

“Can it be achieved? Almost certainly. Would it be devastating to the economy? Probably,” Scotia Capital (USA) Inc. analyst Andrew Weisel said in a Dec. 11, 2020, phone interview. With thousands of people dying each day from the



COVID-19 pandemic and millions of people out of work and struggling to pay their bills, this may not be the best time to pursue a massive green energy spending plan.

“The impacts from COVID on the economy have been devastating for a lot of people,” Weisel said.

Still, the analyst noted that the Biden administration would have “a lot more flexibility” to implement its climate and energy goals if Democrats are able to take control of the U.S. Congress, “which seems unlikely.”

During a recent virtual summit to celebrate the five-year anniversary of the Paris Agreement on climate change, dozens of countries, including China and the U.K., announced more aggressive climate goals. Scientists do not expect the current decarbonization commitments of the countries party to the Paris accord to be sufficient to meet the goal of limiting global warming to 2 degrees Celsius. But recent formal and informal net-zero emissions targets by some countries, including Biden’s plan, could put the world very close.

Travis Miller, an energy and utilities strategist at Morningstar Inc., also pointed out that these goals, which include reaching net-zero emissions across the entire economy by 2050, “are very aggressive with the technology that is out there today.”

“Renewable energy, for the most part, is not compatible with reliable electric service,” Miller said in a Dec. 8, 2020, phone interview. “You have to have natural gas on the grid to ensure reliability right now.”

The Morningstar analyst also pointed to affordability as one of the biggest near-term hurdles facing the clean energy transition.

“I think the utility industry is eager to continue investing in clean energy,” Miller said, noting the question is whether customers will be willing to pay higher costs.

When it comes to meeting net-zero emissions, analysts see the need for more economic clean energy technologies.

“It’s going to be that last mile that is going to be the real challenge,” Weisel said. “I point to [NextEra Energy Inc.], which is obviously the global leader in renewables, they are big believers that it would be very difficult to get to 100%. You can get very close and have dramatic reductions in your carbon emissions, but to go 100% net zero is where you either need new technologies or more likely current technologies that are uneconomic to become economic. Hydrogen is a great example of that.

“Hydrogen is technologically available today. We can do it. It’s just unimaginably expensive.”

### **Utilities preach patience**

American Electric Power Co. Inc. Chairman, President and CEO Nicholas Akins is among those skeptical of achieving a carbon-free power sector by 2035.

“I think 2035 is particularly aggressive,” Akins told S&P Global Market Intelligence. “If the Senate were to go to Democrats, you may see something like that. But that, to me, [is not feasible] particularly in areas AEP serves. It’s not California. We do have seasons. We do have industrial customers.”

AEP, which aims to reduce emissions 70% by 2030 and 80% by 2050 from a 2000 baseline, announced Nov. 5, 2020, that it will shut down more than 1,600 MW of coal capacity in Texas by the end of 2028. The company, however, plans to continue operating Appalachian Power Co.’s 2,930-MW John E. Amos and 1,330-MW Mountaineer coal plants in West Virginia, as well as the 1,560-MW Mitchell coal plant in West Virginia.

Akins said he does see the potential for some existing fossil-fueled capacity to serve as “more of an insurance policy” to ensure reliability in the future. “But still, to remove all fossil generation by 2035 is going to be really, really a tall order.”

NiSource Inc. subsidiary Northern Indiana Public Service Co., or NIPSCO, said in September 2018 that it plans to shut down its remaining coal capacity within 10 years as part of the utility's plan to reduce carbon emissions by 90% off of a 2005 baseline. NIPSCO is focusing on a combination of wind, solar and storage capacity to replace its coal generation.

Still, NiSource President and CEO Joseph Hamrock said Biden's transition plan deserves a cautious approach.

"We are going to have to look at, like we always do, the economics of that transition," Hamrock said. "And then we also look at the environmental impact. We also look at the reliability aspects of the plan. ... So, achievable is a pretty loose word. I would say technically you could probably solve for [Biden's plan]. It's all those other factors that will ultimately shape the answer for us."

Southern Co. Chairman, President and CEO Thomas Fanning said Biden's plan is likely feasible and achievable, but he also cautioned against moving too quickly.

"I think society benefits as a whole if you allow enough time for technology innovation to take place to make the transition safer and more economic than if you rush headlong into a 2035 goal," Fanning said in a recent interview. "Could we do it? Yes. I think from the posture of clean, safe, reliable, affordable [electricity], I think there are other solutions that could achieve similar objectives and perhaps with less disruption to society."

#### **Emissions cuts will continue**

Fanning in May 2020 announced Southern's revamped strategy to target net-zero emissions by 2050 and reiterated the company's goal to reduce emissions by 50% by 2030 from 2007 levels, if not sooner.

"The general structure of how you advance to net-zero will be retiring coal over time and evaluating gas with carbon capture technology," the CEO added.

As Southern prepares to bring the first of two delayed and over-budget units at its Alvin W. Vogtle Nuclear Plant expansion online in the third quarter of 2021, Fanning has not ruled out the possibility of investments in new carbon-free nuclear technology.

Xcel Energy Inc., which is planning to cut emissions 80% by 2030 and decarbonize its power portfolio by 2050, also views Biden's carbon-reduction plan as overly ambitious.

"There's a reason why we chose 2050," Xcel Chairman and CEO Ben Fowke said on the company's third-quarter 2020 earnings call. The CEO said he would "welcome the chance ... to work with the Biden administration and kind of let them know that 2035 in the utility timeframe for the technologies that will be needed is very aggressive."

Weisel, the Wall Street analyst, said he believes an extension of tax credits for wind and solar projects, possibly even nuclear and offshore wind projects, is the "most likely action that could be accomplished" by the Biden administration.

"I really think the outlook calls for more of the same," Weisel said. "What I mean by that is companies are going to be retiring coal plants and older gas plants, building more renewables. We will still see some highly efficient gas peakers being built as well, probably not baseload gas though. And then, a lot of grid modernization."

## **The Federal Regulatory Outlook**

*By Jim O'Reilly, Principal Analyst, Energy, S&P Global Market Intelligence*

The Federal Energy Regulatory Commission has authority over electric utility wholesale sales and transmission rates in interstate commerce, the transportation and sale of natural gas in interstate commerce, and the licensing and inspection of private, municipal and state hydroelectric projects. FERC also has jurisdiction over open access to the interstate electric transmission grid and certain mergers and acquisitions involving public utilities.

While FERC has little or no direct role in the development, siting and construction of generating resources other than hydroelectric projects, the commission's policies and actions can have significant indirect impacts on renewable energy resources in a number of ways.

The election of Joe Biden as president will produce a Democratic chairman at FERC and an eventual Democratic majority on the commission in 2021, and key FERC policies will likely become more supportive of the energy transition and clean energy resources. The following are key FERC matters that merit close watching by stakeholders in the renewables sector in 2021.

### **Wholesale market rules and state public policy goals**

FERC regulation is intended to ensure open, competitive wholesale power markets and electricity prices that are just and reasonable, and market rules in regions of the U.S. administered by regional transmission organizations and independent system operators, or RTOs/ISOs, are regulated by the commission. The market rules are often undergoing modifications and adjustments, including those governing participation of generating resources, including renewables, in the energy, capacity and ancillary services markets in each RTO/ISO.

At the same time, the energy transition and public policy goals, including state renewable portfolio standards and carbon pricing mechanisms, are transforming the U.S. generation portfolio mix. The transformation is increasingly giving rise to conflicts with FERC's oversight and regulation of wholesale electricity markets, most recently involving proposed rules designed to accommodate renewable resources in the capacity markets operated by the PJM Interconnection and New York ISO.

Recent FERC decisions involving the proposed rules in PJM and the NYISO have generated significant controversy and provoked strong opposition from clean energy groups and Commissioner Richard Glick, the only Democrat on the commission at the time the decisions were issued.

Glick, who is a candidate to be named chairman of the commission, issued a blistering dissent to FERC's PJM orders issued in April 2020, stating "from the beginning, this proceeding has been about two things: dramatically increasing the price of capacity in PJM ... and slowing the region's transition to a clean energy future. Accordingly, I dissent as strongly as I can from both orders, which are illegal, illogical, and truly bad public policy."

Glick had been the lone Democrat on the FERC since August 2019 until Allison Clements was sworn in Dec. 8, 2020, and with a Democratic chairman and Democratic majority on the horizon, he will likely have growing influence on the commission's 2021 agenda.

### **Electric transmission**

Upgrades and additions to the interstate transmission grid can further facilitate the expansion and deployment of renewables such as wind and solar, and while FERC has already taken some initial steps to address transmission needs there will be opportunities in 2021 to further promote transmission investment that would likely benefit clean energy resources.

FERC launched a broad rulemaking in 2020 into the commission's existing policies governing a series of transmission incentives that were originally adopted in 2006 to encourage investment in transmission infrastructure. The commission's proposed rules would dramatically increase and expand the size and scope of ROE incentives and fundamentally revise the commission's approach for evaluating requests for those incentives.

While the proposed rules do not currently contemplate incentives for transmission projects that would serve public policy goals like state renewable portfolio standards, Glick has argued these types of projects should be commission priorities and that in "providing an incentive — whether an ROE or a non-ROE incentive — commensurate with that priority, the Commission could take a significant step toward building the transmission system necessary to continue providing low-cost, reliable power as the generation mix evolves."

The outcome of the commission's proposed rulemaking is uncertain and could have significant implications for transmission owners and clean energy resources in 2021.

FERC also requires transmission owners to provide nondiscriminatory access to their transmission lines, and renewable projects planning to interconnect to the interstate transmission system must navigate a landscape of regional rules and regulations. In addition, there is growing momentum for FERC to revisit and revise regional and interregional transmission planning processes, originally adopted in 2011 in Order No. 1000, to facilitate the development and deployment of additional clean energy resources.

New interconnection rules adopted in 2019 intended to provide additional transparency and certainty to transmission customers, including renewable resource owners and developers, and the potential for a fresh approach to transmission planning to reflect the course of the energy transition will continue to impact transmission owners and clean energy resources in 2021.

#### **PURPA**

The Public Utility Regulatory Policies Act, or PURPA, was enacted in 1978 to introduce competition in generation and promote fuel diversity in the U.S. generation portfolio mix. Among other things, PURPA created a framework to encourage the development of small power production facilities whose primary energy source is renewable, biomass, waste, or geothermal.

On July 16, 2020, FERC finalized rules that revised fundamental aspects of PURPA and increased uncertainty for renewable project developers and lenders. Among other things, the new rules likely make it more difficult for certain renewable projects to secure fixed-term contracts for their output that facilitate financing the projects.

Glick criticized the changes to PURPA in a dissent to the final rules, which will likely be appealed to federal court in a process that could take a year or more to conclude.

#### **M&A**

M&A involving generation resources, including many transactions involving renewable assets, can be subject to FERC's review and approval. Potential consolidation in the industry in 2021 could be affected by horizontal or vertical market power concerns and FERC's review of the potential effect on competition in some cases or regions.

## **Wind-turbine makers see hope in climate, recovery plans after 2020 disruption**

*By Camilla Naschert, Reporter, Energy, S&P Global Market Intelligence*

A year of coronavirus-related disruption and corporate restructurings in 2020 has changed the landscape for wind turbine manufacturing.

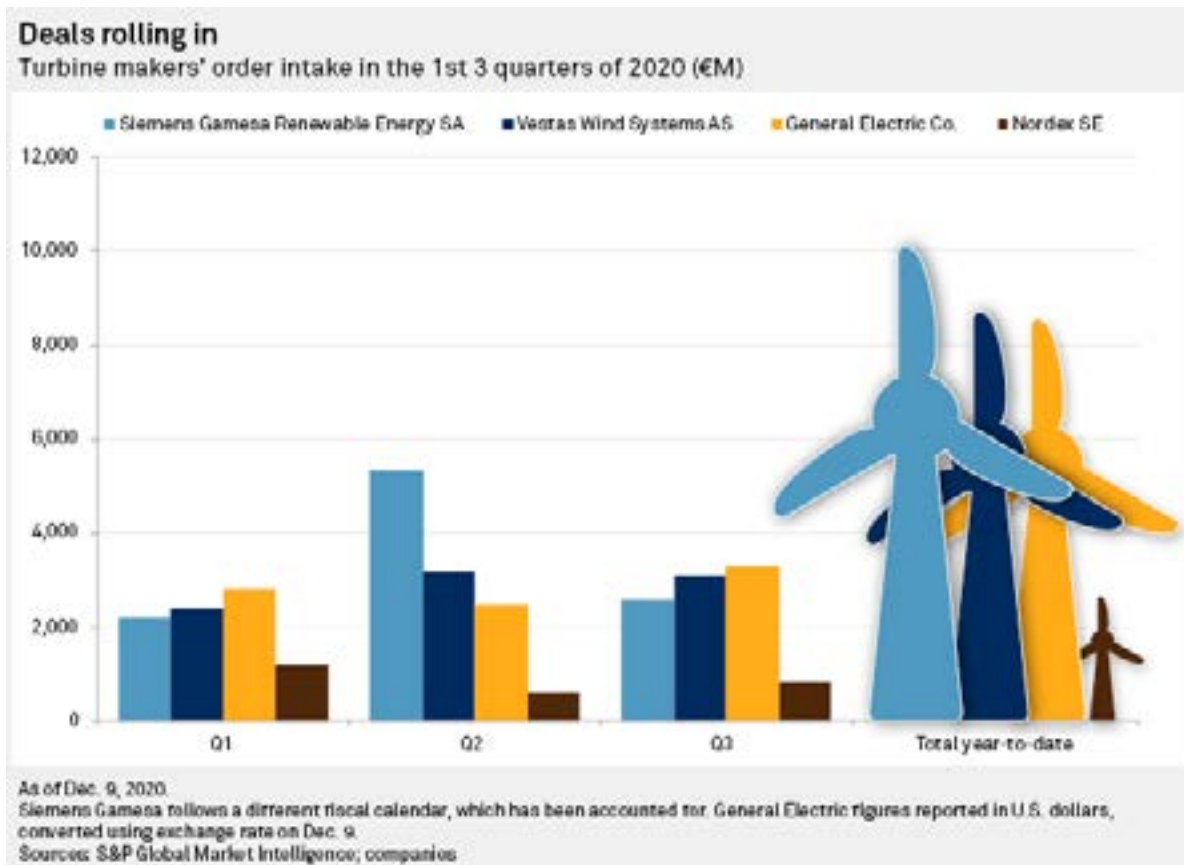
The COVID-19 pandemic has been challenging for a sector heavily reliant on functioning international supply chains, but manufacturers were able to largely shake off the disruption of the initial lockdowns earlier in the year. More recently, ramped-up renewables targets and green recovery plans across Europe have brightened the long-term outlook.

"Onshore [wind] has maybe lost a little bit of volume, but offshore has lost very little progress," with contractors increasing spending on safety measures to ensure delivery of the valuable offshore contracts, said Andy Strowbridge, associate director at advisory firm BVG Associates.

Siemens Gamesa Renewable Energy SA experienced supply chain turbulence and cost overruns in 2020 and, after a profit warning in the spring, cut ties with CEO Markus Tacke, with Andreas Nauen replacing him. Earlier in the year, the manufacturer snapped up rival Senvion SA's intellectual property and European wind farm servicing business. In September 2020, the group was moved under the umbrella of newly spun out Siemens Energy AG.

Siemens Gamesa also took the lead in the race for scale in the offshore turbine segment in 2020, announcing a 14-MW machine that will become available by 2023. Until that turbine is rolled out, General Electric Co.'s GE Renewable Energy unit will be the leader in terms of scale in the offshore space, with first delivery of its 12-MW Haliade-X turbine set to begin this year.

MHI Vestas Offshore Wind A/S could make the next move now that the company is a full subsidiary of Vestas Wind Systems A/S, which bought out partner Mitsubishi Heavy Industries Ltd.'s share of their joint venture in 2020. Former CEO Philippe Kavafyan was replaced at the helm by Vestas veteran Johnny Thomsen.



Under new ownership, the company will be able to move faster toward a new supersized offshore machine, according to Strowbridge. "I wonder if the JV between Vestas and MHI slowed down the decision-making. With a single owner, there is more clarity," he said.

In the onshore segment, German manufacturer Enercon GmbH is busy with its own restructuring effort to turn the fledgling business around, which includes a new onshore turbine design. "The new product looks utterly different. It will be interesting whether they will be able to deliver on the transformation of the company. If not, they will likely be the last consolidation that will be available on the market," Strowbridge said.

### **Big targets**

While competition in the turbine-making space is stiff, the market is also likely to be big enough for all. In Europe, a new target of 300 GW of offshore wind capacity by 2050 will require a real effort from the suppliers to deliver, industry group WindEurope said. Onshore, the sector is facing the growing task of repowering wind farms: removing the first turbines installed in the 1990s and early 2000s and replacing them with new machines.

“European countries decided that COVID-19 could be a great opportunity to accelerate decarbonizing the economy. So the European Green Deal is there as a multiyear package and is real and is driving demand,” Nordex SE CEO Jose Luis Blanco said during the company’s third-quarter earnings call in November 2020.

2020 also unleashed momentum around green hydrogen, powered by the European Commission’s 40-GW electrolyzer capacity goal for the end of this decade. “This year has been peak hype in offshore wind and hydrogen in terms of policymakers realizing that there is a solution here that can be scaled,” Strowbridge said in an interview Dec. 10, 2020.

On the back of that hype, Vestas late in 2020 became an anchor investor in a new energy transition fund focused on power-to-X — referring to technologies that convert electricity into other energy carriers, such as hydrogen — as part of a €500 million deal to buy a 25% stake in Copenhagen Infrastructure Partners K/S, a Danish fund manager.

### **New market leader in 2025**

U.S. and European manufacturers are set to have an edge over competition from China, according to consultancy Wood Mackenzie. Global operational scale, onshore and offshore presence, large balance sheets, closer proximity to the largest asset owners and financial strength will prove to be advantageous for leading Western turbine-makers and will help to consolidate global market share outside of China, the company said in a Dec. 3, 2020, report.

Vestas, Siemens Gamesa and GE are set to increase their global market share from 43% in 2019 to 60% by 2029, Wood Mackenzie added.

Vestas, now sitting in top spot in the global rankings, will be faced with strong competition over the coming years due to Siemens Gamesa’s aggressive expansion in the offshore segment. “[Siemens Gamesa] will secure the global number one ranking by 2025 and retain that position through the end of the decade,” Shashi Barla, principal analyst at Wood Mackenzie, said in a statement.

Against the backdrop of rising renewables targets globally, the eight largest turbine-makers are set to more than double their cumulative installations in gigawatt terms by the end of the decade. Vestas and Siemens Gamesa each will have reached 200 GW, and GE will be just shy of that target, Wood Mackenzie predicted.

### **Buy cheap, buy twice**

Some supply chain challenges in Europe are expected to remain as capacity targets are hiked. Shipping vessels capable of lifting and installing the largest offshore turbines are in short supply. The offshore wind sector was expecting the delivery of the Orion installation vessel by DEME Group in May 2020, but the ship was severely damaged during a final crane load test in the port of Rostock, Germany.

DEME has booked alternative vessels for the first couple of jobs, including the Moray East wind farm off the coast of Scotland, developed by Engie SA and EDP Renováveis SA. Crane-maker Liebherr, which had hoped to gain a foothold in the offshore renewables segment, said work to repair the vessel would wrap up at some point this year.

While the logistical disruption from this incident may be short lived, it is likely to further concentrate minds in the search for contractors in the ancillary wind supply chain. “It has for sure created a massive focus on choice of various suppliers in the [offshore wind supply] chain,” Frederik Colban-Andersen, managing director for offshore renewables at shipping company Clarksons Platou, said in an email. “As such it’s good, there is focus on quality and that buying cheap is not necessary the best. Buy cheap, buy twice.”

# New members of US Congress include climate defenders, carbon tax opponents

*By Molly Christian, Reporter, Power, S&P Global Market Intelligence*

U.S. congressional leaders have yet to announce committee rosters for the newly launched 117th Congress, but several freshman members will bring energy and climate change-related experience that could shape policy in the next two years regardless of their committee assignments.

## Senate

Party control of the U.S. Senate will not be determined until Georgia holds Jan. 5 runoff elections for its two Senate seats. If Republicans keep their Senate majority, chances are slim for President-elect Joe Biden to advance ambitious climate plans, such as a national clean electricity standard or firm emissions limits, through Congress.

But several new Senate members are vowing climate action.

Former Colorado Gov. John Hickenlooper, a Democrat, beat Republican incumbent Cory Gardner for Colorado's open Senate seat. During his campaign, Hickenlooper called for a transition to a "100% renewable energy economy with net-zero emissions" by 2050.

To reach that goal, Hickenlooper said he would fight for large-scale investments in government-funded climate technology research and support raising fuel economy standards to fully transition the U.S. vehicle fleet to electric cars. He also backs a national price on carbon dioxide emissions, with revenues returned to American taxpayers as a dividend.

Furthermore, Hickenlooper pledged to continue efforts to strengthen methane emissions standards for oil and gas producers. While governor of Colorado, Hickenlooper helped form the first state-level limits on methane pollution from oil and gas wells, which are estimated to have cut Colorado's methane leaks by over half, according to his campaign website.

Defeated incumbent Gardner, a member of the Senate Energy and Natural Resources Committee, has advocated for research into clean energy technologies, including battery storage and nuclear power. But he also supported efforts to roll back environmental regulations for the oil and gas sectors and speed application reviews for LNG export terminals.

Other new climate action advocates in the Senate will include Democrat Ben Ray Luján of New Mexico, who is currently a U.S. congressman representing the state's third district. Since 2019, Luján has been a member of the U.S. House of Representatives' Select Committee on the Climate Crisis, which released a massive climate action framework in June 2020. Prior to his time in Congress, Luján was chairman of the New Mexico Public Regulation Commission, where he helped develop the state's renewable portfolio standard.

Retired U.S. Navy pilot and astronaut Mark Kelly, who won the Arizona Senate seat currently held by Republican Martha McSally, has not held public office before but is likely to back aggressive action on climate change and clean energy. Kelly said unchecked climate change "poses a threat to Arizona's economy and our way of life," and that the need for action on the issue prompted his Senate run.

"I have seen the planet change from space, and wanting to stop that and protect our state and our planet is part of what inspired me to run," Kelly said. "As an engineer and astronaut, I care deeply about climate change and its impact on our country and our planet."

But not all incoming senators have voiced urgency on climate change. Alabama Senator-elect Tommy Tuberville, who beat Democratic incumbent Doug Jones, said in a 2019 interview that “you do have a little bit change of weather” but “somebody needs to prove to me that it is because we are burning coal or we have cars driving on the streets.”

## House

Democrats lost several House seats in the November 2020 elections, narrowing their majority in the lower chamber. But a handful of new members are expected to bolster the party’s push to pass clean energy and climate legislation in the new Congress.

“I think there’s a lot of energy and unity within the Democratic caucus on the need to move to 100% clean energy and address climate and environmental justice issues,” said Craig Auster, senior director of political affairs for the League of Conservation Voters.

As a former North Carolina state legislator, incoming House member Deborah Ross voted to support clean energy legislation, oppose hydraulic fracturing, and address climate change. On her campaign website, Ross called for modernizing the electric grid to increase the distribution of renewable energy and creating incentives to expedite battery storage deployment to handle growth in intermittent renewable resources.

Ross also previously worked for a regional transit authority in North Carolina, where she focused on improving public transportation options. “In Congress, I will work to help drive investment in the transportation and infrastructure projects of the future and increase renewable energy options in pursuit of a more carbon-free future,” she said.

Other new House Democrats include Kai Kahele of Hawaii, who has chaired the Hawaii Senate’s water and land committee as a state legislator.

Several incoming Democrats are proponents of the Green New Deal climate action platform, which calls for transitioning the U.S. to 100% carbon-free electricity while providing jobs and healthcare guarantees for all Americans.

Green New Deal backers entering the House include Nikema Williams, who won the Georgia seat held by the late Democratic Rep. John Lewis; Marie Newman, who will represent Illinois’ 3rd congressional district; and Ritchie Torres, who won the race for New York’s 15th congressional district.

Many new Republican House members have also expressed a desire to fight climate change.

“Nearly all [new House Republicans] have made some public comments about dealing with CO2 emissions reductions or climate change or embracing more new clean energy,” said Luke Bolar, managing director of external affairs for ClearPath, a nonprofit organization focused on advancing conservative clean energy policies.

But many freshman Republicans have echoed party leadership in wanting to avoid more sweeping climate policies.

Representative-elect Cliff Bentz of Oregon, who will fill the seat held by retiring House Energy and Commerce Committee Chairman Greg Walden, R-Ore., was part of a group of Oregon state senate Republicans who walked out during the state’s 2019 legislative session to effectively block Gov. Kate Brown and the Democrat-majority legislature from passing a carbon tax bill.

But Bentz has advocated other climate solutions, including carbon capture and sequestration and the development of solar energy, according to an August 2019 story by The Dalles Chronicle.

Florida voters elected a handful of new Republicans who have pledged to help coastal areas in the state prepare for the impacts of climate change, including through increased infrastructure investment. Those incoming members include Carlos Gimenez, who previously served as mayor of Miami-Dade County, and journalist Maria Elvira Salazar, both of whom defeated Democratic incumbents.



But Gimenez has openly opposed a tax on carbon dioxide emissions, saying it would hurt the poor and middle class. As with many existing House Republicans, the crop of new GOP members has instead promoted private sector innovation to reduce emissions, including from fossil fuel-based energy resources.

“We need to encourage the private sector innovation which is driving the transition to renewable energy sources,” said Representative-elect Peter Meijer, R-Mich., who will fill Libertarian Rep. Justin Amash’s House seat. “At the same time, we need to understand that our power needs will always require on-demand energy sources. I support an all-of-the-above energy strategy that includes wind, solar, hydro, nuclear, and natural gas components.”

## COVID-19 slows breakout year for US battery storage in 2020

*By Garrett Hering, Reporter, Power, S&P Global Market Intelligence*

Going into 2020, Pacific Gas and Electric Co. expected two of the world’s largest lithium-ion battery storage projects, both adjacent to Vistra Corp.’s Moss Landing CC natural gas-fired power plant on California’s Central Coast, to contribute nearly 500 MW of four-hour energy storage combined by the end of the year.

But Vistra’s Moss Landing Energy Storage Facility, under contract to provide an initial 300 MW to the PG&E Corp. subsidiary, and the utility’s own 182.5-MW Tesla Moss Landing Battery Energy Storage Project (Elkhorn) are both delayed, a spokesperson for Pacific Gas and Electric, or PG&E, confirmed. Those projects will not start coming online before early to mid-2021, the companies said.

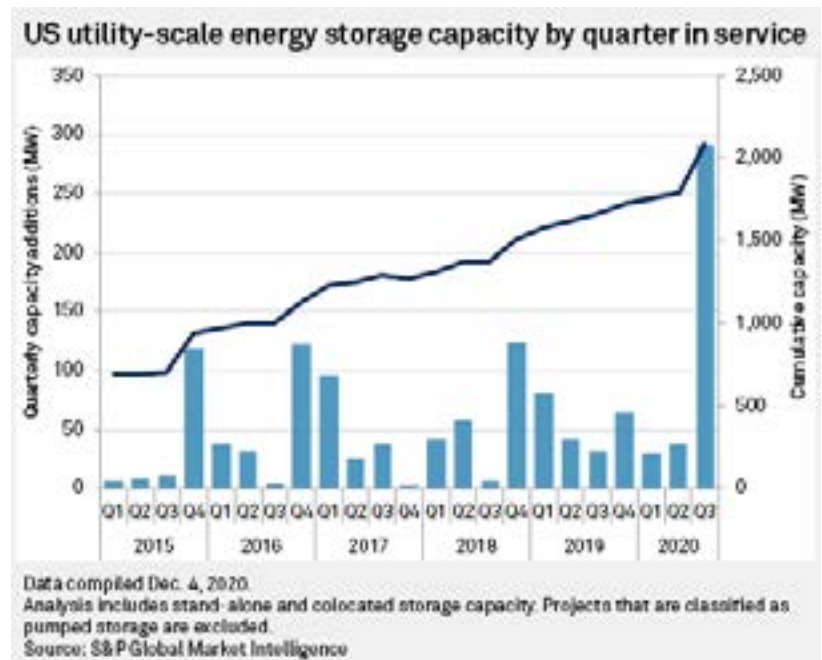
Such delays, largely related to the COVID-19 pandemic, have slowed but not stopped a breakout year for U.S. battery storage in 2020. Developers still appear on track for record deployments in 2020 after adding more utility-scale capacity in the third quarter than in all of 2019 according to S&P Global Market Intelligence data.

Including about 400 MW installed through September at stand-alone battery stations and hybrid projects with wind farms, solar plants and gas facilities, the total amount of utility-scale battery storage brought online in 2020 reached nearly 1,500 MW. That would be almost seven times as much as developers completed in 2019. Even with further delays, market analysts still expect that when all data is calculated, annual nonhydroelectric energy storage additions in 2020 will surpass 1,000 MW for the first time.

In the next three years, volumes are poised to dwarf all previous years combined, with more than 15,000 MW of utility-scale storage planned to enter service between 2021 and 2023, S&P Global Market Intelligence data shows.

### ‘An integral role’

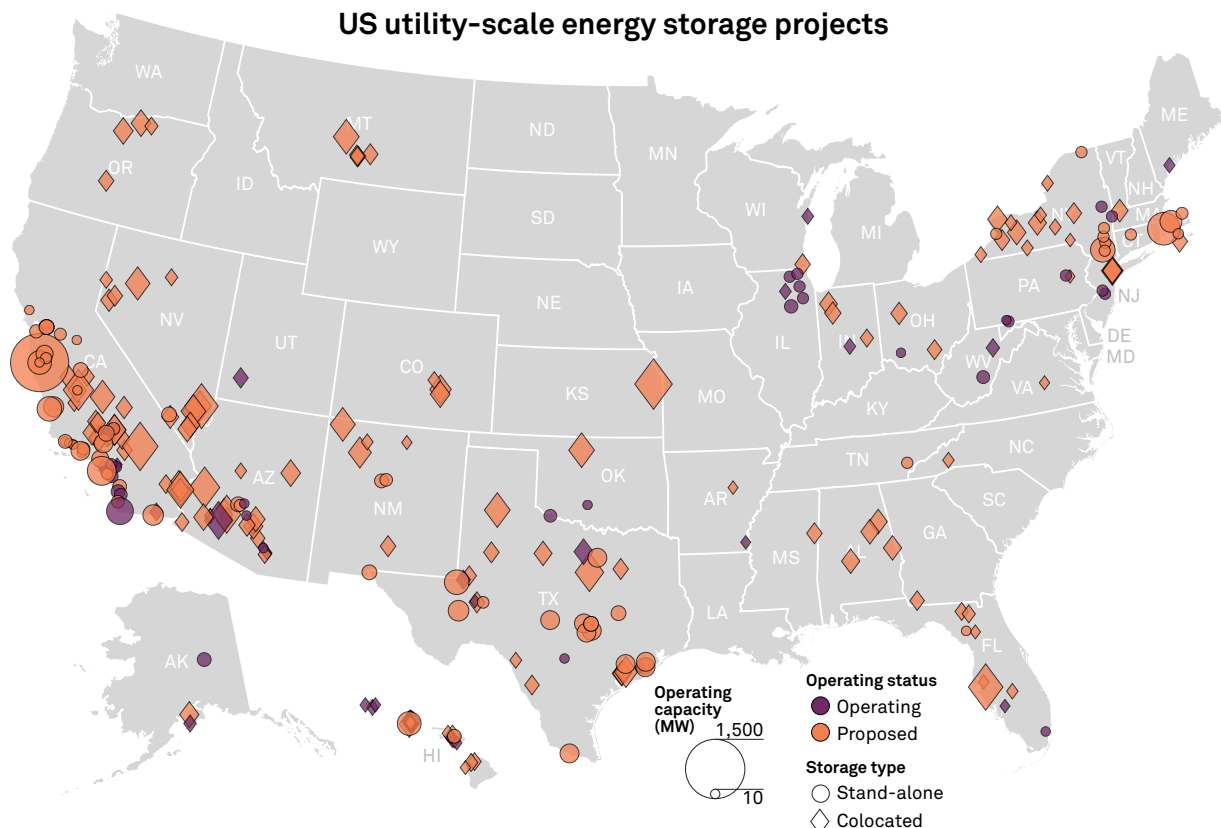
Despite the pandemic’s effects, there were some big successes in 2020. Currently the largest operating battery storage facility in the United States, LS Power Group’s 250-MW Gateway Energy Storage Project in Southern California, reached



full power in September. Underpinned by contracts with PG&E and Southern California Edison Co., the one-hour storage project is scheduled to expand to three hours by next summer.

U.S. utilities are increasingly looking to such large-scale energy storage projects to keep the lights on as they decarbonize their power systems. That is especially true in California, which must quickly confront the state's suspect electric grid reliability after a heatwave, poor planning for higher shares of renewable energy and thin capacity reserves led to rolling blackouts in August.

"Battery energy storage plays an integral role in enhancing overall electric grid efficiency and reliability, integrating renewable resources while reducing reliance on fossil fuel generation," PG&E spokesperson Paul Doherty said in an email. "It can serve as an alternative to more expensive, traditional wires solutions, resulting in lower overall costs for our customers."



As of Dec. 4, 2020.  
Analysis includes both stand-alone and colocated storage.  
Excludes projects classified as pumped storage and projects that are less than 10 MW in capacity.  
Map credit: Elizabeth Thomas  
Source: S&P Global Market Intelligence

**S&P Global**  
Market Intelligence

### Nationwide battery buildout

Much of the capacity in active development is in the Southwest, led by contracted projects in California, Texas, Nevada and Arizona, with significant capacity also planned in Florida, Hawaii, Massachusetts and New York.

NextEra Energy Inc., one of the most prolific developers, plans to spend more than \$1 billion in 2021 on a nationwide battery building spree, said John Ketchum, president and CEO of NextEra Energy Resources LLC, the company's development arm, during a third-quarter 2020 earnings call.

NextEra is on track to complete the 409-MW Manatee Energy Storage Center in 2021; the center is at NextEra's FPL Manatee Solar Energy Center (Parrish Facility) and is operated by its Florida Power & Light Co. utility, NextEra Energy Inc. CFO Rebecca Kujawa said. NextEra Energy Resources plans to deliver 1,275 MW of battery storage capacity in 2021 and 2022, mostly in the Southwest, up from only 14 MW in 2020.

NextEra's Fish Springs Ranch Solar Farm and Dodge Flat Solar Energy Center in Nevada, both under contract with NV Energy Inc., are scheduled for completion in 2021, adding a combined 300 MW of solar with 75 MW of energy storage. Also on track for completion in 2021 is NextEra's Wheatridge Solar & Battery Storage Facility in Oregon, part of a wind-solar-storage project with Portland General Electric Co., and several large battery additions at existing solar farms under contract with Southern California Edison.

NextEra sees significant growth for such "trifecta opportunities" combining wind, solar and batteries, as well as solar-plus-storage projects and stand-alone stations in the next few years, Ketchum said.

In all, NextEra and other developers have lined up about 6,500 MW of planned battery storage additions in 2021, followed by another almost 9,000 MW in 2022 and 2023, according to S&P Global Market Intelligence data. The pace at which that pipeline comes online, though, may depend on factors well outside of the industry's control, including the pandemic's trajectory, the rollout of vaccines and the pace of economic recovery.

## Renewables developers vying for more than 40 GW in Europe's 2021 auction bonanza

*By Yannic Rack, Reporter, Energy, S&P Global Market Intelligence*

Renewable energy developers are set to compete for dozens of gigawatts worth of government contracts to build new renewable energy plants in Europe during 2021, teeing up a bumper year for the industry at a time of increasing focus on reaching EU climate targets.

More than 40 GW of new wind and solar photovoltaic capacity is scheduled to come to auction in 10 of the largest renewables markets on the continent, according to an analysis by S&P Global Market Intelligence and S&P Global Platts. Scheduled bidding processes include the largest ever auction round in the U.K. and some of the first tenders held in Spain's red-hot renewables market in almost four years.

The tenders will provide ample opportunity for utilities, oil companies and other investors to build out their project pipelines. Power producers including Enel SpA and Iberdrola SA have already announced major new investment plans that require an acceleration of their green energy buildout. And oil majors like BP PLC, Royal Dutch Shell PLC and Total SE are stepping up their pursuit of large-scale projects to meet their own decarbonization targets amid increasing investor pressure.

In the 10 countries that were analyzed, at least 13 GW of solar and more than 30 GW of onshore and offshore wind capacity will likely come to auction over the next 12 months. In total, the new volumes would equate to 15% of the installed capacity across the three technologies for those countries, although some of the projects will not be awarded until after 2021 and many will take much longer to build.

Auction schedules could change, and the volumes on offer in some of the tenders are only provisional. There are also some countries that are scheduled to hold onshore renewables auctions but have not yet published planned volumes, including the Netherlands, Portugal, Denmark and Ireland.



The tenders come as countries continue to ramp up their renewable energy targets in light of higher EU ambitions to cut greenhouse gas emissions. They also show that governments are unlikely to rely entirely on markets to deliver that green buildout, despite focus in the industry shifting increasingly away from state-run procurement toward merchant development backed by contracts with corporate energy buyers.

**Offshore wind**

The largest share of new capacity could come from a handful of offshore wind auctions planned in six countries. Together, those tenders could increase the current capacity of turbines spinning off European shores by two-thirds, although many of the projects would not be installed until the end of the decade.

One of the most-watched bidding processes of the year is set to play out in the U.K., where the government is planning to award contracts for difference, or CfDs, for about 12 GW of new onshore and offshore plants — twice the volume awarded during the country’s last round, which saw prices drop to record lows.

The renewables industry overall has matured to the point where developers are now comfortable bidding at or below the wholesale market price to secure development rights. The Netherlands and Germany have previously awarded offshore wind projects without direct subsidies, and a solar tender in Portugal in 2020 ended with most winners paying the state to secure grid connections, rather than the other way around.

That makes it likely the next 40 GW of renewables contracts will be the cheapest 40 GW ever procured in Europe.

In the U.K. at least, competition is set to be intense again: As much as 17 GW of projects could be eligible to bid in the upcoming round, according to Cornwall Insight, a consultancy. “It is clear the industry is gearing up for the opportunity provided by the [CfD auction], especially when compared to alternative subsidy-free options,” Lucy Dolton, an analyst at Cornwall Insight, said last November.

At least 5 GW of offshore wind projects are lined up to compete in the U.K., and several more could get their permits ready in time, according to trade association RenewableUK. For the first time since 2015, there are also gigawatts of

onshore wind and solar projects expected to bid, after the government decided to reverse its policy of excluding more mature technologies from its CfD program.

Across Europe, 2021 will also see a wave of tenders for floating offshore wind parks. Used in deeper waters, they have only been deployed at demonstration sites so far, although developers are itching to build larger plants.

Specific floating projects will be tendered in France and Norway, and developers can also bid them into the U.K.'s CfD auction, where they will compete with other less established technologies.

### **Spain comes roaring back**

Spain, which has emerged as one of the most lively unsubsidized markets in Europe, is set to hold its first annual tenders for onshore renewables since 2017. The government has relaunched auctions in a bid to reach its 2030 climate targets, which require doubling the share of renewable sources in total energy consumption and will see almost 20 GW of capacity auctioned by 2025.

The last three tenders held in the country led to the installation of a combined 7 GW of new capacity up until 2020. But since then, new projects — most of them merchant plants backed by power purchase agreements with utilities or corporates — have lagged far behind what is needed to meet the 2030 obligations.

The two biggest power generators in the country, Iberdrola and Enel-owned Endesa SA, have played down the importance of auctions, which they see mainly as a gateway for smaller competitors without the wherewithal to finance projects on their balance sheets. Still, Endesa CEO José Bogas told investors last November that the utility plans to participate.

In some markets, regulators are more likely to worry about a lack of competition. Onshore wind tenders in Germany have been heavily undersubscribed, as developers have seen their projects held up by lawsuits and lengthy bureaucratic procedures. The government is now mulling payments for local communities to increase acceptance for new projects and recently passed measures to speed up grid expansion so that more plants can be connected.

The growth engine behind Europe's early renewables buildout, Germany is now hoping to propel wind and solar into a post-subsidy era where state contracts are awarded at or below wholesale market prices. For offshore wind, the government recently rejected calls from the industry to switch to U.K.-style CfDs, opting instead to randomly allocate awards in the event of multiple zero-subsidy bids.

Developers in neighboring France have also been rankled by recent policy proposals, decrying a plan floated by the French government to renegotiate existing solar power contracts for some older plants. Similar retroactive cuts to subsidies caused investor confidence to evaporate in Spain after the last financial crisis.

Still, more countries are launching auction programs. Germany has said it wants to auction 40 GW of new renewables by 2025 but is now revising its plans to take into account the EU's higher emissions cuts. Meanwhile, Brussels has even said it could introduce regular bloc-wide renewables tenders from 2021.

That means industry groups are left to only increase their installation forecasts, even amid the disruption caused by the coronavirus pandemic. SolarPower Europe said Dec. 15, 2020, that it expects annual solar additions to surpass 35 GW by 2024.

"The next few years we will see very steep growth because of the many tenders we are seeing," said Michael Schmela, the group's executive adviser and head of market intelligence.

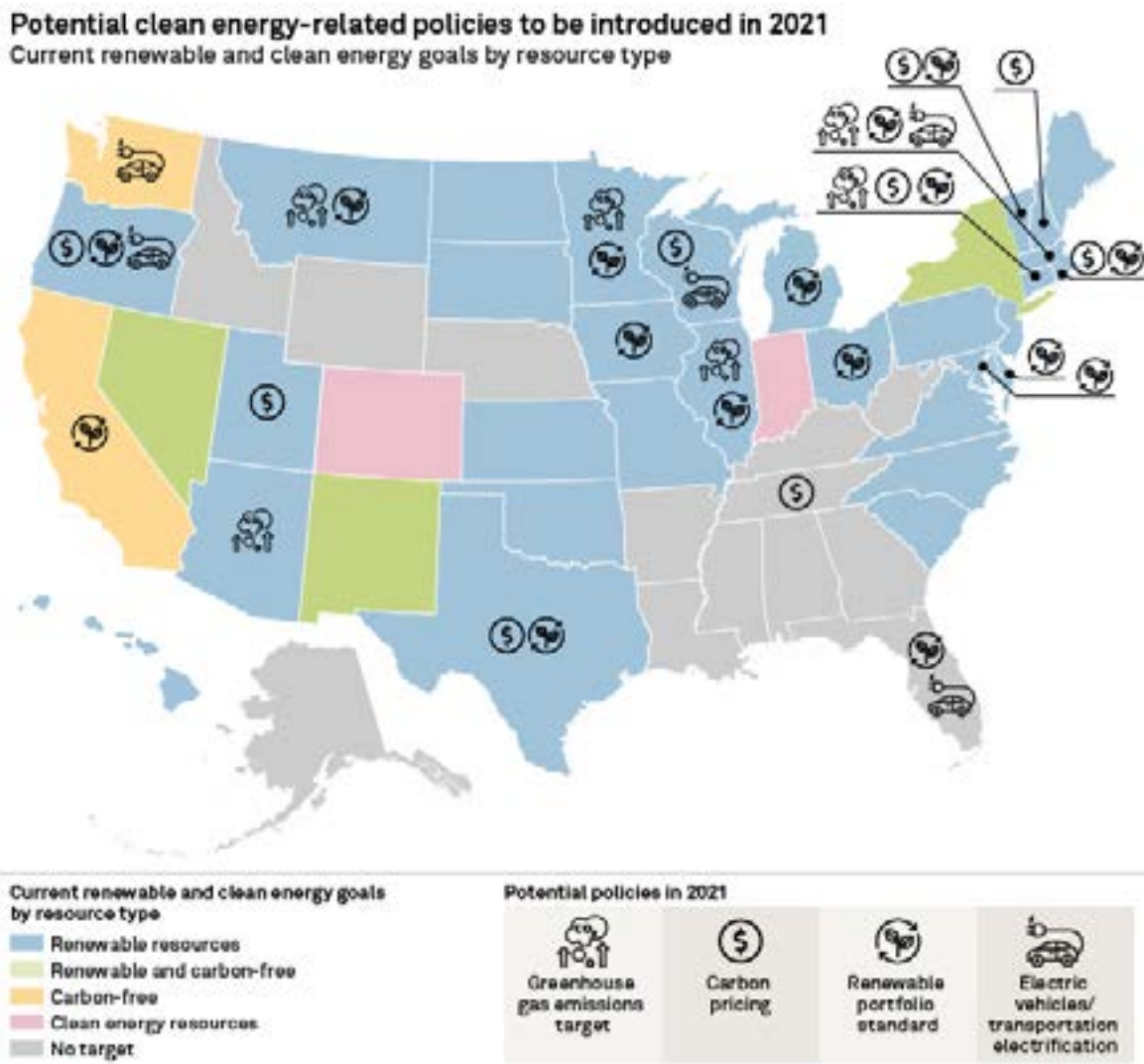
*Henry Edwardes-Evans and Andreas Franke, reporters with S&P Global Platts, contributed to this article.*

# 2021 Renewable Energy Policy Outlook

By *Monica Hlinka, Research Analyst, Energy, S&P Global Market Intelligence*

As states look to recover from the various economic challenges of the coronavirus pandemic and address social justice reform, renewable energy policy may be less of a legislative priority in the upcoming sessions. In prior years, such policies have flourished by way of legislation and executive orders, but such positive momentum at the state level may not be sustainable as priorities begin to shift.

On top of that, a majority of the states who championed ambitious renewable energy policies in the past have already enacted aggressive and robust measures, such as 100% renewable portfolio standards and net-zero greenhouse gas emissions targets. These states are now looking at measures to achieve those targets, whether through energy storage bills, a clean fuel standard or renewable natural gas policies.



Data as of Dec. 15, 2020.  
List was compiled on a best-efforts basis and may not be comprehensive.  
Indiana, Kansas, North Dakota, Oklahoma, South Carolina, South Dakota and Utah have renewable portfolio goals instead of standards.  
Credit: Arleigh Andes  
Source: S&P Global Market Intelligence

California, a clean energy movement leader, could potentially look to move up its clean energy goal. The state, which for the past few years has been ablaze with wildfires, currently has a goal of 100% of all retail sales should come from renewable energy and zero-carbon resources by 2045. Gov. Gavin Newsom has said that the state is “in the midst of a climate emergency” and that the 2045 target year is “too late.” California state lawmakers may look to pass legislation in 2021 that would move the plan forward from 2045.

As in prior years, legislators may begin to look at implementing carbon-free goals and mandates, rather than renewables-only targets. This trend is likely due to states and investor-owned utilities continuing to announce their greenhouse gas emissions reduction targets. States such as Florida, Illinois, Oregon and Texas may look to introduce measures that would implement a 100% RPS requirement or bills to conduct studies on the feasibility of implementing such a target.

As a shift in Georgia’s political landscape occurs, it would not come as a surprise to see legislation introduced in the Peach State that would implement a renewable energy goal, albeit a small target. Currently, the state does not have a renewable portfolio standard; however, the Georgia Public Service Commission began requiring Southern Co. subsidiary Georgia Power to install notable solar amounts in 2013 through the company’s integrated resource planning proceedings. Earlier in 2020, Southern Co. announced its long-term greenhouse gas emissions reduction goal of net-zero emissions by 2050. Additionally, several major cities in the state have enacted 100% RPS goals, which could help spur conversations at the state level.

While carbon pricing measures, which could help mitigate climate change, have been introduced countless times in the Northeast and Pacific Northwest states, lawmakers have failed to garner enough votes to pass such legislation. A climate crisis act is expected to be introduced by legislators in Rhode Island and would establish a fee on companies that sell fossil fuels within the state. Oregon policymakers could potentially look to give up on their battle to enact such measures and instead try to muster enough support to pass a 100% clean energy standard.

In an attempt to reduce carbon emissions, Washington could look to move forward with its goal of decarbonizing its transportation sector. In its most recent draft of the state’s 2021 Energy Strategy, the Washington Department of Commerce articulates that establishing targets for electric vehicle sales and adopting a low-carbon fuel standard are two critical legislative actions necessary in achieving that goal. A potential low-carbon fuel standard would be a comprehensive mechanism to replace fossil fuels with electricity, hydrogen and clean synthetic or biogenic fuels. Additionally, legislators may introduce measures that would complement a memorandum of understanding that Gov. Jay Inslee signed along with 15 other jurisdictions. This memorandum set a goal to ensure that 100% of “all new medium- and heavy-duty vehicle sales be zero emission vehicles by 2050 with an interim target of 30% zero emission vehicle sales by 2030.”

Several Northeastern and Mid-Atlantic states have joined a regional collaboration, the Transportation and Climate Initiative, which seeks to “improve transportation, develop the clean energy economy and reduce carbon emissions from the transportation sector. Policymakers in the 13 participating jurisdictions may look to introduce measures that could mirror policies laid out in a memorandum of understanding, which was released on Dec. 22, 2020. The governors of Massachusetts, Connecticut, and Rhode Island, and the mayor of the District of Columbia have announced they will be the first jurisdictions to launch the multi-state program.

# Mitsubishi Power, Entergy executives envision green hydrogen future

By Garrett Hering, Reporter, Power, S&P Global Market Intelligence

- The need to balance variable renewable resources and reliably decarbonize energy systems is driving new interest in hydrogen.
- Near-term hydrogen generation and storage projects in Texas and Utah could offer potential pathways for carbon-free energy systems.
- Tax incentives, deployment targets and utility commitments will be key commercialization drivers.

*S&P Global Market Intelligence spoke with Paul Browning, CEO of Mitsubishi Power Americas Inc., an affiliate of Japan's Mitsubishi Heavy Industries Ltd. and an emerging supplier of hydrogen generation and storage technologies, and Paul Hinnenkamp, COO at utility Entergy Corp., in a joint interview on the future of hydrogen. The companies are exploring hydrogen and battery storage projects throughout Entergy's four-state service territory in Arkansas, Louisiana, Mississippi and Texas.*

This interview has been edited for length and clarity.

**S&P Global Market Intelligence: There is a lot of talk about hydrogen these days. What is behind the resurgence of interest?**

**Paul Browning:** We now have utilities with enough renewables on their grids that they have a real need for long-duration storage. On top of that, some of the decarbonization targets that utilities like Entergy are making, that's also new. That combination of having real market signals that the grid needs storage, through renewable energy curtailments and duck-curve energy pricing, as well as the commitments by major utilities to decarbonize their power grids, is new and is really driving the interest in hydrogen.

**Paul Hinnenkamp:** As intermittent renewables get built out, the inherent risk of blackouts is very real and it speaks to the need for flexible capacity you can count on, i.e., gas turbines. If we look at our commitment of net-zero carbon emissions in 2050, the path to get there with that capacity is green hydrogen. It's real today as an opportunity for us.

**How real, how big is this opportunity?**

**Hinnenkamp:** We just finished two large combined-cycle plants, and a third in Texas is nearing completion. We would be looking at those, as well as any new ones, to convert to hydrogen. I think the potential is significant, not only to convert new and existing generation assets to hydrogen. It's the potential for storage, both battery and hydrogen. It's the potential for electrolysis facilities, powered either by renewables or baseload nuclear. We have laid out, conceptually, what it will take to get to our 2050 target with this hydrogen effort. It's not an overnight solution. It will take time and it will take work, but it's certainly a path we see as very viable, very achievable.

**Browning:** The three projects that we've already worked on together are about 1 GW each, and a new project in Texas is about 1.2 GW. So we're not talking about small, demonstration kind of projects. We're talking about major utility-scale storage and power generation. Also, we have a strategy to decarbonize the entire Western Interconnect, based on the Intermountain project in Delta, Utah, with the Los Angeles Department of Water and Power. These are game-changing projects that have wide implications for achieving the net-zero carbon targets in different parts of the U.S. and around the world. We are in the early stages of a multidecade rollout of hydrogen that's really going to be, I believe, the linchpin that helps us achieve not just the power-sector decarbonization targets but the rest of our uses of carbon-emitting fuels as well.



**What is the role of the existing hydrogen infrastructure overlapping with Entergy's service area in southeast Texas?**

**Hinnenkamp:** There is a lot of opportunity with that infrastructure. In fact, we own storage caverns in that area, and we have started exploring how to store hydrogen in one of those caverns, and there is existing hydrogen pipeline infrastructure in that area. For the Orange County Power Station, for example, which we have proposed in the Sabine area of Texas, we've started talking to hydrogen providers about providing hydrogen to that asset. We would initially go 30% hydrogen, 70% natural gas upon commercial operation in 2026, and we would design it upfront to get to 100% hydrogen at some point. So, we would start there, and then over time, we would look to expand that infrastructure.

**Browning:** We've been using hydrogen now for over three decades to desulfurize motor fuels in the refining industry. There's decades of experience storing hydrogen in salt dome caverns like the three existing ones in Texas, and there are over 500 miles of existing hydrogen pipelines that connect all of those storage domes to refineries. So, transporting hydrogen through pipelines is also a well-known, well-established technology.

**Still, renewable hydrogen is not common today. How do you change that?**

**Browning:** Where we've got more work to do is in the gas turbines. We've used nearly 100% hydrogen in gas turbines in the past using older combustion technology that was not as low in emissions of pollutants like nitrogen oxide and carbon monoxide. But with the most recent combustion systems that are extremely low emission of those other pollutants, those right now are capable of using about 30% hydrogen. We're working on giving them the capability to use 100% hydrogen. Another important area is electrolysis, a relatively small industry. What we expect to see as we get economies of scale with electrolysis is the same kind of dramatic cost reductions that we saw with solar panels, wind turbines and lithium-ion batteries. Finally, it's important to see hydrogen today as a storage technology and compare its costs to other storage technologies rather than as a fuel because it's going to take us some time to get the overall cost to be competitive, for example, with natural gas.

**How does hydrogen compare on cost with other storage today?**

**Browning:** For short-duration storage, four hours or less, right now at today's prices, lithium-ion batteries are lower cost. We have a lithium-ion business that's just booming. But when you get to 10 or 12 hours, then the cost comparison flips. So, we think both technologies are going to be really important to the future. Day-to-day, week-to-week, month-to-month and seasonal storage are going to be very important.

**Europe recently set some aggressive targets to help scale up green hydrogen. Does the U.S. need to follow suit?**

**Browning:** It's decarbonization targets by utilities that are driving this in many cases. But one thing that we would really like to see is an investment tax credit for stand-alone storage. We think that would really help move the needle. Also, something analogous to renewable portfolio standards would be very helpful.

**Hinnenkamp:** There is certainly a role for smart policy for what we're trying to achieve, but I would say policy is not driving us.

**What is hydrogen's biggest hurdle?**

**Browning:** There's a little bit of a chicken-and-egg issue. The underground infrastructure won't get built until there's facilities above ground that need hydrogen. And the facilities above ground won't get built unless there's an underground infrastructure to provide the hydrogen. That's why you're seeing the early activity happening in places like Texas and Utah, where a lot of that underground infrastructure already exists or is low cost to put in place, and the above-ground need for decarbonization is very real. In other parts of the country, for example, PJM Interconnection and New York ISO, the underground infrastructure does not exist so we're putting hydrogen storage on-site in smaller quantities, sometimes above ground, sometimes below. That power demand then will allow an investor to make the investment in large-scale, below-ground infrastructure. So, I think we've got that chicken-and-egg problem pretty well addressed.

**Hinnenkamp:** I mean, straight up, there's a significant amount of work to be done. I need to get the economics right, that's the big one, and I need to get support from customers, communities, regulators and other stakeholders. I need to get a little further down the road on bending that cost curve on electrolysis and then being able to take that and power a unit. And I need to demonstrate that. I think the reliability will get there. It's just a matter of time.

**Browning:** We're sort of where we were five to eight years ago on solar, maybe where we were a decade ago on wind, or five years ago on lithium-ion batteries, where the industry is starting to scale, and you can see a very clear cost trajectory as a result of that scale. But it hasn't happened yet, and so until we really see it take off and scale ... well, seeing is believing.

**What does your crystal ball say about hydrogen in the next few years?**

**Browning:** The next few years are actually crystal clear to me. We already have full notice to proceed on the project in Utah. It's got a 2025 commercial operation date. We've guaranteed the customer that that power plant is going to be able to use 30% hydrogen in 2025 and the customer has made a commitment that no later than 2045 it will be ready to convert to 100% hydrogen. With Entergy, that Orange County project has a delivery date of 2026. Assuming they get through the approvals, we'll be off and running on that project as well. We also have projects in the Netherlands, in Australia and Japan. That's the exciting thing. We have real projects, with real commercial operation dates, that we're really working on.

**Hinnenkamp:** My crystal ball says we have real projects that are on the table, that need to get developed, need to get selected and need to get approved. And should they, I think we will see some power plants powered by hydrogen, by us, this decade. I don't have a date yet for 100% green hydrogen on one of those power plants, but it's certainly our aspiration to have that delivered as soon as we can, assuming all the economics and technology are there.

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