

US Green Economy Report Series

Case Study - Washington



SCHOOL OF
PUBLIC POLICY
CENTER FOR GLOBAL
SUSTAINABILITY

Washington State Profile

Washington's governor, Jay Inslee, considered one of the most ambitious climate leaders in the United States, is supported by Democratic control of both the state's Senate and House, increasing the likelihood the state will continue to build on its major climate initiatives over the past two years. Inslee was one of three governors that formed the US Climate Alliance. Washington State, also a part of the Western Governors' Association (WGA), is the founding member of the Pacific Coast Collaborative, a partnership among West Coast states, British Columbia and a number of cities that seeks to enhance coordination between stakeholders to reduce emissions and create a low-carbon economy.

Washington passed a number of energy and climate packages in 2019 that aim to boost the state's green economy. The state's renewable energy standard, established in May 2019, mandates that the electricity sector be 100 percent carbon neutral by 2030 and have 100 percent zero emissions by 2045.

Washington is one of the top 3 states in renewable electricity generation as a result of its dominance in hydropower, which accounts for more than 60 percent of the state's total capacity. In 2019, Washington's hydroelectricity generation made up almost a quarter of the country's total.

WASHINGTON STATE GOALS



100%

carbon-neutral electricity by 2030



45%

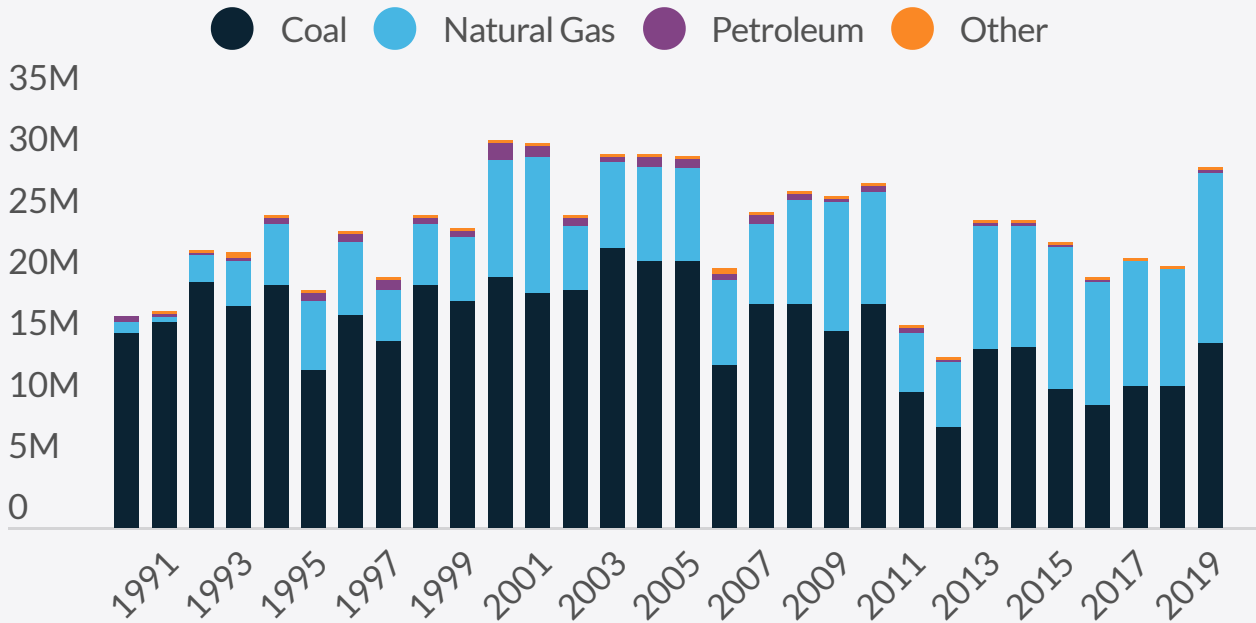
cut in greenhouse gas emissions below 1990 levels by 2030, 95% below 1990 levels by 2050



100%

clean energy by 2045

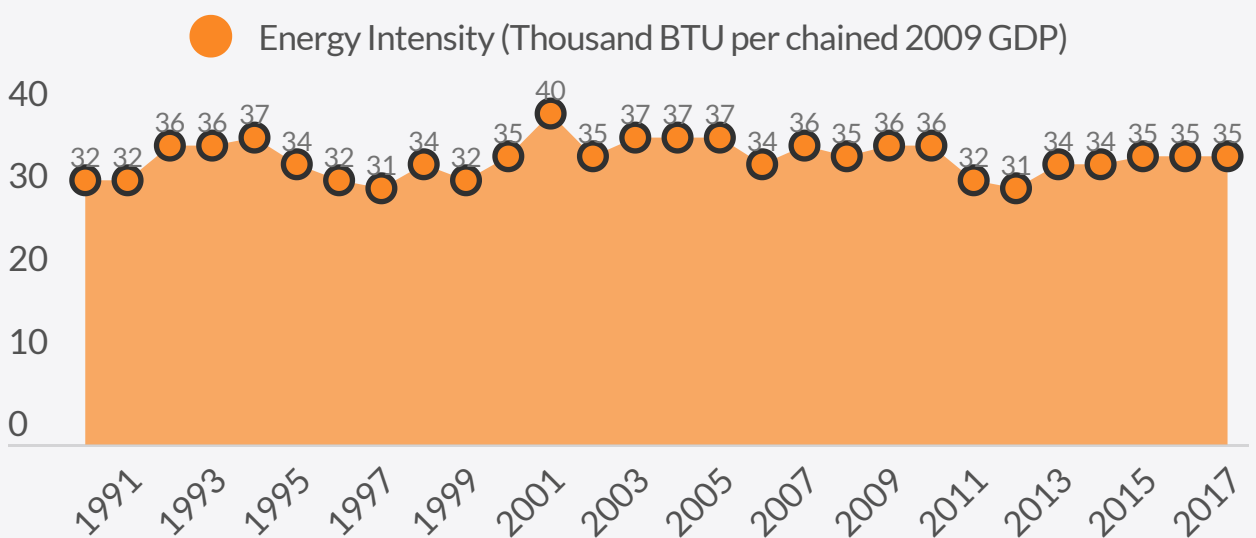
ENERGY-RELATED GREENHOUSE GAS EMISSIONS



[Download data](#)

Carbon Dioxide emissions over time by energy generation source, according to the Energy Information Administration. Note: other includes non-biogenic municipal solid waste, batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, tire-derived fuels, and miscellaneous technologies; other Gases includes blast furnace gas, propane gas, and other manufactured and waste gases derived from fossil fuels.

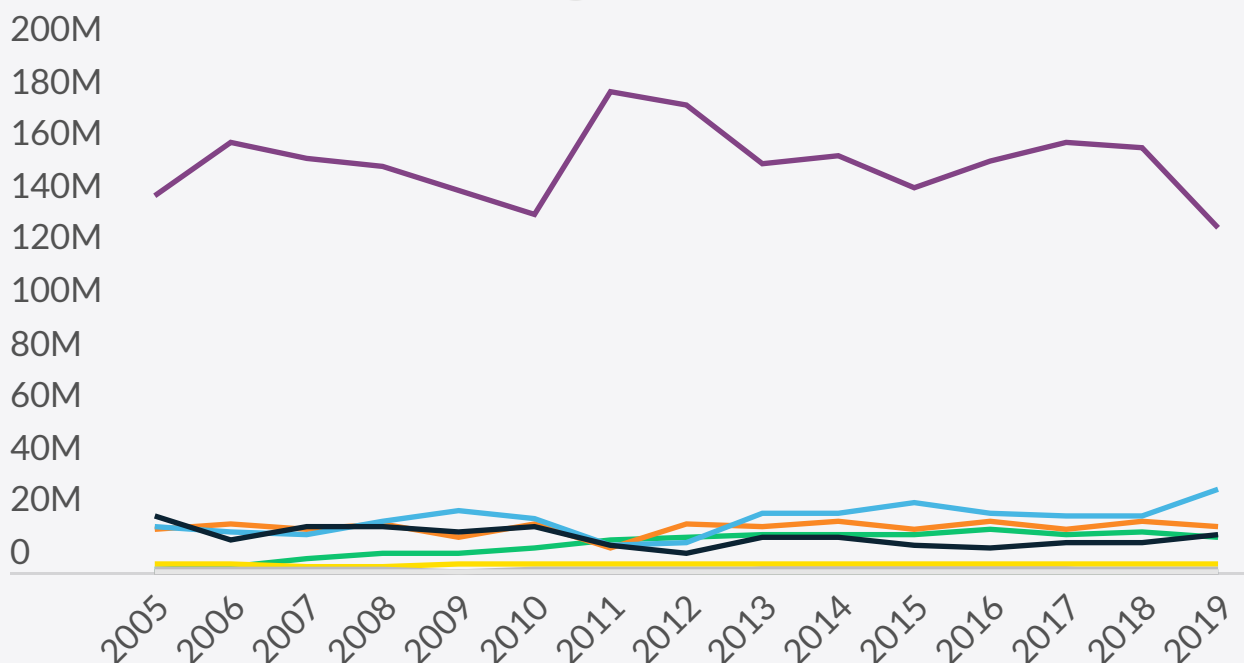
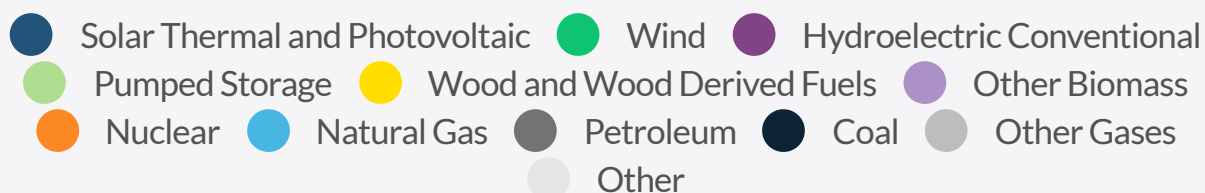
ENERGY INTENSITY OVER TIME



[Download data](#)

Source: Energy Information Administration

ELECTRICITY GENERATION BY SOURCE



[Download data](#)

Generation over time, according to the Energy Information Administration. Note: other includes non-biogenic municipal solid waste, batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, tire-derived fuels, and miscellaneous technologies; other Gases includes blast furnace gas, propane gas, and other manufactured and waste gases derived from fossil fuels.

ENERGY FACTS AND FIGURES

ENERGY LOSSES	576,837	BBTU
ELECTRICITY PRICES	23.63	USD per MBTU
ENERGY PER GDP	4.01	Thousand BTU per 2012 USD
CONSUMPTION PER CAPITA	272.70	MBTU
NET-INTERSTATE FLOW	163,168	BBTU

Facts and figures, according to the Energy Information Administration. Note: negative net interstate flow of electricity and associated losses indicates flow out of state.

WASHINGTON'S LARGEST GENERATING PLANTS

Largest generation facilities by capacity, according to the Energy Information Administration



7,079 MW

Hydroelectric: Grand Coulee



1,254 MW

Hydroelectric: Rocky Reach



2,410 MW

Hydroelectric: Chief Joseph



1,163 MW

Nuclear: Columbia Generating Station



1,340 MW

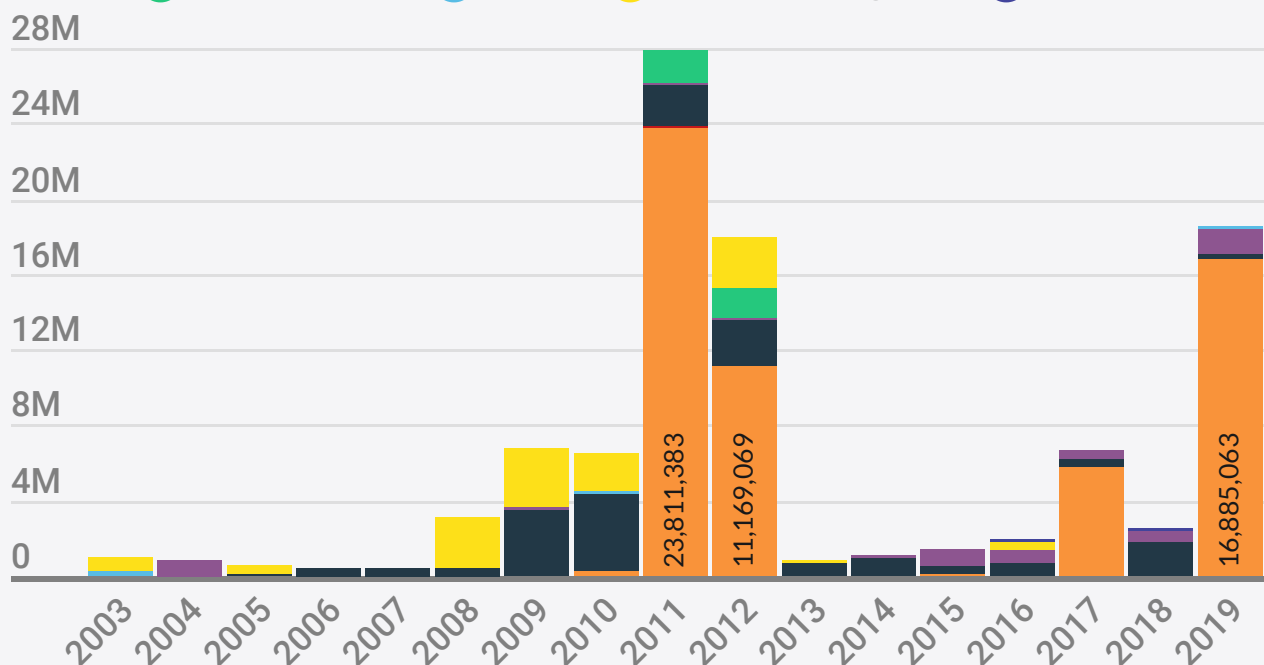
Coal: Transalta Centralia Generation



1,104 MW

Hydroelectric: Boundary

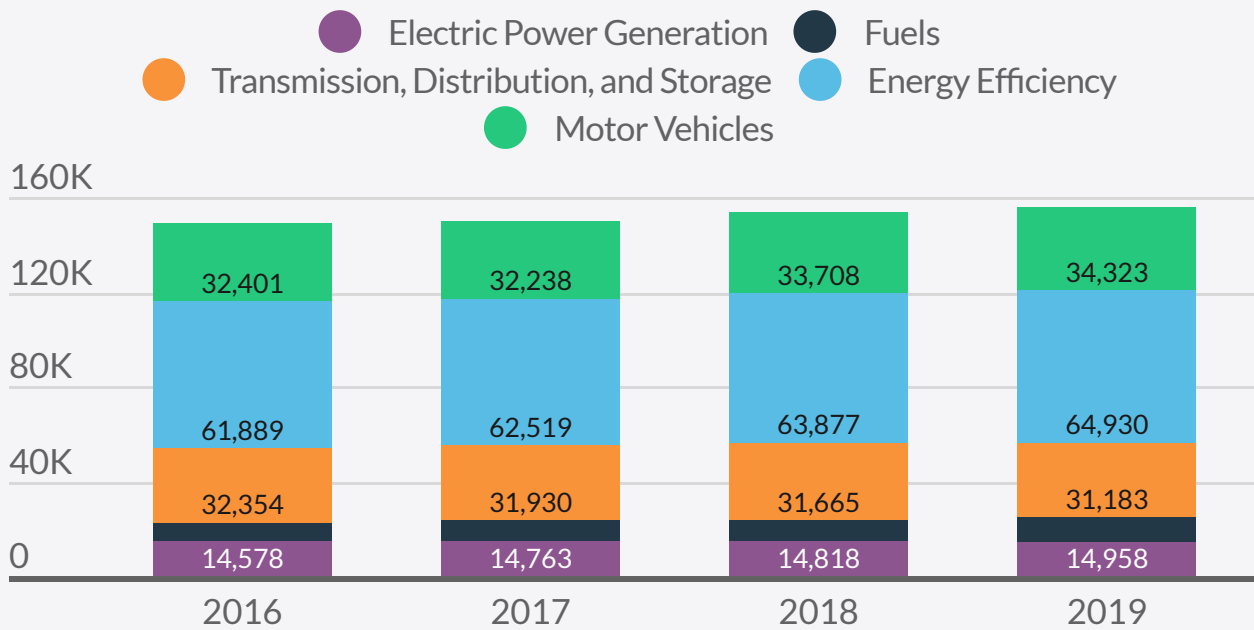
PUBLIC INVESTMENT BY GENERATION TYPE (DOA)



Download data

Public investment by energy type from 2002 to 2020, according to the United States Department of Agriculture. Data includes all investments made through Department of Agriculture programs.

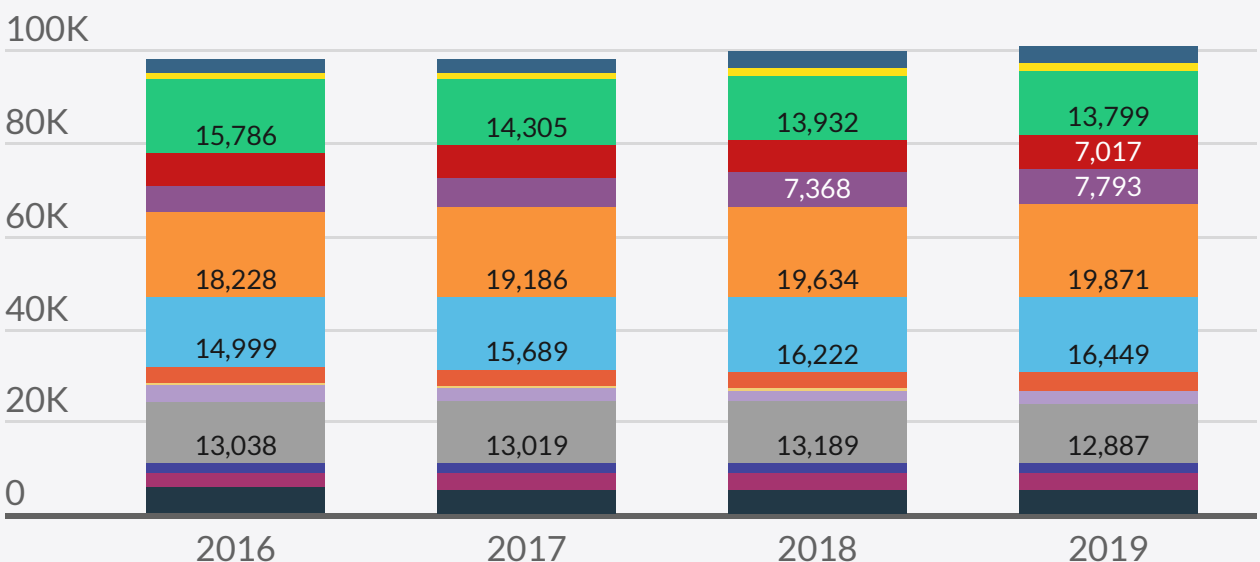
TRADITIONAL ENERGY SECTOR JOBS



 [Download data](#)

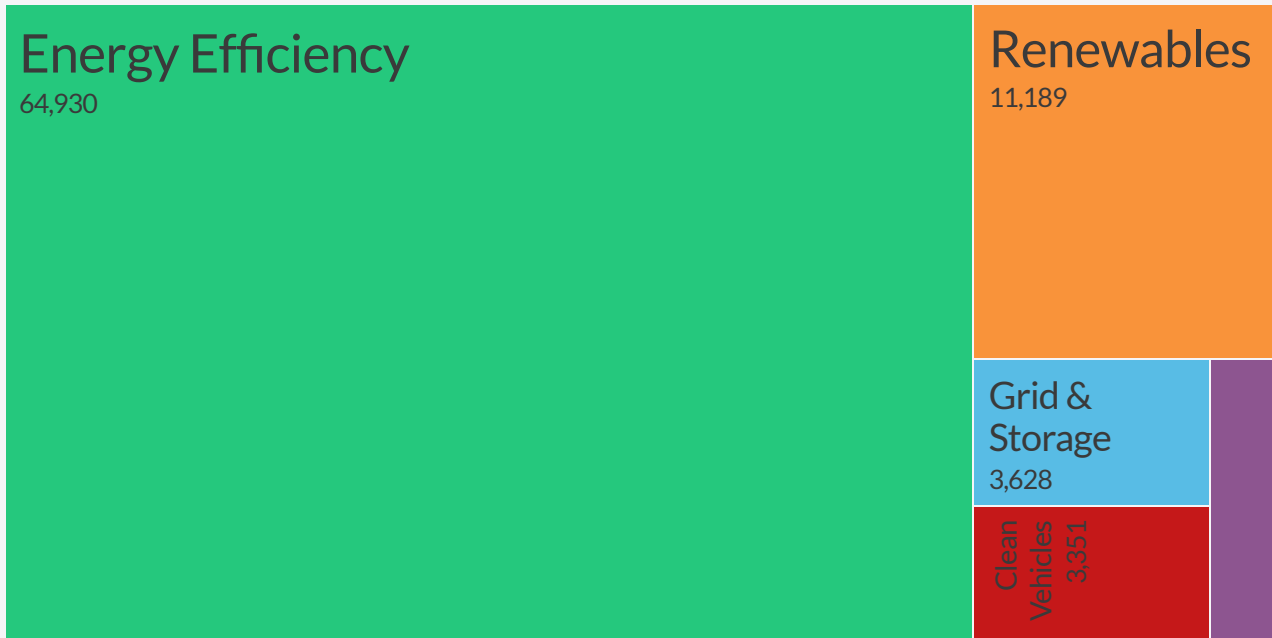
Traditional energy sector jobs over time, according the United States Energy and Employment Report (USEER).

CLEAN ENERGY JOBS BY TYPE



Clean energy jobs over time by type, according to the USEER. See Appendix for definitions and methodology.

OVERVIEW OF CLEAN ENERGY JOBS BY CATEGORY



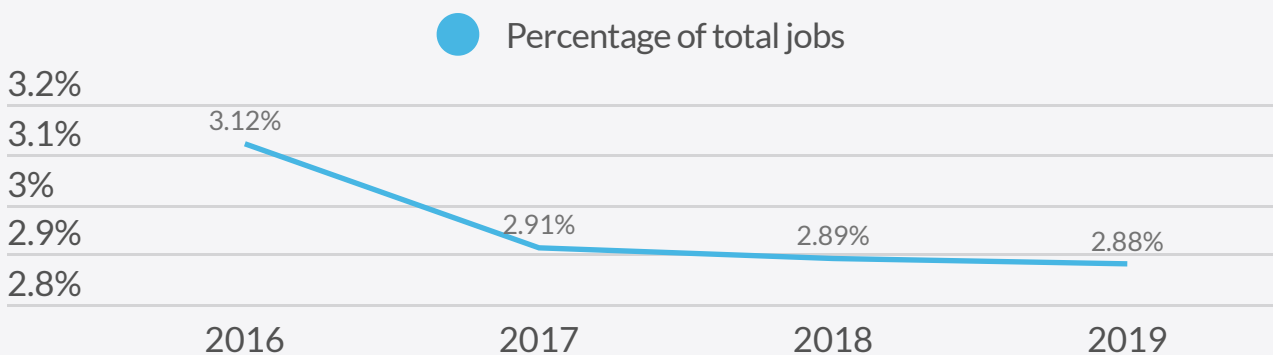
Clean energy jobs over time by technology, according to E2 Clean Jobs America.

CLEAN ENERGY COMPENSATION

Average state clean energy wage	\$25.39
Percent above/below median state wage	10.7%
#1 most difficult to hire occupation	Electrician/construction workers
#2 most difficult to hire occupation	Sales, marketing, or customer service

Clean energy jobs compensation and hiring, according to E2 Clean Jobs America and the USEER.

CLEAN ENERGY JOBS AS PERCENTAGE OF OVERALL JOBS



Clean energy jobs as a percentage of Bureau of Labor Statistics employment total numbers.

ELECTRIC VEHICLES



Washington is ranked 6th according to the ACEEE EV Scorecard, indicating the state's prioritization of the EV sector. The state's headline initiatives are the grant programme for electric vehicle supply equipment (EVSE), its green public transportation grant programme and its EV and EVSE tax exemptions. EVs accounted for 4.28 percent of vehicle sales in Washington in 2018. There are 28,400 EVs and 1,422 charging stations in the state. In addition, the state is one of fifteen (plus the District of Columbia) to sign an MOU to advocate for electric medium- and heavy-duty trucks. With sales projected to continue to increase, the state is expected to quickly fund expansion in EV infrastructure. Washington is also currently providing grants to government agencies and non-profit organizations to support uptake.

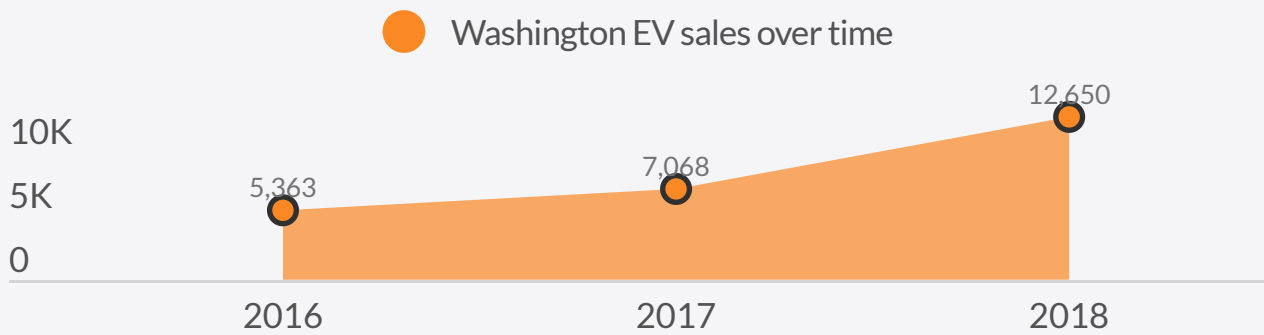
Key Partnerships: Forth, Plug In America, West Coast Electric Fleets, and Western Washington Clean Cities

ELECTRIC VEHICLE FACTS AND FIGURES

National rank based on EV sales	3
Percentage of national EV sales	4.2%
Market share within state	4.3%
Market share within state (year over year growth)	71%
EV sales as a percentage of motor vehicle sales	3.1%
Number of people per charging station	8,923
Number of people per charging station (rank)	9
EV Fuel Cost per eGallon (2018)	\$0.88
EV Fuel Cost per eGallon (% above/below national average)	-31%
Fuel cost savings per gallon versus gasoline	\$2.40
Most popular EV (search volume)	Kia Soul EV

Electric vehicle quick facts based on data from EVAdoption.

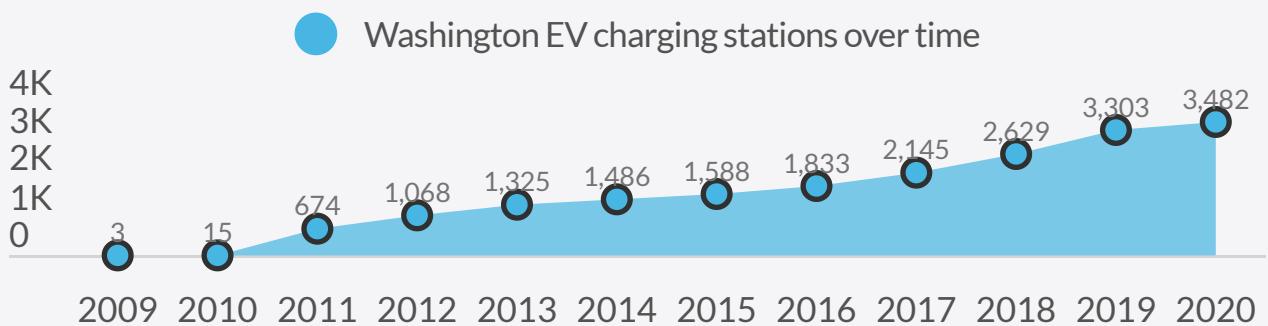
ELECTRIC VEHICLE SALES OVER TIME



[Download data](#)

Electric vehicle sales over time, according to EVAdoption.

ELECTRIC VEHICLE CHARGING STATIONS OVER TIME



[Download data](#)

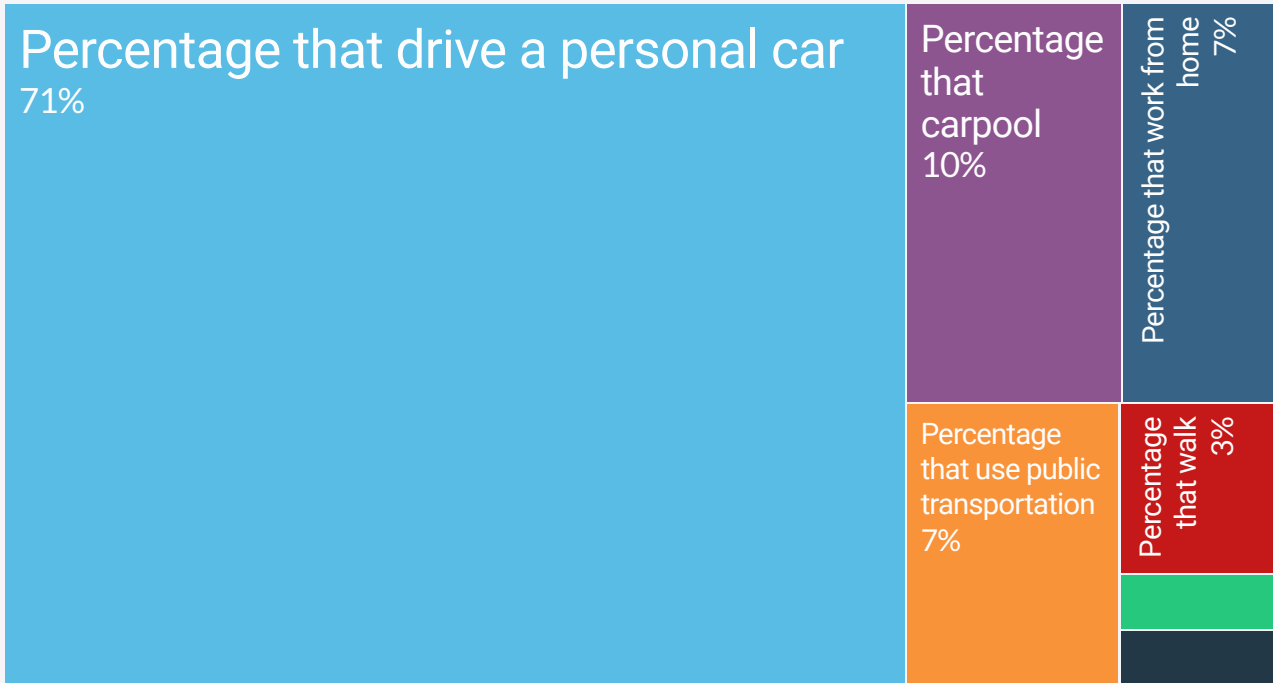
Charging stations over time, according to the United States Department of Energy's Alternative Fuels Data Center.

ELECTRIC VEHICLE LAWS AND INCENTIVES

	Strength	Number	Compared to National Average
Number of EV laws & incentives	High	26	76%
Number of HEV laws & incentives	Medium	1	-51%
Number of PHEV laws & incentives	High	23	73%
Number of NEV laws & incentives	Medium	1	-4%
Number of fuel economy/efficiency laws & incentives	High	2	73%

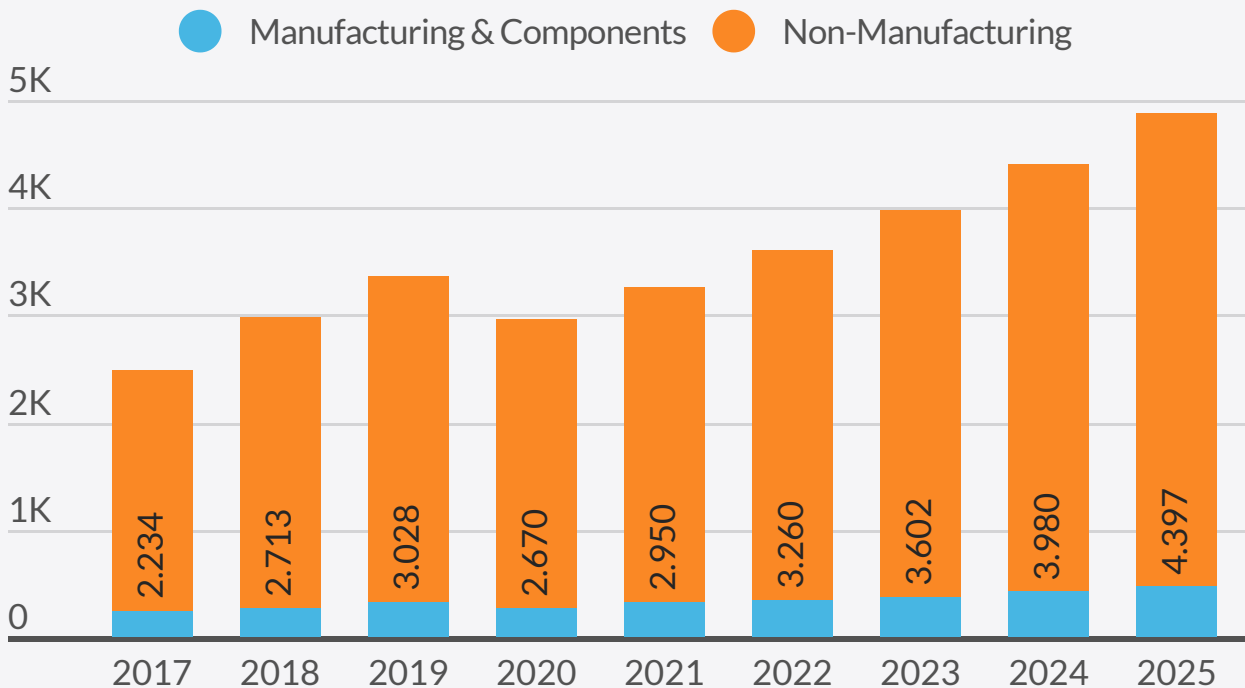
Quantity of state laws and incentives on electric vehicles, in comparison to national average, according to the Alternative Fuels Data Center.

PROFILE OF A WASHINGTON COMMUTER



State commuter dynamics, according to the United States Department of Commerce, Bureau of Census.

PROJECTED CLEAN VEHICLE JOBS (2020-2025)



Methodology: Percentage of manufacturing jobs by state (NAICS codes 3361,3362,3363) of total motor vehicle jobs was applied to total clean vehicle jobs by state (E2) to determine the break down. Forecast based on projected clean vehicles miles travelled. More detail in the Appendix.

ENERGY EFFICIENCY



Washington is ranked 11th on ACEEE's 2020 State Energy Efficiency Scorecard, reflecting the state's strong efforts to improve energy efficiency. The state has 74 financial incentives for energy efficiency, including Energy Revolving Loan Fund grants to finance building energy efficiency technologies with limited access to capital. Washington is one of only a few states that require all non-residential customers and qualifying public agency buildings to record energy consumption data on ENERGY STAR Portfolio Manager. The state also enacted legislation in 2005 for all major state-funded facilities to be designed, constructed and certified to at least the LEED Silver standard. The Smart Buildings Center and Washington State University's Energy Program are focusing on research and development efforts to advance energy efficiency technologies.

Key Players: Avista Utilities, Puget Sound Energy, PacifiCorp (Pacific Power), Seattle City Light, Bonneville Power Administration, Northwest Energy Efficiency Alliance (NEEA), Northwest Power and Conservation Council

ENERGY EFFICIENCY RANKINGS BY CATEGORY



11

Energy Efficiency Rank



19

Utilities Rank



14

Government Rank



6

Transportation Rank



2

Buildings Rank

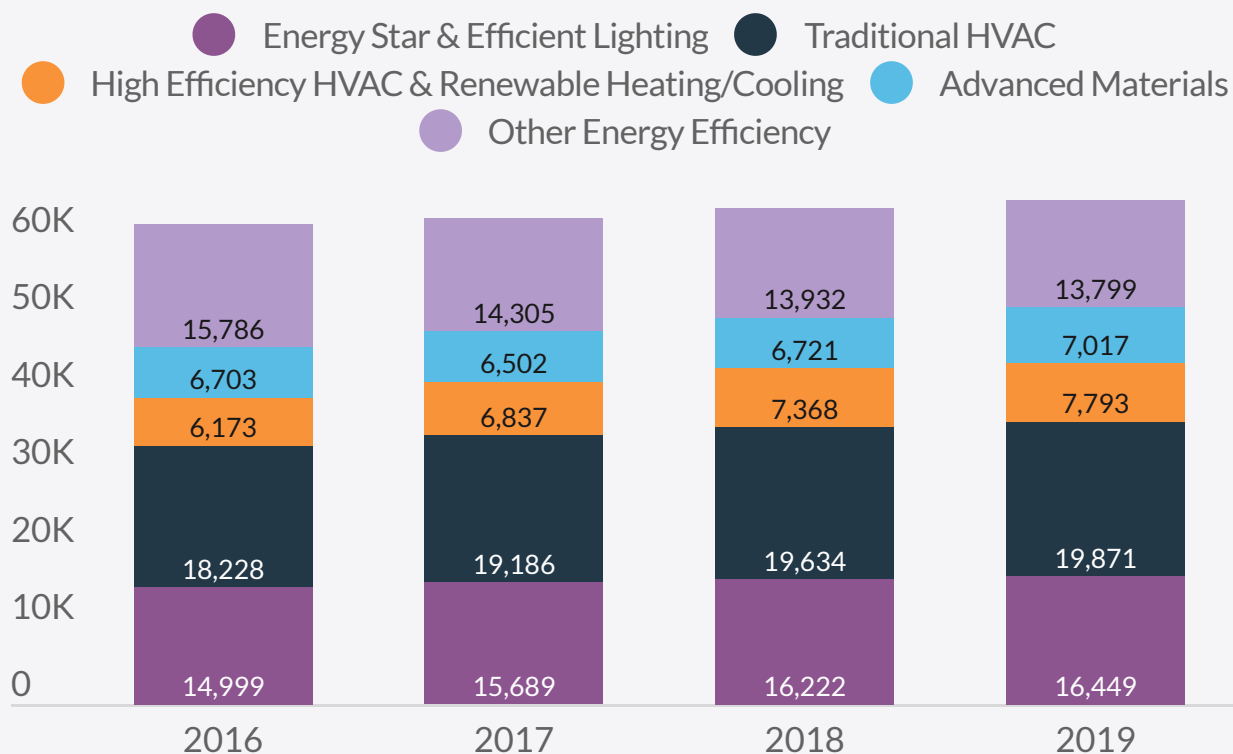


2

Appliances Rank

Each component of energy efficiency was evaluated by state by the American Council for an Energy-Efficient Economy, which is the basis for these national rankings. The ACEEE monitors state policies and programs, which feed into an assessment of 32 energy efficiency metrics.

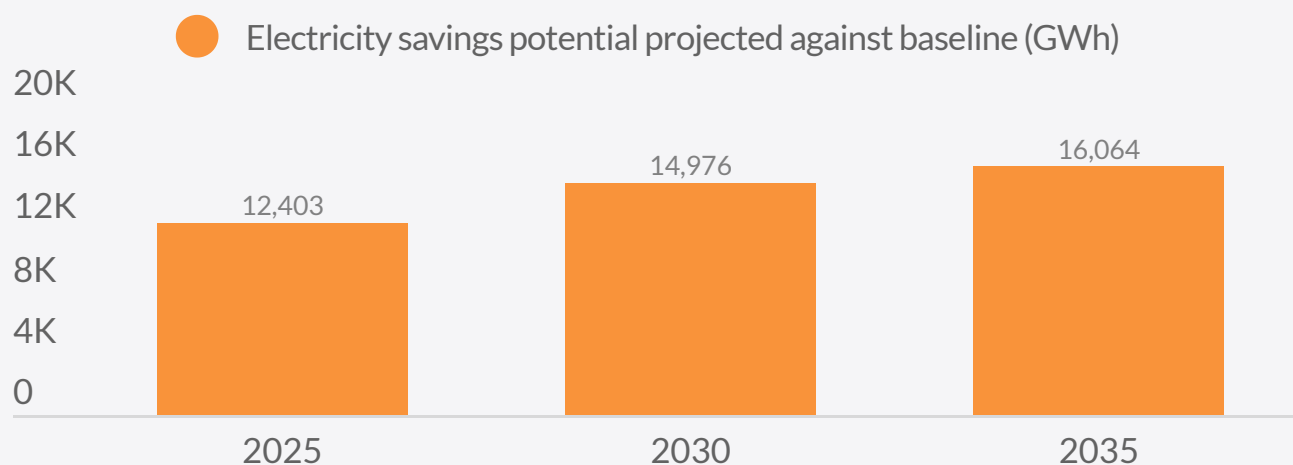
ENERGY EFFICIENCY JOBS BY CATEGORY



[Download data](#)

Categories of energy efficiency jobs, according to the United States Energy and Employment Report.

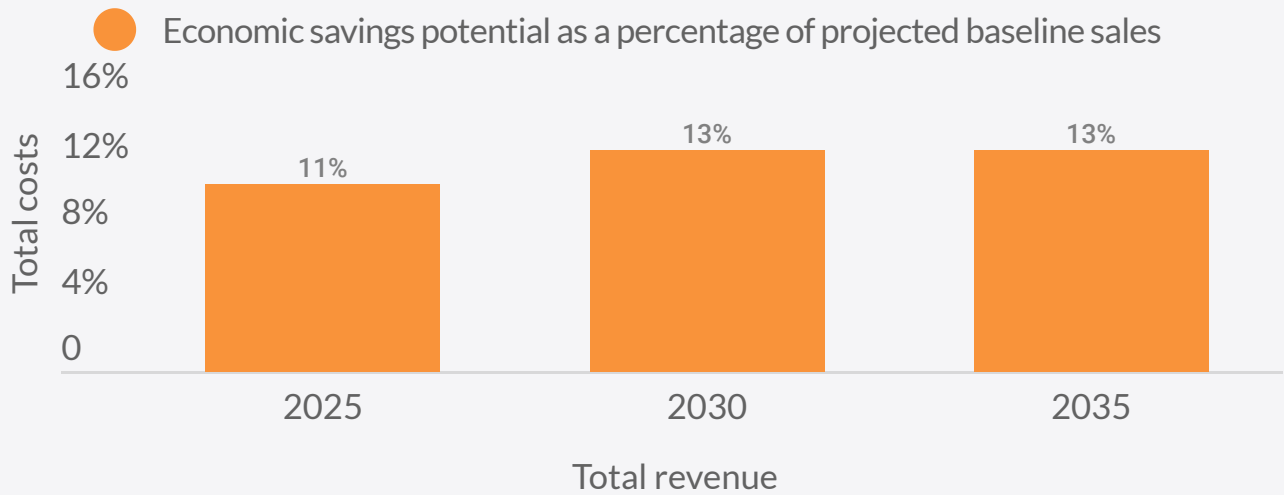
ENERGY EFFICIENCY ELECTRICITY SAVINGS POTENTIAL PROJECTED AGAINST BASELINE



[Download data](#)

Electricity savings projected by the the United States Office of Energy Efficiency and Renewable Energy.

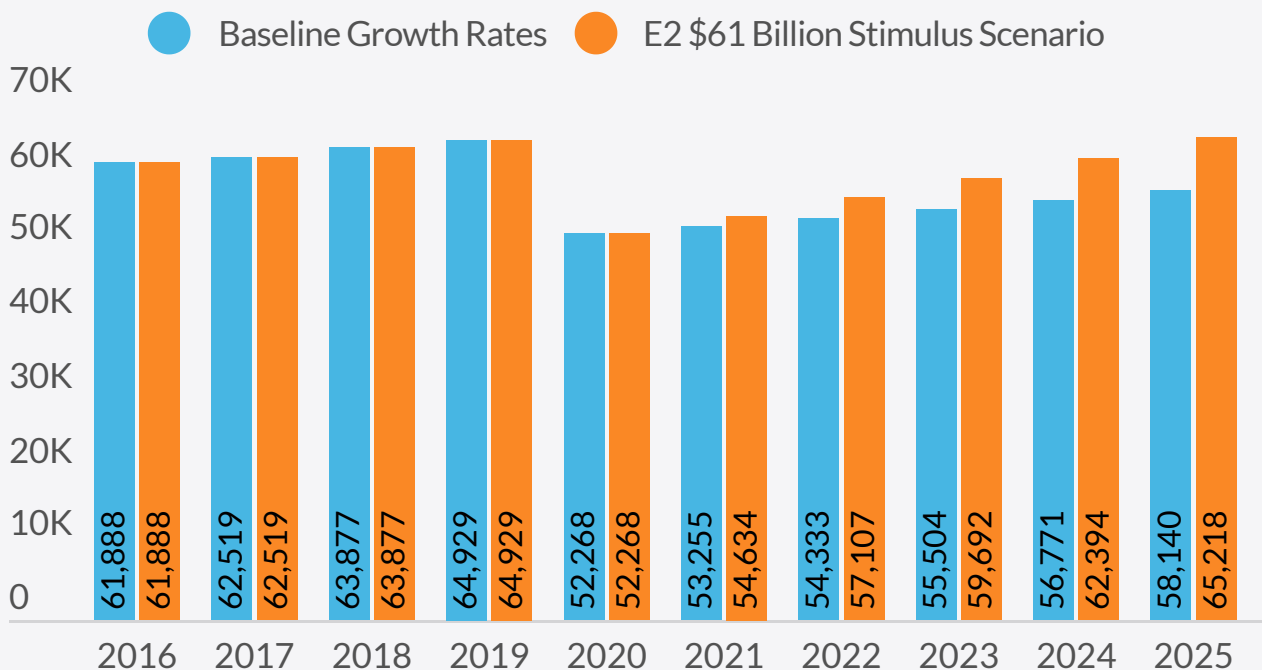
ENERGY EFFICIENCY ECONOMIC SAVINGS POTENTIAL AS A PERCENTAGE OF BASELINE SALES



 [Download data](#)

Electricity savings projected by the the United States Office of Energy Efficiency and Renewable Energy.

PROJECTED ENERGY EFFICIENCY EMPLOYMENT



Methodology: US Energy & Employment actuals for ENERGY STAR and efficient lighting, traditional HVAC, high efficiency HVAC and renewable heating and cooling, advanced materials and other energy efficiency. Current growth rates use historic compound annual growth rate, while the E2 \$61 Billion stimulus scenario uses growth rates based on projected impacts of a federal stimulus bill. Both cases adjust for COVID-19 job loss actuals in 2020. Additional detail in the Appendix.

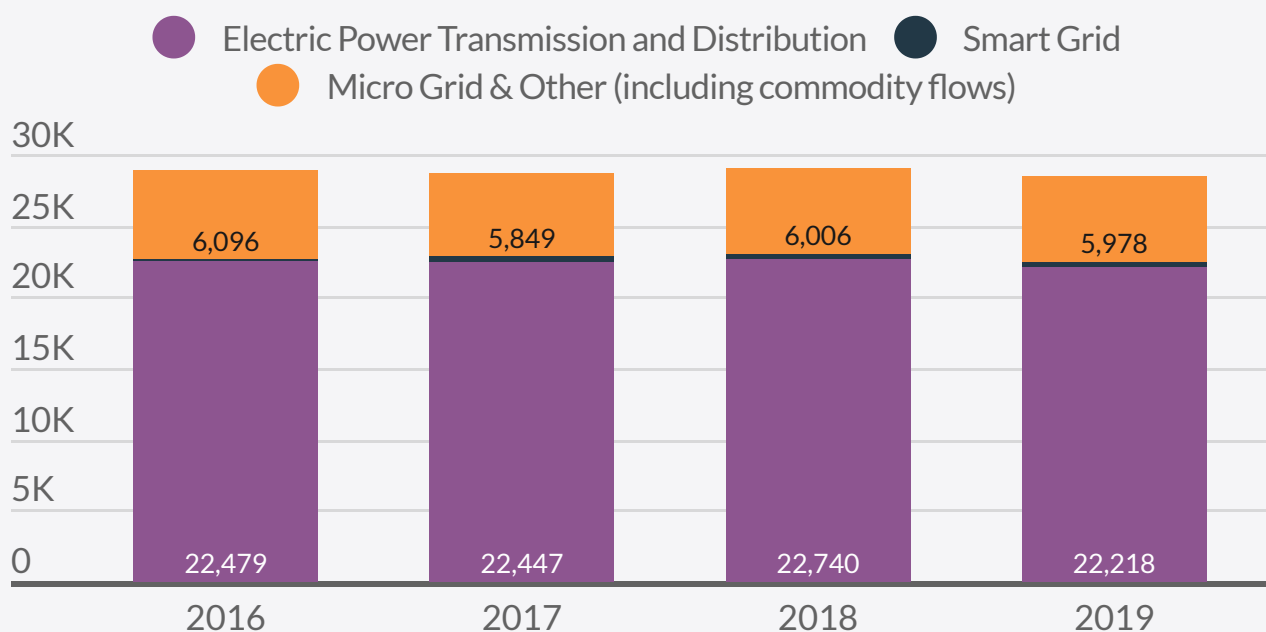
GRID MODERNISATION



Washington ranks 22nd in the 2018 Grid Modernization Index, based on state policy support, customer engagement and degree of grid operations investment. The state focuses on grid modernisation in its energy plan, but the Washington Utilities and Transportation Commission has yet to formally consider adopting customer data access policies. Approximately 37 percent of customers use smart meters in Washington, significantly below the 60 percent nationwide average. Grid modernisation action has been highlighted through the state's Clean Energy Fund (unlocking \$452 million in public and private investment since 2014) and Governor Jay Inslee's climate priorities, such as a proposal for \$15 million towards grid modernisation programmes under the 2021 State Energy Strategy. The Clean Energy Transformation Act of 2019 authorized the transition of the utility business model to performance-based regulation. In 2020, 25 bills relating to energy infrastructure and regulations were introduced, of which 5 were enacted. As it stands, Climate Advisers anticipates average growth in this sector, with high levels of climate and grid ambition being offset by weak policies and implementation.

Key Players: Bonneville Power Administration, Puget Sound Energy, Washington Utilities and Transportation Commission, University of Washington Clean Energy Institute

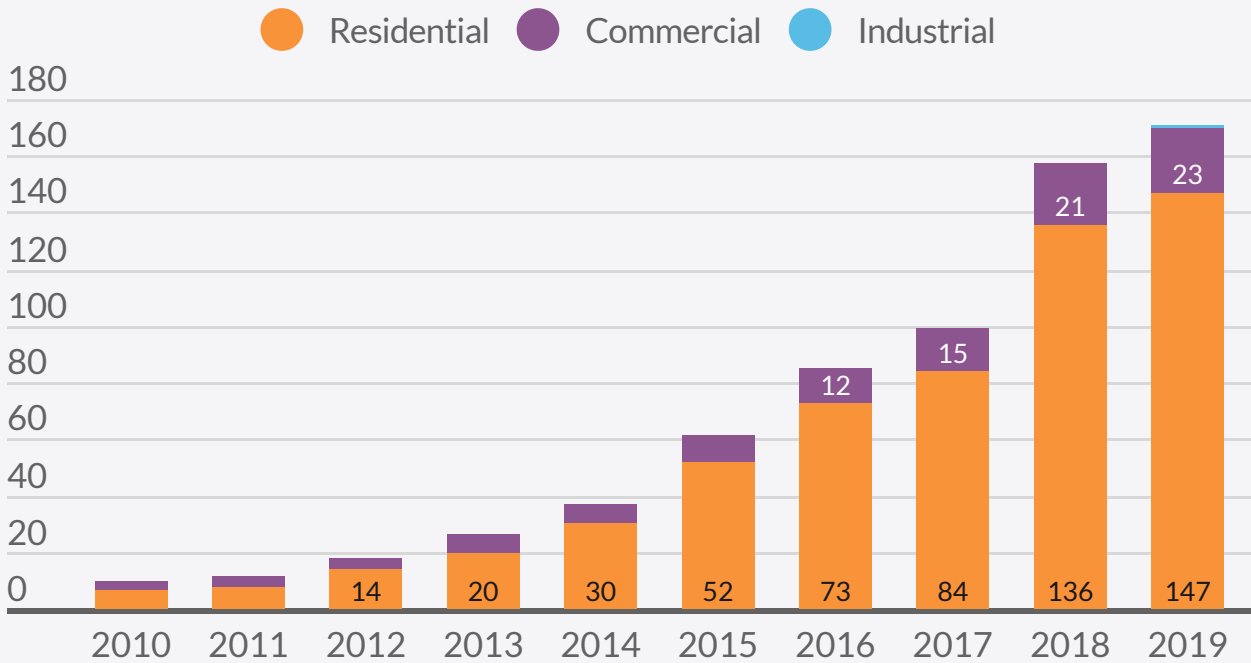
GRID JOBS BY CATEGORY OVER TIME



[Download data](#)

Categories of grid-related jobs, according to the United States Energy and Employment Report.

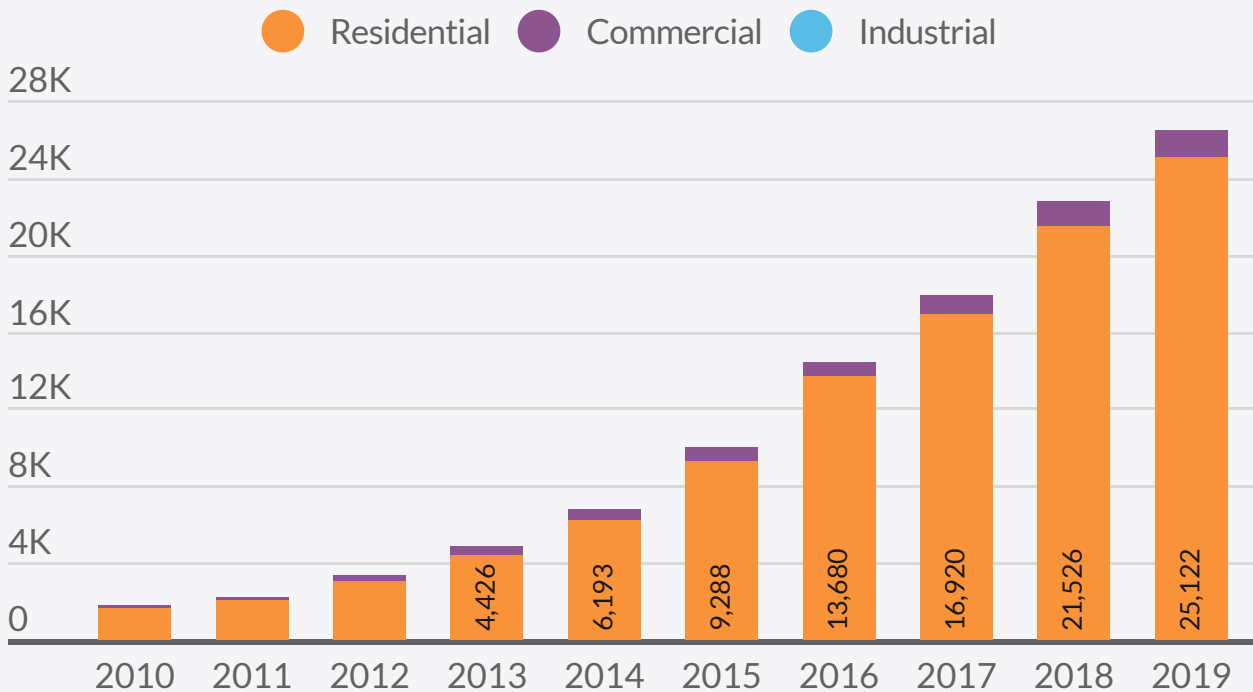
DISTRIBUTED GENERATION: NET METERING CAPACITY MW



[Download data](#)

Net metering capacity over time sourced from the Energy Information Administration.

DISTRIBUTED GENERATION: NET METERING CUSTOMERS



[Download data](#)

Number of net metering customers sourced from the Energy Information Administration.

ENERGY STORAGE



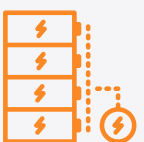
Installed Capacity: Washington currently has 6.2 MW of battery storage and 314.0 MW of hydroelectric pumped storage installed, the largest of which are the 53.5-MW Grand Coulee pump storage projected operated by the U.S. Bureau of Reclamation and the 2-MW Glacier Battery Storage operated by Puget Sound Energy Inc. All of the state’s batteries are operated by utilities. There are currently 10 energy storage projects in the state.

Policies: Washington has demonstrated modest efforts to stimulate energy storage growth in the state. While Washington does not have a state mandate or target for energy storage, in October 2017, the Washington Utilities and Transportation Commission directed utilities to consider energy storage in resource planning and procurement. The Washington Clean Energy Fund also allocated \$14.3 million in matching funds for Washington utilities to deploy 4 utility-scale energy storage projects.

Project Pipeline: Washington currently has no planned projects for battery storage. For pumped hydro storage, Copenhagen Infrastructure Partners (CIP) acquired ownership of a 1.2 GW Goldendale closed-loop pumped hydro storage project in Klickitat County from Rye Development and UK-based National Grid. The project is expected to be completed by 2028.

Key Players: U.S. Bureau of Reclamation, Puget Sound Energy, Inc., PUD 1 of Snohomish County, Washington Utilities and Transportation Commission, Washington Clean Energy Fund

ENERGY STORAGE: POLICIES AND CAPACITY INSTALLED



320 MW

Capacity installed



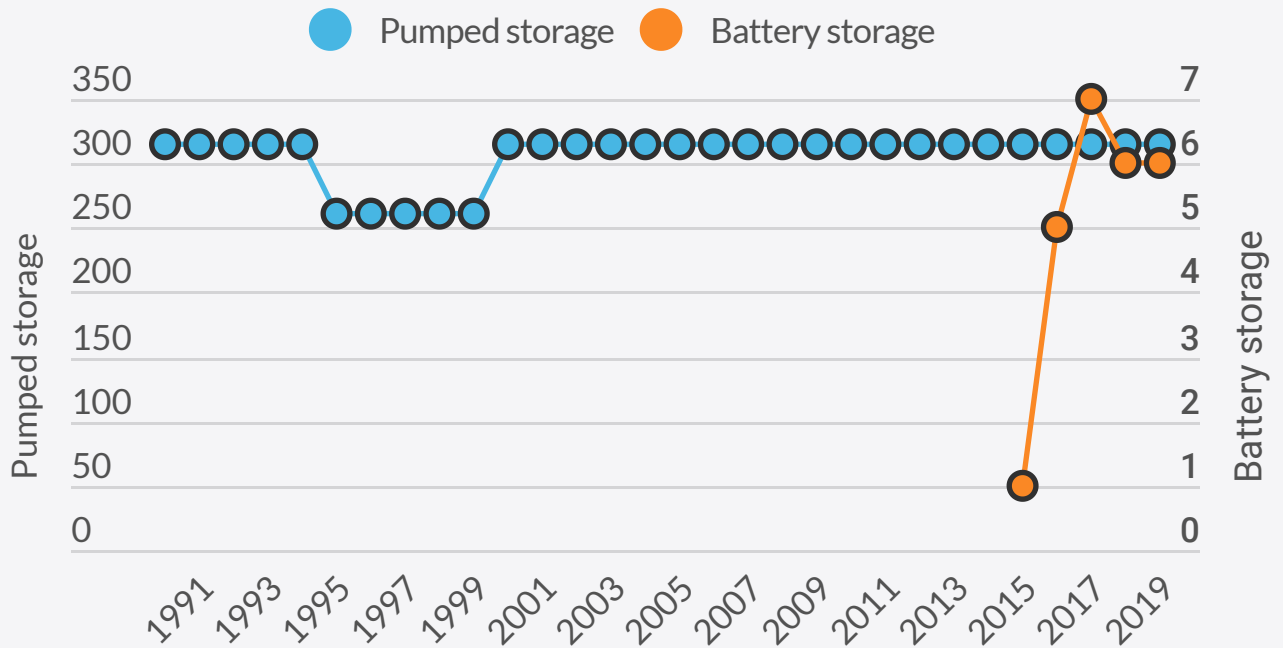
2,616

Energy storage jobs

	Yes/No
Procurement Targets	No
Regulatory Requirements	Yes
Demonstration Programs	Yes
Financial Incentives	No
Consumer Protection	No

Targets, policies and incentives maintained by the Pacific Northwest National Laboratory through the United States Department of Energy. Capacity installed sourced from EIA and jobs from USEER.

WASHINGTON'S CURRENT ENERGY STORAGE CAPACITY

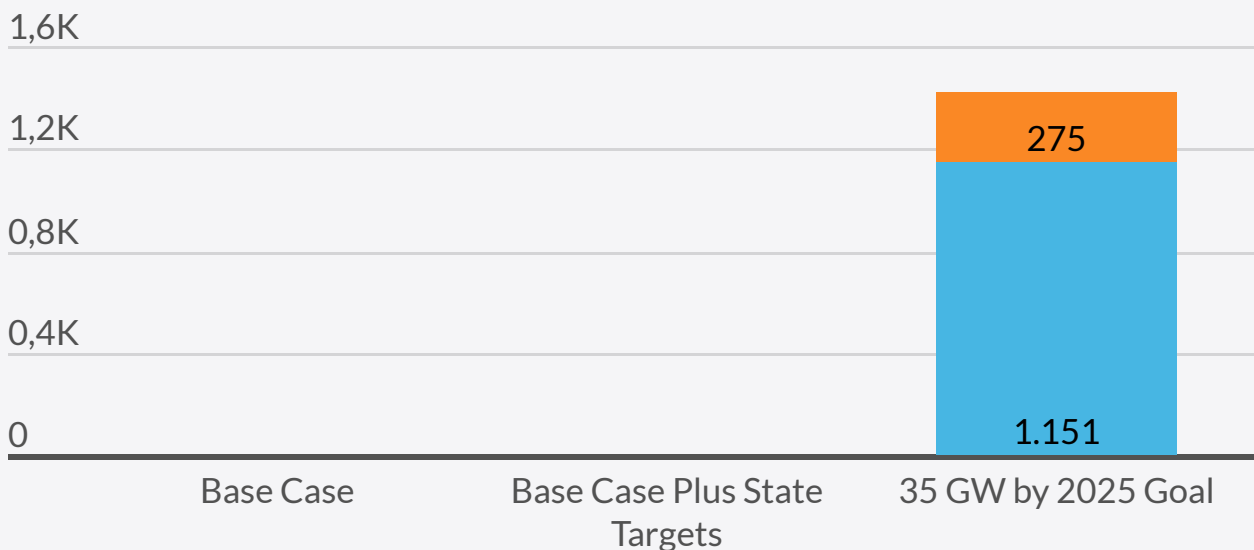


Download data

Energy storage generation capacity over time available through the Energy Information Administration.

PROJECTED ENERGY STORAGE FTE ADDITIONS (2021-2025)

● Battery Construction
 ● Battery O&M
 ● Battery Manufacturing
 ● Pumped Hydro Storage



Methodology: Battery construction, battery O&M, and Pumped Hydro Storage jobs per MW rates based on historical data and Navigant estimates through 2025; manufacturing based on NAICS 335911 with manual adjustments. Base case capacity forecasts from the EIA pipeline; base case plus state targets includes announced state targets and the 35 GW by 2025 goal is based on an Energy Storage Association vision report. Additional information available in the Appendix.

GREEN CONSULTANCY



In Washington, there are currently 3,130 environmental consultants employed, earning an average salary of \$78,230.

Washington's renewable energy consultancy sector is promised growth by the state's renewable energy potential of 3,089,074 GWh, driven primarily by rural utility-scale PV and offshore wind. Washington ranks 34th in the nation for renewable energy potential.

Key proposed projects in the state include a solar PV facility to be run by Avangrid Renewables, along with onshore wind turbines of similar size proposed by Rattlesnake Flat LLC and Southern Power Company. Given the aggressive policies but modest technical potential of the state, Climate Advisers expects growth in Washington's green consulting sector to be around the national average of 11 percent (from 2016 to 2026).

CARBON CAPTURE, UTILISATION AND STORAGE



Although Washington has no significant legislative policies or regulations to support CCUS, the legislature has included the sector in its 2021 energy strategy, signalling that additional funding or incentives may be forthcoming this year. A pilot programme, Wallula Basalt Pilot Project, funded by the federal government, has been labeled a successful sequestration project. The state's renewable energy standard could stimulate CCUS as utilities are under pressure to reduce emissions.

Key Players: Big Sky Carbon Sequestration Project

WASTE TO ENERGY



Biogas: Washington is ranked 22nd for biogas production potential with an estimated 18.54 billion cubic feet of renewable methane per year. The highest potential is in manure (131 systems), food waste (47 systems), wastewater (46 systems) and landfill (7 systems). These systems would result in a combined \$694 million in capital investments, 5,786 construction jobs and 384 permanent jobs. Furthermore, estimated emissions reductions would be equivalent to having 1.83 million cars fewer cars on the road. Washington currently operates 33 wastewater, 9 manure, 6 landfill and 1 food waste biogas systems.

Transport: Washington requires state and local agencies to use 100 percent biofuels or electricity to operate publicly owned vehicles “to the extent practicable.” The state also rules that at least 20 percent of all diesel fuel used in state-owned vehicles must be biodiesel, which further supports a renewable fuel standard mandating that at least 2 percent of all diesel fuel sold in the state is biodiesel or renewable diesel. The Department of Agriculture, which also assesses biofuel quality, is authorized to increase the 2 percent to 5 percent if sufficient biofuels capacity is available. As part of the Renewable Fuel Standard, at least 2 percent of all gasoline sold in the state is denatured ethanol. The state government also regulates how biofuels are stored in underground storage tanks, requires appropriate labelling of alternative fuels at pumps and authorizes districts to produce, sell and distribute biodiesel. Sustainable aviation fuels, which Boeing, Washington State University, the Port of Seattle, PNNL and Alaska Airways are all actively engaged on, are a growing industry in Washington.

Biomass: 1.5 percent of the state’s net electricity generation came from biomass sources in 2019, primarily through wood and wood waste. Two wood pellet manufacturing plants in the state generate about 90,000 tonnes annually. In Washington, there are also biogas and biofuel projects, which include 2 facilities that can produce up to 20 percent of the state’s annual biodiesel consumption.

Key Players: Impact Bioenergy, Regenis, BioEnergy Washington, Brightmark Energy, Pacific Regional Biomass Energy Program, Biomass Crop Assistance Program (Project Area 6 and Area 8), AgSTAR Partner, Northwest Advanced Renewables Alliance, Washington Forest Protection Association, Governors’ Biofuels Coalition

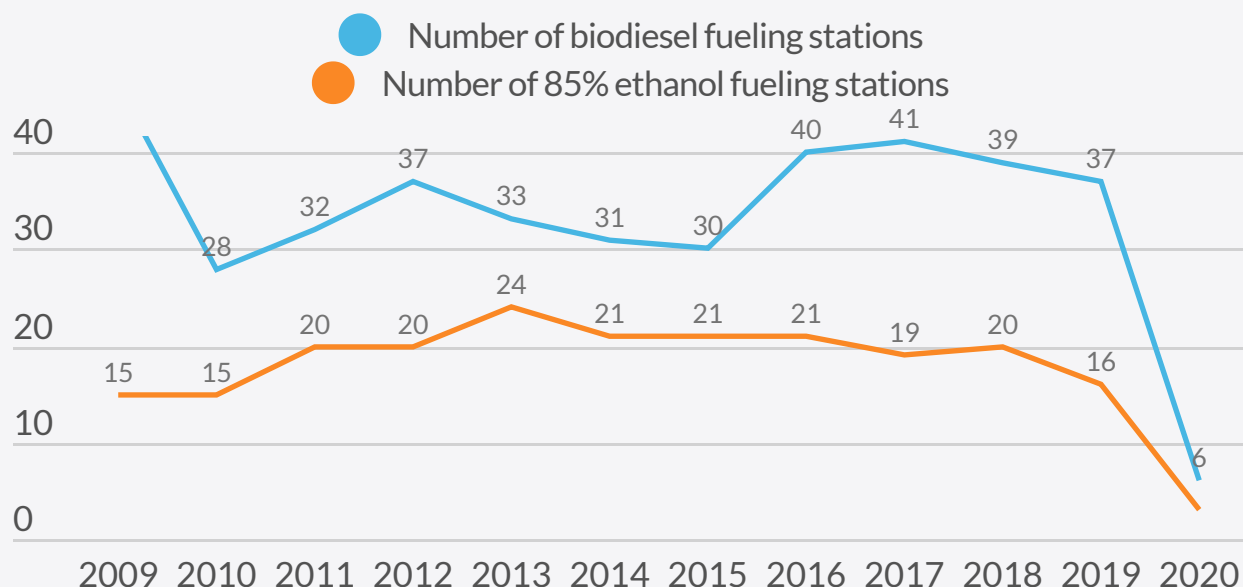
WASTE TO ENERGY: BIOMETHANE POTENTIAL

Biomethane Type	Output (Tonnes/Year)	National Rank
Methane Emissions from Landfills	6,821	39th
Biogas Generation Potential from Wastewater	58,153	11th
Biogas Generation Potential from Industrial, Commercial and Institutional Organic Waste	24,177	15th
Biogas Generation Potential from Animal Waste	37,967	14th

Biomethane generation potential and biomass feedstocks, according to the National Renewable Energy Laboratory's Biofuels Atlas..

WASTE TO ENERGY: BIOFUEL LAWS AND INFRASTRUCTURE

	Strength	Number	Compared to National Average
Number of biodiesel laws & incentives	High	10	71%
Number of ethanol laws & incentives	High	7	28%



[Download data](#)

Fueling stations and applicable laws and incentives, according to the United States Department of Energy's Alternative Fuels Data Center.

WASTE TO ENERGY: CAPACITY BY PLANT TYPE

Biopower Plant Type	Production Capacity (MW)	National rank
Landfill Gas	10	28th
Municipal Solid Waste	23	14th
Wood/Wood Waste Biomass	262	14th
Other Waste Biomass	5	19th
Co-Firing Biomass	91	7th

Production capacities, according to the National Renewable Energy Laboratory's Biofuels Atlas.

HYDROGEN



With 11 policies and incentives on the books, Washington’s lawmakers have made hydrogen a greater priority in the past couple of years, but it still lags other sectors. The state has only one fueling station. Looking forward, the Renewable Hydrogen Demonstration Project, a partnership between Douglas County Public Utility District, the Renewable Hydrogen Alliance and Toyota Motor North America, is expected to be completed toward the end of the year. There is also potential in the state to use hydrogen as a surplus energy storage system – the state tends to create excess energy from renewable sources in the spring when days are sunny and breezy and the Columbia river is high. This excess power could be efficiently stored using hydrogen, helping the state meet its emissions target. However, further incentives and investment will be required to bolster the industry.

Key Players: Douglas County Public Utility District, Renewable Hydrogen Alliance, and Toyota Motor North America

HYDROGEN PRODUCTION POTENTIAL NATIONAL RANKING



16th

Rank of hydrogen production potential in the wind sector



37th

Rank of hydrogen production potential in the solar sector



16th

Hydrogen production potential in the biomass sector



35th

Hydrogen production potential across renewable technologies

Hydrogen potential, according to the National Renewable Energy Laboratory's Hydrogen Demand and Resource Analysis Atlas.

HYDROGEN PRODUCTION COST AND RANK BY PROCESS

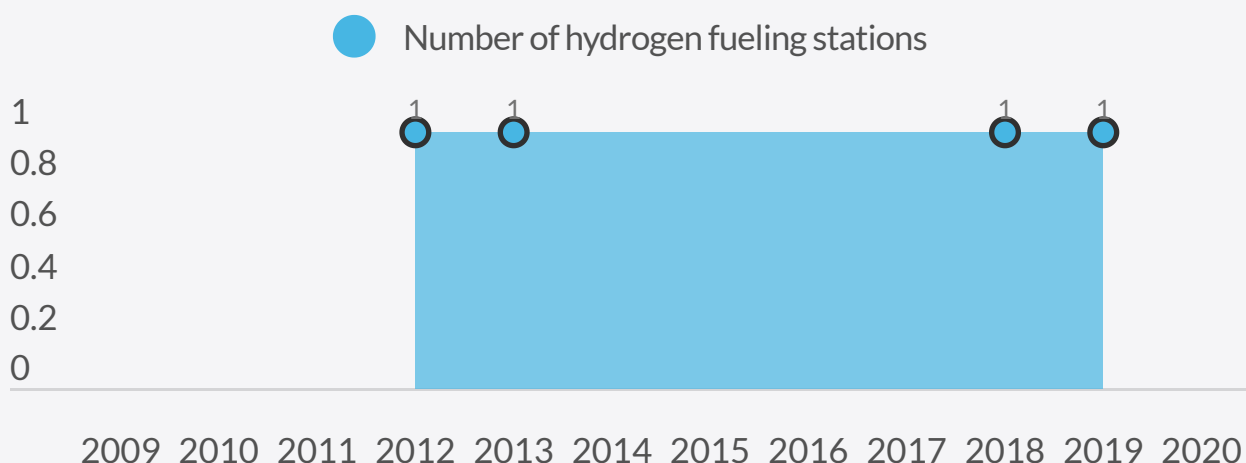
Hydrogen Electrolysis Costs	USD/kg	Rank (Low to High)
Commercial	242	17th
Industrial	209	17th
Residential	249	17th

Hydrogen Steam Methane Reforming Costs	USD/kg	Rank (Low to High)
Commercial	166	33rd
Industrial	162	33rd
Residential	176	33rd

Hydrogen costs, according to the National Renewable Energy Laboratory's Hydrogen Demand and Resource Analysis Atlas.

HYDROGEN FUELING STATION POLICY AND INFRASTRUCTURE

	Strength	Number	Compared to National Average
Number of hydrogen fuel laws & incentives	High	11	98%



[Download data](#)

Fueling stations over time and state laws and incentives, according to the United States Department of Energy's Alternative Fuels Data Center.

OFFSHORE WIND



Despite abundant wind resources from its coastal waters, Washington's offshore wind industry is still in its infancy. The Bureau of Ocean Energy Management (BOEM) has funded numerous studies to identify potential leasing areas for wind farms in the Pacific Outer Continental Shelf (OCS) area offshore Washington for FY 2021. The state's renewable energy standard calls for carbon-free generation by 2045, which could give the sector potential in the coming decades. However, it is likely to remain limited in the short term, because of concerns from the marine, fishing and tribal communities, as well as the depth of the waters and preservation zones.

Key Organizations: Clean Energy States Alliance, Pacific Northwest National Laboratory, Renewable Northwest, Spark Northwest, 25x25 Alliance