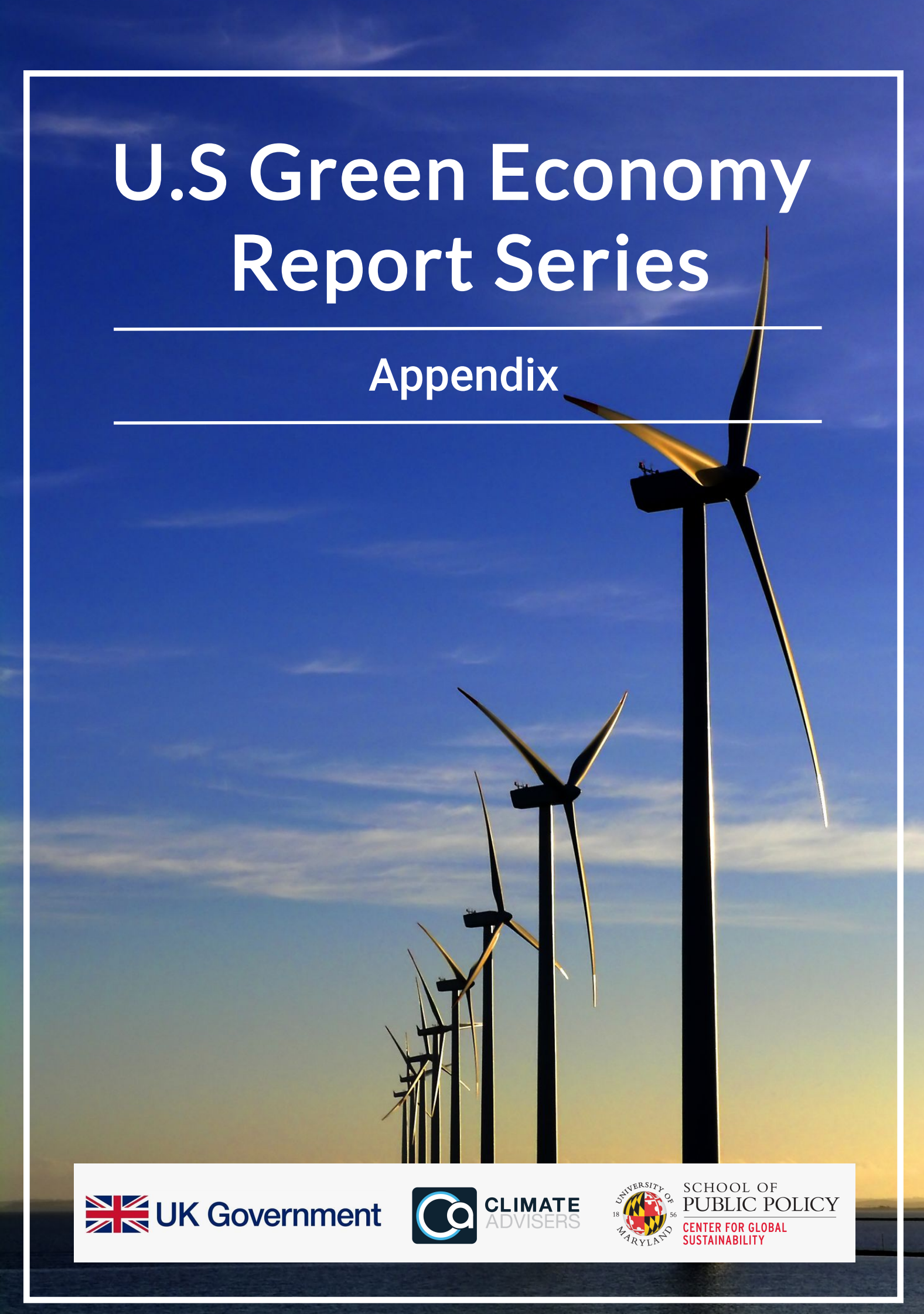
U.S Green Economy Report Series

Appendix



UK Government

CLIMATE ADVISERS

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SCHOOL OF PUBLIC POLICY

CENTER FOR GLOBAL SUSTAINABILITY

METHODOLOGY FOR STATE OPPORTUNITY ASSESSMENTS

Ratings by State: Overall Policy and Action and by Technology

low — high

State Name	Green Economy Policy and Action	Energy Efficiency	Grid	Energy Storage	Green Consultancy	Waste to Energy	Electric Vehicles	CCUS	Hydrogen	Offshore Wind
Arizona										
California										
Colorado										
Florida										
Georgia										
Illinois										
Louisiana										
Massachusetts										
Maine										
Michigan										
Minnesota										
Montana										
North Carolina										
New Jersey										
New Mexico										
Nevada										
New York										
Ohio										
Pennsylvania										
South Carolina										
Tennessee										
Texas										
Virginia										
Washington										
Wisconsin										

Table: Climate Advisers • Created with Datawrapper

Green Economy Policy and Action Score: The evaluation criteria for the green economy policy and action score includes the following: whether the state has a renewable or clean energy standard; whether the state has a greenhouse gas emissions target; the state's party make-up for governor and its legislature; and whether the state has passed major climate legislation in the past four years. In calculating the recommendation, each of the four categories were given equal weighting of 25 percent to determine a score of 0-100 points. Green represents scores above 75 points; Yellow represents 25-75 points; and Red represents scores below 25 points.

Carbon Capture, Utilisation and Storage (CCUS): The evaluation of the growth potential in CCUS is based on the following criteria: regulatory framework, incentive structure, technological research, utilisation projects, existing infrastructure and regional dynamics. Where data is available, geographic potential for carbon storage, the number of facilities which potentially qualify for a federal CCUS tax credit and total emissions that could be captured are taken into account. As CCUS is a nascent technology, the ranking system does not represent immediate potential for large-scale projects, but whether progress, both politically and commercially, is expected in the next 3-5 years. Red represents states with little to no progress/potential in the majority of categories. Yellow represents states with modest progress in two or more areas. Green represents significant progress in two or more areas, or modest progress in three or more areas.

Electric Vehicles (EV): The evaluation criteria for the growth potential of the energy efficiency sector is based on the State Transportation Electrification scorecard from the American Council for an Energy Efficient Economy (ACEEE). The ACEEE ranking is based on EV purchases, charging infrastructure goals and planning, incentives for EV deployment, equity and outcomes as well as other considerations. In this report, green represents states ranked 1-15, yellow represents states ranked 16-30, and red represents unranked states.

Energy Efficiency: Energy efficiency technologies discussed in this report include LED lighting, renewable heating and cooling, high efficiency HVAC and smart meters. The evaluation criteria for the growth potential of the energy efficiency sector is based on the ACEEE's 2020 State Energy Efficiency Scorecard. The ACEEE ranking is based on the availability of utility and public benefits programmes and policies, building energy efficiency policies, state government-led initiatives on energy efficiency and appliance and equipment standards. In this report, green represents states ranked 1-15, yellow represents states ranked 16-30, and red represents states ranked higher than 30.

Energy Storage: Energy storage technologies discussed in this report include utility-scale lithium ion batteries, flywheel and pumped storage hydropower. The evaluation criteria for the growth potential of the energy storage sector is based on whether a state has procurement targets, regulatory requirements, demonstration programmes, or financial incentives policies for energy storage. Green represents states with 3-4 of those policies, yellow represents states with 1-2 of those policies, and red represents states with 0 of those policies. Ongoing and announced projects were also used as criteria for measuring the states' potential.

Green Consultancy: The evaluation criteria for green consultancy centered on how the state's technical potential for renewable energy ranked nationally, per the National Renewable Energy Laboratory. Other factors included the size of renewable energy projects in the pipeline, as well as the number of environmental consultants in the state and their pay. In this report, green indicates states with high technical potential rankings (top 15), large renewable energy projects and the largest number of well-paid environmental consultants (1,200+ and $70,000+). Yellow indicates states with moderate technical potential rankings (ranks 16-35), sizable renewable energy projects and significant numbers of relatively modestly paid environmental consultants (800-1200 and $60,000-70,000). Red indicates states with low technical potential rankings (36-50), small renewable energy projects and a lower number of environmental consultants with relatively low pay (<800 and <$60,000). States were assigned green, yellow or red based on how closely they aligned with these broader ranges.

Grid Modernisation: The evaluation criteria for grid improvements looks holistically at a weighted range of indicators. The state's 2018 Grid Modernization Index ranking determined 40 percent of the state's green, yellow or red status. The remaining factors -- smart meter penetration rate (in comparison to the national average of 60 percent), a state's energy plan's focus on grid modernisation, demand response programme size (larger or smaller than a benchmark of 200,000 customers), customer data access policy strength, degree of legislative action (more or less than a benchmark of introducing 30+ grid-related bills) and recent policy and/or investment developments -- each made up 10 percent towards determining the state's green, yellow or red status.

Hydrogen: The report examined opportunities in green hydrogen and projects with potential to transition to green hydrogen. Three factors in green hydrogen have been evaluated: hydrogen fuel cell vehicles, green hydrogen production and hydrogen storage or integration. Under each, regulatory structures, incentives, infrastructure and current and planned projects are evaluated. Green represents states that have strong policies and/or incentives and large-scale projects or infrastructure in existence or planned in one or more technology areas. Yellow represents states which have made some progress on one or more technology or have proposed projects or incentives for one or more technology. Red represents states which have made little to no progress.

Offshore Wind: The growth potential of the offshore wind sector varies geographically. Therefore, the evaluation criteria is based on six geographic regions: 1) Northeast region, including Massachusetts and Maine, 2) Mid-Atlantic states, including Virginia, New Jersey and New York, 3) Southeast region, including North Carolina, South Carolina and Georgia, 4) Pacific region, including California and Washington, 5) Great Lakes region,

including Illinois, Michigan, Pennsylvania, Ohio and Wisconsin, 6) Gulf Coast region, including Texas, Louisiana and Florida. Northeast and Mid-Atlantic states, where favourable state policies and aggressive procurement targets have driven offshore wind development, were given green rankings. Southeast coast states, where offshore wind potential exists but has not received a strong policy push, were given yellow rankings. Pacific coast states, where strong policies exist but technical challenges like water depth have impeded industry growth, were also given yellow rankings. Great Lakes states, where state regulatory constraints have presented siting and permitting issues, were given red rankings, as were Gulf Coast states, where hurricane risks set forth technical and economic challenges for offshore wind turbines.

Waste-to-Energy: The evaluation criteria for waste-to-energy combined the state's performance across the biogas, transport and biomass sectors. Rankings of states' biogas growth were based on the American Biogas Council's state profiles, which forecasted future potential for renewable methane in each state. Potential in the transport sector was identified by tracking the strength and number of laws and incentives documented by the Alternative Fuels Data Center. Biomass potential was identified through each state's Energy Information Administration profile. In this report, green indicates high performance across all three sectors, yellow indicates moderate to high performance on at least two sectors, and red indicates low performance across all sectors.

METHODOLOGY FOR CLEAN ENERGY JOBS BY STATE/SECTOR

Clean Energy Jobs by Category: The E2 Clean Jobs America 2020 report provides clean energy jobs numbers by state for 2019 based on the following categories: renewables, grid and storage, energy efficiency, clean fuels and clean vehicles. This data is used for all states in the visual titled "Clean Energy by Category."

Clean Energy Jobs by Sub-Category: Since E2 Clean Jobs America data only provides granularity of clean energy sub-categories for select states and years, we used a combination of the United States Energy and Employment Report (USEER) and researched assumptions on the proportion of clean energy jobs in sectors with both clean energy jobs and combustion jobs.

State metrics were sourced directly from the USEER for the following sectors, in which all jobs are considered clean energy jobs: solar electric power generation, wind electric power generation, traditional hydroelectric electric power generation, energy storage, smart grid, ENERGY STAR and efficient lighting, traditional HVAC, high efficiency HVAC and renewable heating and cooling, advanced materials and other energy efficiency.

For the following sectors that include both clean energy jobs and combustion jobs, however, assumptions were made to approximate the proportion of clean energy jobs in a given sector based on data available in the University of Maryland School of Public Policy Regional Clean Energy report:

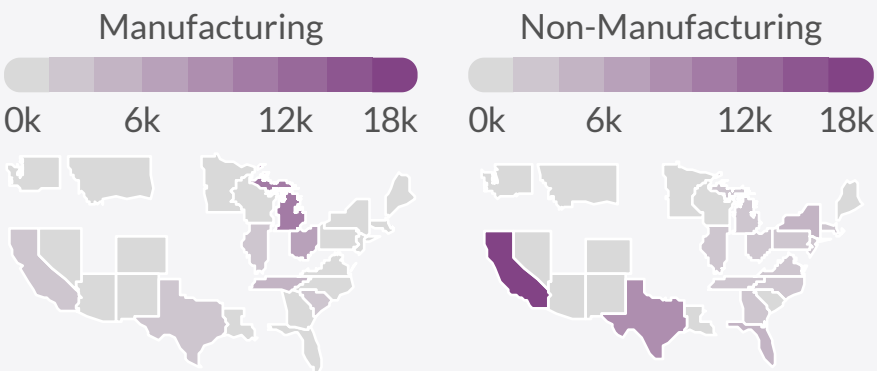
- Traditional electric power transmission and distribution: 58 percent of transmission and distribution jobs included.
- Micro grid: 61 percent of micro grid and other (including commodity flows) jobs included.
- Biofuels: 100 percent of corn ethanol fuels, other ethanol/non-woody biomass and woody biomass employment was included, along with 24 percent of other fuels jobs.

Finally, clean vehicle jobs were sourced from the E2 Clean Jobs America report for 2019 by state, along with the top ten states and national totals for 2017 and 2018. National clean vehicle jobs numbers were allocated to the remaining states using state multipliers calculated from 2019 state data. Clean vehicle jobs include electric vehicles, plug in hybrids, hybrid electric vehicles, hydrogen/fuel cell and natural gas vehicles.

METHODOLOGY FOR 2021 - 2025 CLEAN VEHICLE FORECASTS

Total motor vehicle jobs were sourced from the USEER, while the proportion of manufacturing jobs was calculated using North American Industry Classification System (NAICS) codes 3361 (motor vehicle manufacturing), 3362 (motor vehicle body and trailer manufacturing) and 3363 (motor vehicle parts manufacturing). The percentage of motor vehicle jobs in manufacturing for each state was then used to determine the expected manufacturing and non-manufacturing breakdown of clean vehicle jobs, assuming that current motor vehicle manufacturers will grow clean vehicle product lines over time. The constraint with this assumption is that it does not account for the new manufacturing plants that will be built in states without existing production. Covid-19 job losses were based on national data published by BW Research and allocated to each state in proportion to each state's share of clean energy jobs. Finally, state forecasts of clean vehicle jobs through 2025 are based on the growth in vehicle miles travelled for electric vehicles, fuel cell electric vehicles and liquid hybrid vehicles, projected through the Global Change Analysis Model (GCAM). Compound annual growth rates were calculated and applied for each state.

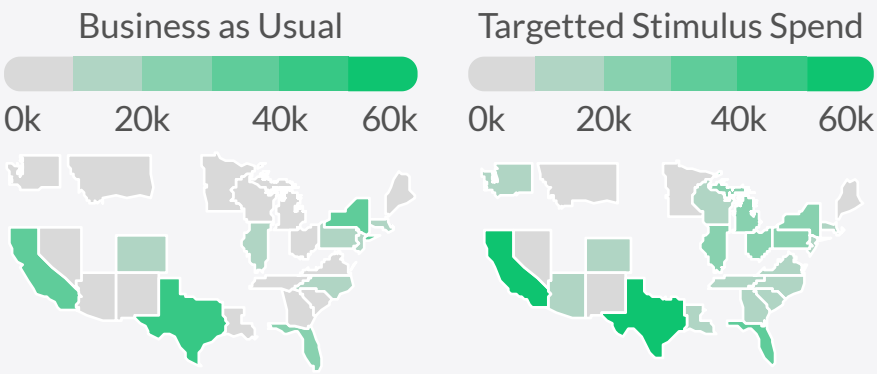
Regional Dynamics: The results of the analysis by state are included below in the form of total 2020 to 2025 FTE additions, split by manufacturing jobs and non-manufacturing jobs. Each state report also provides estimates by year, including the upfront impact of 2020 clean vehicle job losses.



METHODOLOGY FOR 2021 - 2025 ENERGY EFFICIENCY FORECASTS

Energy Efficiency Forecasts: Energy efficiency jobs include the USEER categories of ENERGY STAR and efficient lighting, traditional HVAC, high efficiency HVAC and renewable heating and cooling, advanced materials and other energy efficiency. Covid-19 job losses were sourced by state for 2020 from data published by BW Research. Energy efficiency jobs were particularly impacted by Covid-19, due to high customer interaction. For the base case, compound annual growth rates from 2016 to 2019 were applied between 2021 and 2025. For the more ambitious case, compound annual growth rates were calculated based on the number of jobs forecasted by state in the E2 2020 Energy Efficiency Jobs in America report, which assumes USD 61 billion of targeted stimulus. This scenario was included in this report because investment in energy efficiency has been shown to provide the highest number of jobs per dollar in the clean energy sector, and as such, is well positioned to be included in targetted stimulus spending, especially in the wake of high job losses during Covid-19. Notably, energy efficiency also outpaces fossil fuels at 8 jobs per million dollars of investment compared to 3 jobs per million dollars of investment.

Regional Dynamics: The results of the analysis by state are included below in the form of total projected 2020 to 2025 FTE additions. Each state report also provides estimates by year, including the upfront impact of 2020 energy efficiency job losses.

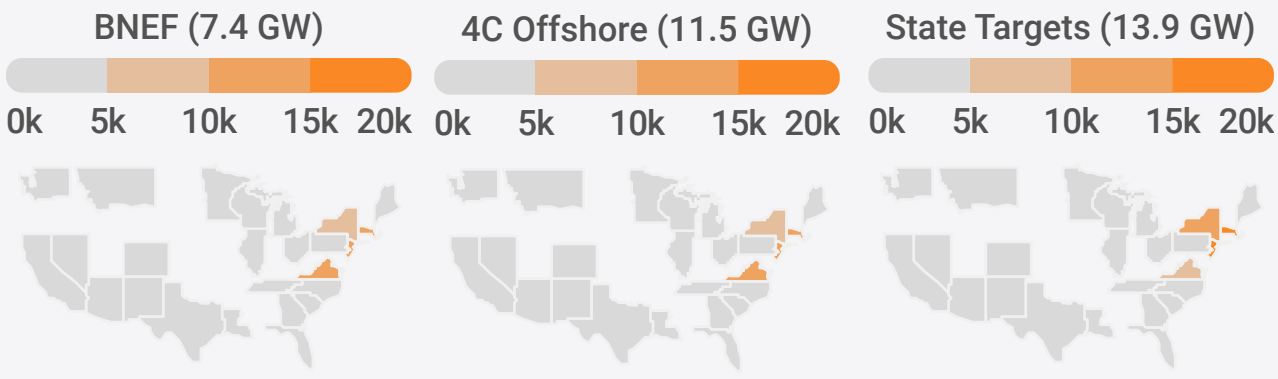


METHODOLOGY FOR 2021 - 2025 OFFSHORE WIND FORECASTS

Offshore Wind Forecasts: Capacity estimates were sourced from 4C Offshore, Bloomberg New Energy Finance, the Energy Information Administration and announced state targets (allocated on a straight line basis). Multiplier rates for both construction jobs and operation and maintenance jobs were sourced from the National Renewable Energy Laboratory (NREL) for the Southeast, Great Lakes, Gulf of Mexico and Mid-Atlantic regions. All rates were based on the NREL's moderate growth scenario. For the Northeast region, an average of Mid-Atlantic and Southeast rates were used. In all scenarios, capacity projections for the West Coast region were zero, given that the majority of growth is anticipated between 2025 and 2030 due to complexities associated with floating technology installations in deep waters.

Annual construction additions were averaged over the entire time period, in order to reflect FTEs, rather than short term jobs. Construction jobs were also assumed to last for just one year, in order to remain consistent with the NREL and the American Wind Energy Association (AWEA), although this assumption is likely conservative. Estimates may vary depending on the proportion of materials sourced in state.

Regional Dynamics: The results of the analysis by state are included below in the form of total 2020 to 2025 FTE additions. Each state report includes both the GW and the associated FTE additions that correspond to all four offshore wind scenarios. The projections based on the EIA pipeline are not included below or in the national report, since the pipeline adds up to less than 1 GW during the time period.



METHODOLOGY FOR 2021 - 2025 ENERGY STORAGE FORECASTS

Energy storage jobs include estimates for battery storage and pumped hydro storage. Battery storage capacity is varied according to three cases: the first case aggregates forecasted MW installed per year and state in the Energy Information Administration (EIA) project pipeline; the second case stretches the planned capacity in the EIA pipeline for states that have announced targets (allocated on a straight line basis); and the third case assumes the Energy Storage Association's goal of 35 GW of battery storage by 2025. Record-breaking battery storage capacity additions in 2020 highlighted the minimal impact of Covid-19 on the growth of this sector.

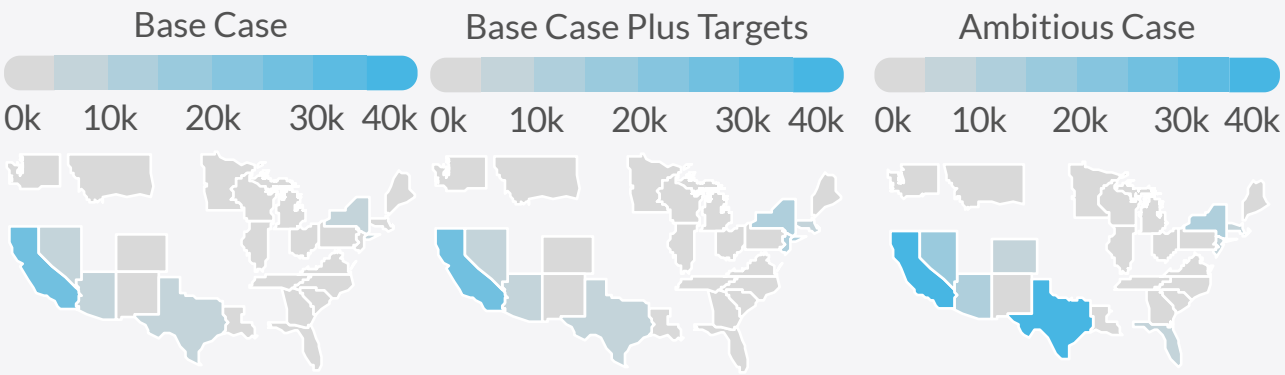
For the first two scenarios, new capacity added each year was multiplied by rapidly decreasing construction jobs per MW based on calculating historical jobs per MW from EIA's installed capacity and USEER battery storage job breakdowns, in addition to Wood Mackenzie construction jobs per MW estimates. Compound annual growth rates were used to calculate interim periods if no estimates were available. Jobs per MW construction multipliers used were 51.46 (2020), 50.90 (2021), 45.50 (2022), 40.67 (2023), 36.36 (2024) and 32.50 (2025). The multipliers were reduced at an accelerated rate in the ambitious case, due to economies of scale. The total jobs estimated may be overstated or understated if these multipliers do not follow expected trends. Construction job multipliers were applied for one year and were averaged over the entire time period, in order to reflect FTEs, rather than short term jobs. The operation and maintenance jobs per MW multiplier was held constant at 2.5, based on ESA estimates (50,000 O&M jobs estimated by 2030 for 20 GW of battery storage). This multiplier was applied annually to the total capacity installed for each state.

While the first two scenarios are based on installed capacity projections by state, the third scenario estimates 35 GW of battery storage nationally by 2025. Given that 2019 installed capacity was just over 1 GW, allocating the projections to the state level using growth rates would have resulted in disproportionate growth only in states with batteries already installed. Instead, this analysis starts with scenario two (EIA pipeline + state targets) capacity projections by state and allocates the remaining GW based on each state's percentage of total renewable energy capacity installed nationally in 2019, according to EIA data. This is based on the assumption that states with higher renewable energy generation capacity will be incentivised to address the rise in intermittency with energy storage solutions.

Historical battery storage manufacturing was estimated using state data for NAICS code 335911 (storage battery manufacturing), with manual adjustments based on desktop research. A secondary check was applied by cross referencing this analysis with the USEER national battery manufacturing jobs number in 2019 (13,190 in USEER versus 12,265 in NAICS plus desktop research). Manufacturing growth rates were based on the change in new capacity added year over year by state, assuming a continuation of current sourcing practices (8 percent sourced domestically). The constraints with these assumptions are that they do not account for the new manufacturing plants that will be built in states without existing production and that policy incentives may increase domestic sourcing in this sector over time. On the other hand, states without current manufacturing capabilities have the opportunity to incentivize in-state production and increase jobs projections.

Due to higher consistency in jobs per MW over time in pumped hydro storage, the 2019 multiplier of 0.39 jobs per MW was extended through the forecast period. Planned capacity additions in pumped hydro storage were based on project proposals discussed by IHS Markit and other desktop research. In this analysis, the total pumped hydro storage capacity projected between 2020 and 2025 is 5.2 GW. Finally, this analysis does not include projections for petroleum storage, natural gas storage, other fuels storage, or other storage. These categories made up 11 percent of storage jobs in 2019.

Regional Dynamics: The results of the analysis by state are included below in the form of total 2020 to 2025 FTE additions. Each state report includes the projected FTE additions that correspond to all three scenarios, broken out into battery storage construction jobs, battery storage operations and maintenance jobs. battery storage manufacturing jobs and total pumped hydro jobs. Battery storage was projected at a more granular level than pumped hydro storage in this analysis, due to its exponential growth forecasts between 2020 and 2025.



ABBREVIATIONS

ACEEE - American Council for an Energy-Efficient Economy
AFV - Alternative Fuel Vehicle
AWEA - American Wind Energy Association
BEV - Battery Electric Vehicle
BOEM - Bureau of Ocean and Energy Management
CAFE - Corporate Average Fuel Economy
CCUS - Carbon Capture, Utilisation and Storage
DOE - Department of Energy
EIA - Energy Information Agency
EOR -- Enhanced Oil Recovery
EPA - Environmental Protection Agency
EV - Electric Vehicle
EVSE - Electric Vehicle Supply Equipment
FCEV - Fuel Cell Electric Vehicle
FERC - Federal Energy Regulatory Commission
HEV - Hybrid Electric Vehicle
ISO - Independent System Operator
ISO-NE - Independent System Operator - New England
ITC - Investment Tax Credit
MISO - Midcontinent Independent System Operator
NAICS - North American Industry Classification System
NREL - National Renewable Energy Laboratory
OCS - Outer Continental Shelf
PACE - Property Assessed Clean Energy
PSH - Pumped-Storage Hydropower
PSC/PUC - Public Service/Utilities Commission
PTC - Production Tax Credit
RTO - Regional Transmission Organization
ZEV - Zero Emissions Vehicle
V2G - Vehicle to Grid

TECHNICAL DEFINITIONS

Lithium-ion batteries: A rechargeable battery technology that involves lithium ions moving from the negative electrode to the positive electrode during discharge and back when charging.

Flow batteries: An energy storage technology that involves electric current flow through a system of two connected tanks containing electrolytes with positively charged cathode and negatively charged anthode, separated by a membrane.

Pumped storage hydropower: An energy storage technology that involves pumping water up a reservoir when electricity demand is low and releasing the water through turbines to generate electricity when demand is high.

Floating offshore wind turbine: A wind turbine mounted on a floating structure suitable for deeper water depths where conventional fixed-foundation turbines are not feasible. Outer Continental Shelf: Submerged lands, subsoil and seabed lying 3 miles off state coastal waters under Federal jurisdiction.

Carbon Capture: Any process to capture carbon dioxide, whether from the ambient air or from a smokestack or other industrial facility. Also called carbon drawdown, and sometimes ambiguously referred to as carbon removal.

Direct Air Capture: The process of capturing carbon dioxide directly from the ambient air.

V2G: A term used to describe the flow of electricity from the vehicle to grid.

Zero Emissions Vehicle: A vehicle that produces no emissions from the on-board source of power.

Enhanced Oil Recovery: The process of injecting carbon dioxide into oil wells to increase oil production.

Hybrid Electric Vehicle: A vehicle which combines a conventional internal combustion engine (ICE) with an electric propulsion system.

Alternative Fuels: Alternative fuels include gaseous (such as hydrogen), alcohol (such as ethanol), vegetable and waste-derived (such as biodiesel) fuels that emit fewer emissions than petroleum-based transportation fuels. Electricity for transportation is also considered an alternative fuel.

Renewable Fuel Standard: National mandate for a certain volume of renewable fuels to replace or reduce the use of petroleum-based transportation fuel.

Corporate average fuel economy standards: These regulations require improvements in the average fuel economy of the US fleet, by levying penalties on automobile manufacturers if their vehicles do not meet the requisite standards.

Grid modernisation: A term that constitutes a catch-all for the various upgrades required to improve the electric grid's reliability, cost-effectiveness and sustainability.

Smart meters: Customer-side installations that allow for two-way communication about electricity data, which allows for more effective electricity management.

Demand response: A term that refers to the ability of customers to manage their electricity use, enabled by access to energy data.

Renewable energy technical potential: A 2012 NREL study evaluated the technical feasibility of different renewable energy sources in each state, on the basis of geographic conditions and natural resources.

Environmental consultants: Individuals, assisting both public and private sector clients, that are often involved in conducting environmental impact project assessments.

Enhanced geothermal systems: Systems of geothermal power generation that uses energy stored in dry and impermeable rock.

Concentrating solar power: A system that generates power by concentrating areas of sunlight on to a receiver, which captures the solar energy for later use.

LIST OF INTERVIEWEES

Julie Cerqueira, U.S. Climate Alliance
Campbell Delahoyde, National Association of State Energy Officials
David Terry, National Association of State Energy Officials
Dylan Tucker, National Association of State Energy Officials
Kyrsten Verclas, National Association of State Energy Officials
Rodney Sobin, National Association of State Energy Officials
Sam Cramer, National Association of State Energy Officials
Shemika Spencer, National Association of State Energy Officials
Ed Carley, National Association of State Energy Officials
Maddie Koewler, National Association of State Energy Officials
Sandy Fazeli, National Association of State Energy Officials
Cassie Powers, National Association of State Energy Officials
James Kahn, SkyBaron
Ari Marder, The Open Air Collective
Gregg Small, Climate Solutions
Rob Gramlich, Grid Strategies
Chris Markuson, BlueGreen Alliance
Leslie Hayward, Rivian
Shaun Hoyte, Consolidated Edison
Anthony Mansell, Vivid Economics
Chris Micsak, Pickering Energy Partners
MIke Mastrandrea, Stanford University
Tom Cyrs, World Resources Institute
Joel Jaeger, World Resources Institute
Jonah Kurman Faber, Climate Xchange