US Green Economy Report Series

Case Study - New York

UK Government

CLIMATE ADVISERS

UNIVERSITY OF MARYLAND 1856

SCHOOL OF PUBLIC POLICY

CENTER FOR GLOBAL SUSTAINABILITY

New York State Profile

In summer 2019, New York cemented its status as a climate leader by passing the Climate Leadership and Community Protection Act (CLCPA), which establishes some of the country's most ambitious climate targets and touches on all parts of the green economy.

New York first established a Renewable Portfolio Standard in 2004 and has increasingly raised its ambition in the past decade and a half. The state is a member of the US Climate Alliance, which was co-founded by New York Governor Andrew Cuomo, a Democrat, whose leadership was instrumental in passing the CLCPA.

It is also a member of the ZEV Alliance and New York City is a member of C40, a coalition of cities committed to climate action. Green finance is a growing part of the economy, with the NY Green Bank working with private-sector actors on clean energy projects with $1.1 billion investment so far. Like the governorship, both houses of the state's legislature are controlled by Democrats, increasing the chances that New York will continue to prioritise funding and implementation of its climate initiatives in the coming years.

NEW YORK STATE GOALS

6,000 MW

of renewable energy by 2030

9,000 MW

of offshore wind by 2035

70%

of renewable energy by 2030

100%

carbon-free electricity by 2040

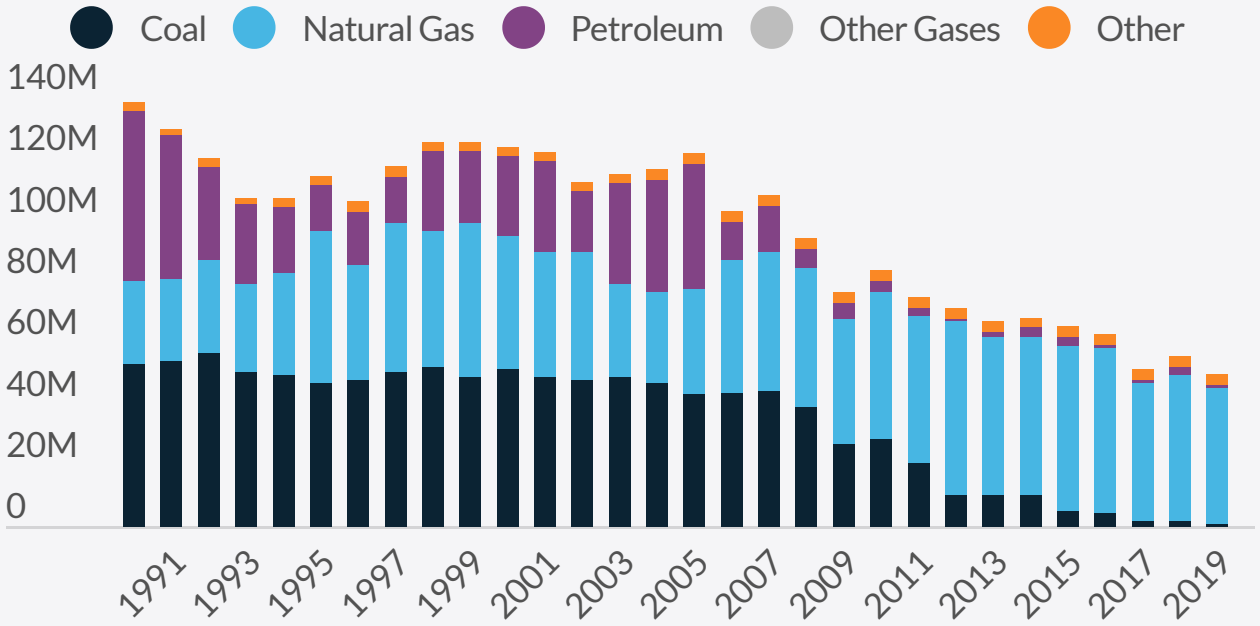
3,000 MW

of energy storage by 2030

85%

cut in greenhouse gas emissions from 1990 levels by 2050

ENERGY-RELATED GREENHOUSE GAS EMISSIONS



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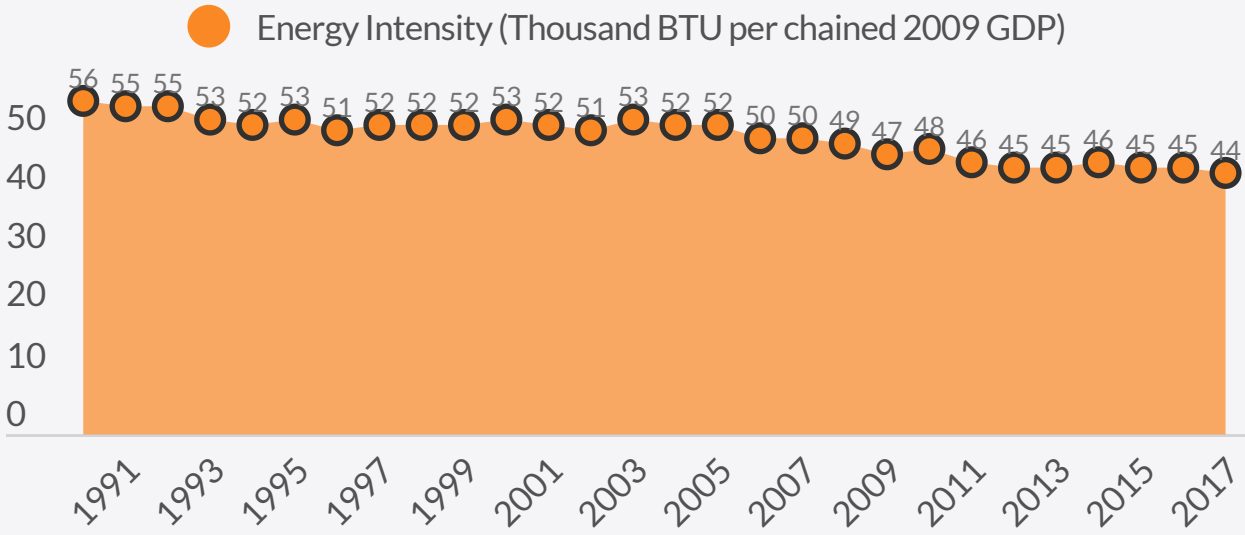
Carbon Dioxide emissions over time by energy generation source, according to the Energy Information Administration. Note: other includes non-biogenic municipal solid waste, batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, tire-derived fuels, and miscellaneous technologies; other Gases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

ENERGY INTENSITY OVER TIME



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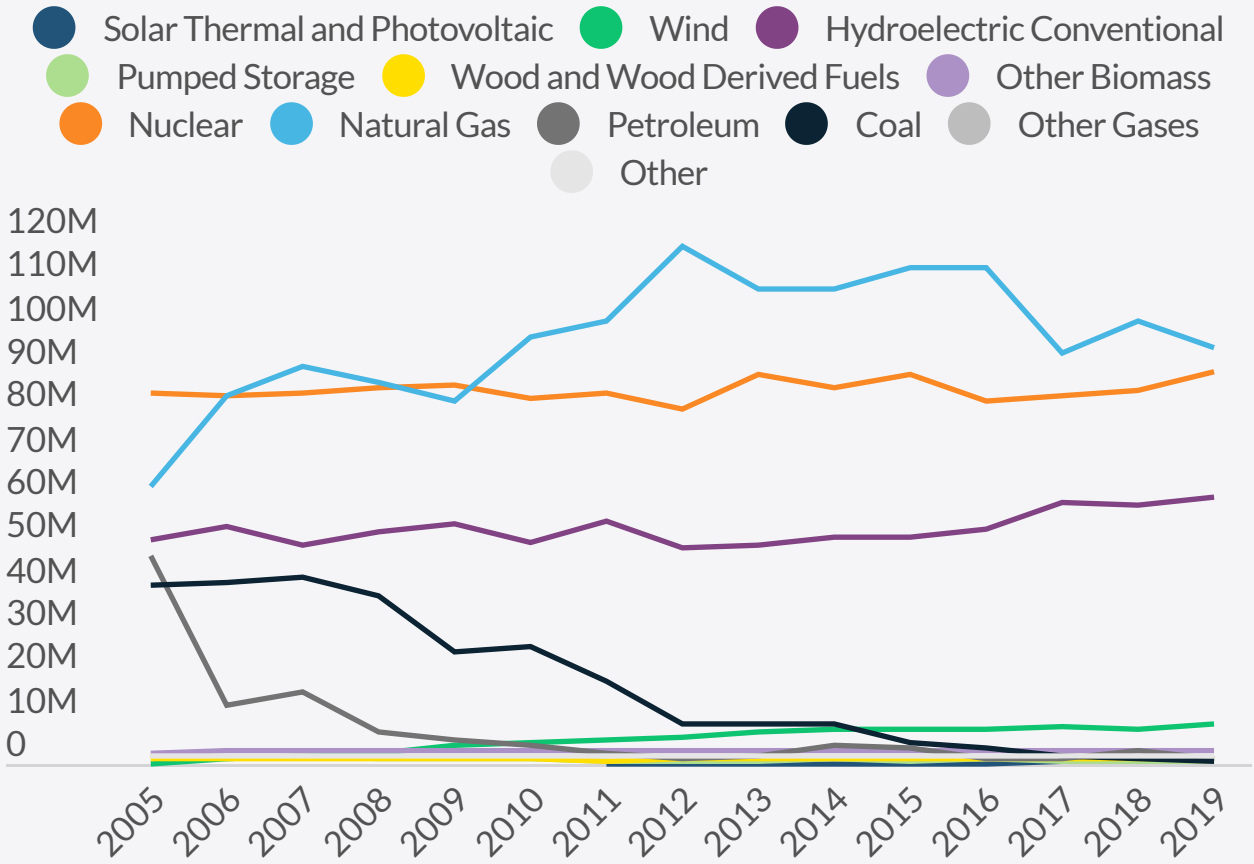
Source: Energy Information Administration

ELECTRICITY GENERATION BY SOURCE



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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	901,043	BBTU
ELECTRICITY PRICES	43.46	USD per MBTU
ENERGY PER GDP	2.76	Thousand BTU per 2012 USD
CONSUMPTION PER CAPITA	203	MBTU
NET-INTERSTATE FLOW	122,811	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.

NEW YORK'S LARGEST GENERATING PLANTS

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

2,435 MW

Hydroelectric: Robert Moses Niagara

1,642 MW

Petroleum: Oswego Harbor Power

2,299 MW

Natural gas: Ravenswood

1,604 MW

Natural gas: Northport

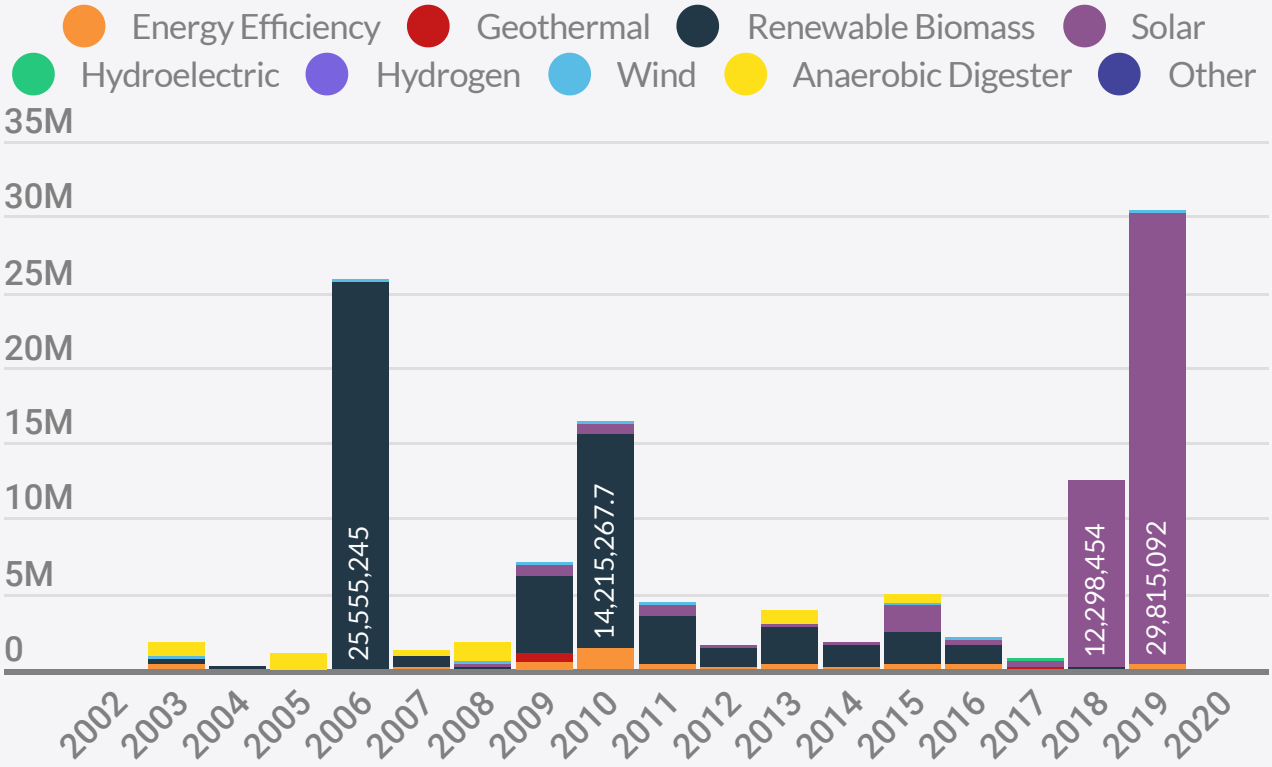
1,914 MW

Nuclear: Nine Mile Point Nuclear Station

1,314 MW

Natural gas: Astoria Generating Station

PUBLIC INVESTMENT BY GENERATION TYPE (DOA)



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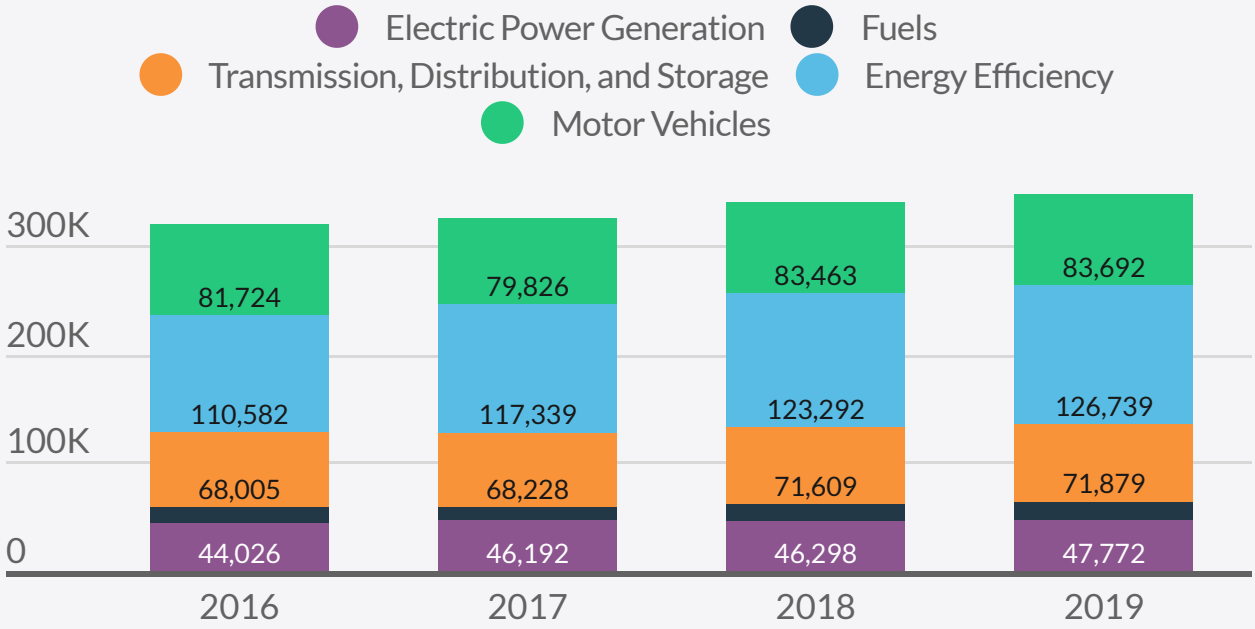
Public investment by energy type from 2002 to 2020, according to the United States Department of Agriculture. Data includes all investments made through Department of Agriculture programs.

TRADITIONAL ENERGY SECTOR JOBS



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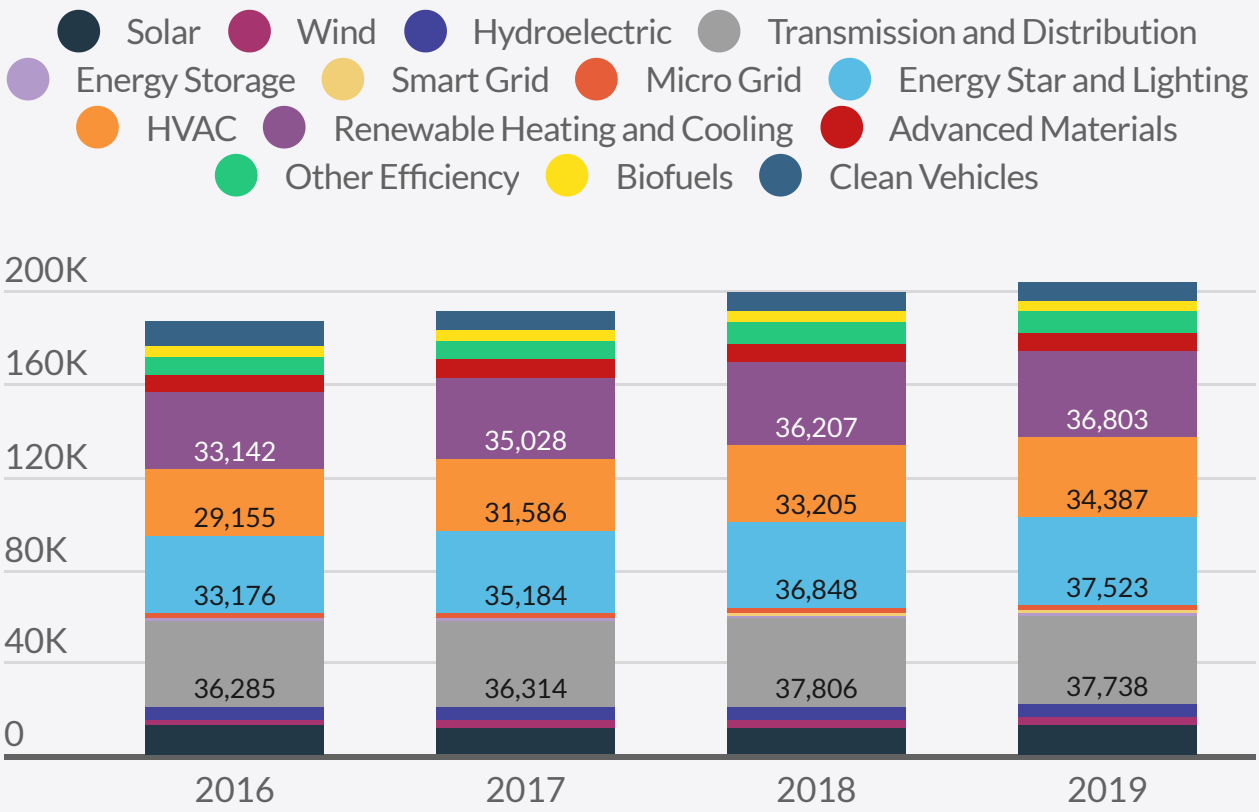
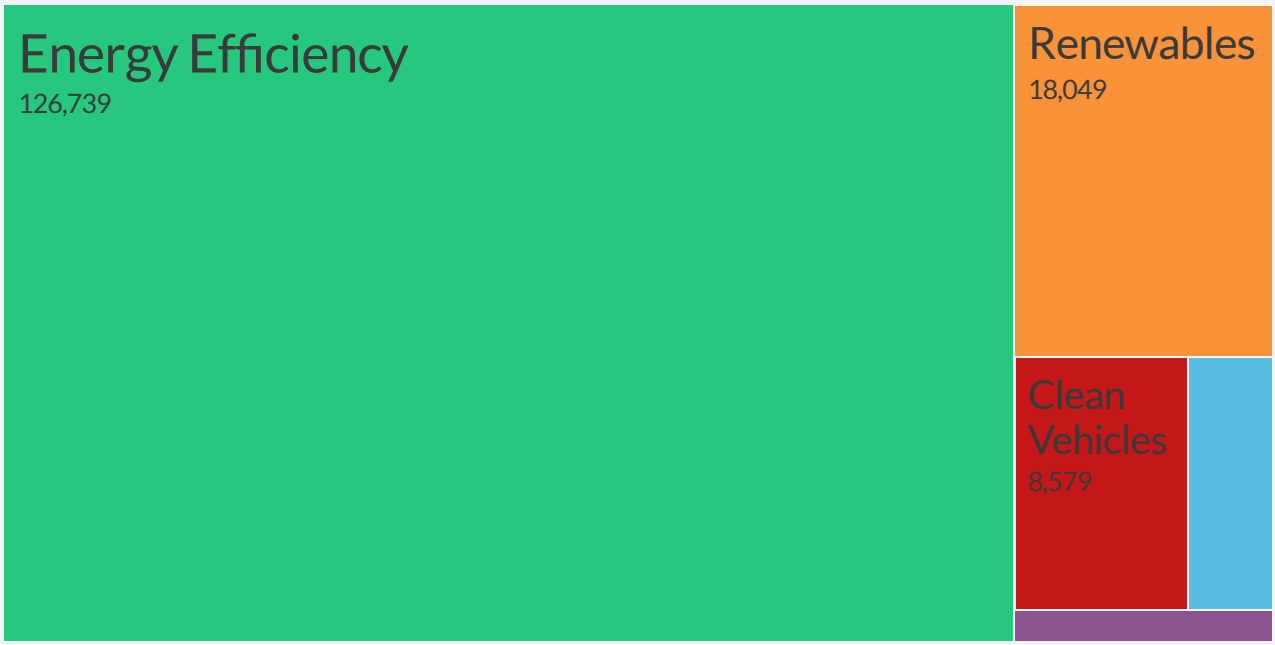
Traditional energy sector jobs over time, according the United States Energy and Employment Report (USEER).

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



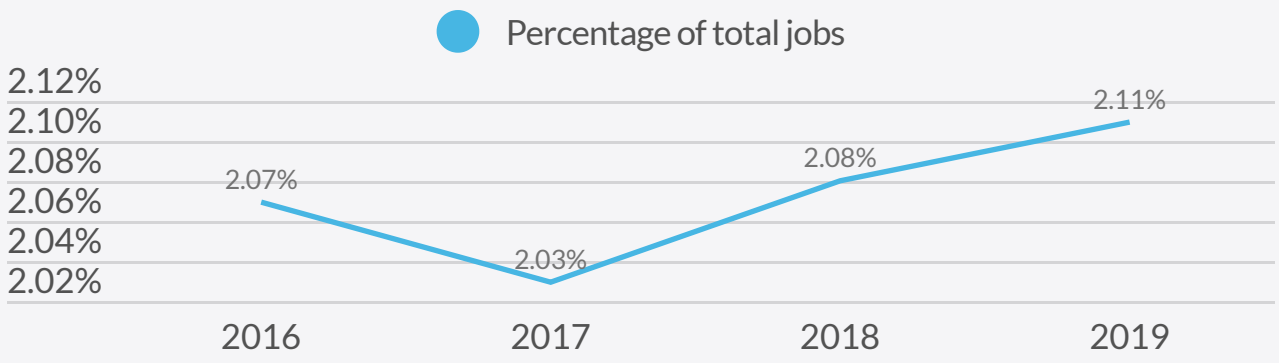
Clean energy jobs over time by technology, according to E2 Clean Jobs America.

CLEAN ENERGY COMPENSATION

Average state clean energy wage	$27.07
Percent above/below median state wage	20.09%
#1 most in-demand occupation*	Management
#2 most in-demand occupation*	Technician or mechanical support

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

New York is in tier 2 according to the ZEV State Policy Scorecard, indicating the state's high overall progress on EV policies, practices and investments. The state's headline initiatives include Charge Ready NY, which offers rebates of up to $4,000 per station to public or private organisations that install Level 2 EV charging stations at public parking facilities, workplaces and multifamily apartment buildings; Evolve NY, a plan to spend $250 million through 2025 to build a statewide network of public EV charging stations; and the Drive Clean rebate programme, which provides buyers and lessees of new EVs and plug-in hybrids rebates of up to $2,000.

In addition, Governor Cuomo has set an ambitious goal of having 850,000 EVs on the road by 2025. According to EV Adoption, EVs accounted for 1.56 percent of vehicle sales in New York in 2018, and there are a total of 2,346 charging stations in the state. Looking forward, there is a policy on medium- and heavy-duty zero-emissions vehicles expected early this year, which shows that the future potential for ZEVs in New York will likely continue to improve.

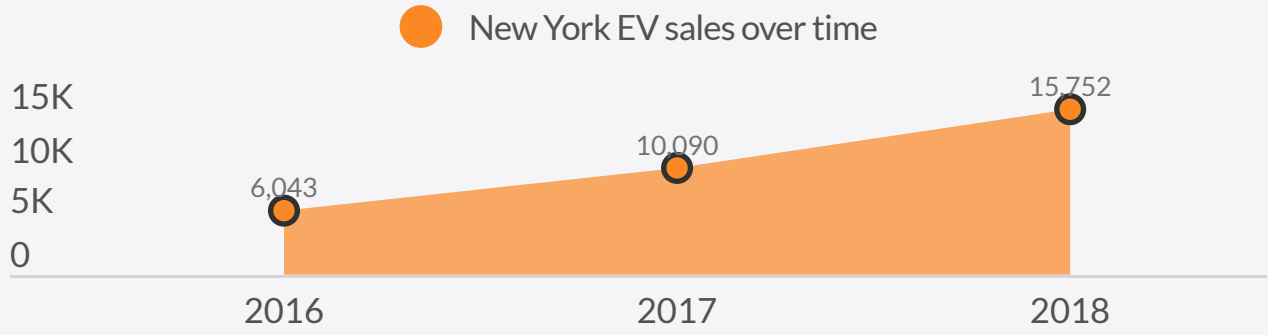
Key Players: Department of Environmental Conservation, New Yorkers for Clean Power, NESCAUM

ELECTRIC VEHICLE FACTS AND FIGURES

National rank based on EV sales	2
Percentage of national EV sales	4.8%
Market share within state	1.6%
Market share within state (year over year growth)	51%
EV sales as a percentage of motor vehicle sales	0.7%
Number of people per charging station	17,802
Number of people per charging station (rank)	32
EV Fuel Cost per eGallon (2018)	$1.68
EV Fuel Cost per eGallon (% above/below national average)	32%
Fuel cost savings per gallon versus gasoline	$1.23
Most popular EV (search volume)	Mitsubishi i-MiEV

Electric vehicle quick facts based on data from EVAdoption.

ELECTRIC VEHICLE SALES OVER TIME



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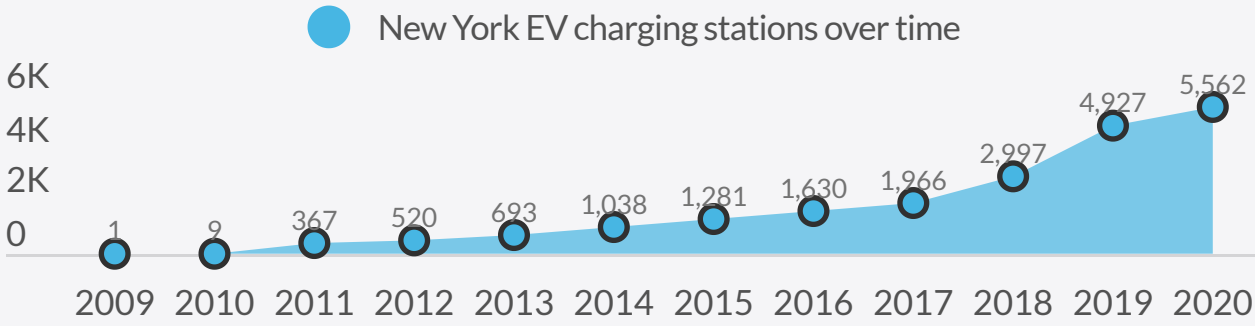
Electric vehicle sales over time, according to EVAdoption.

ELECTRIC VEHICLE CHARGING STATIONS OVER TIME



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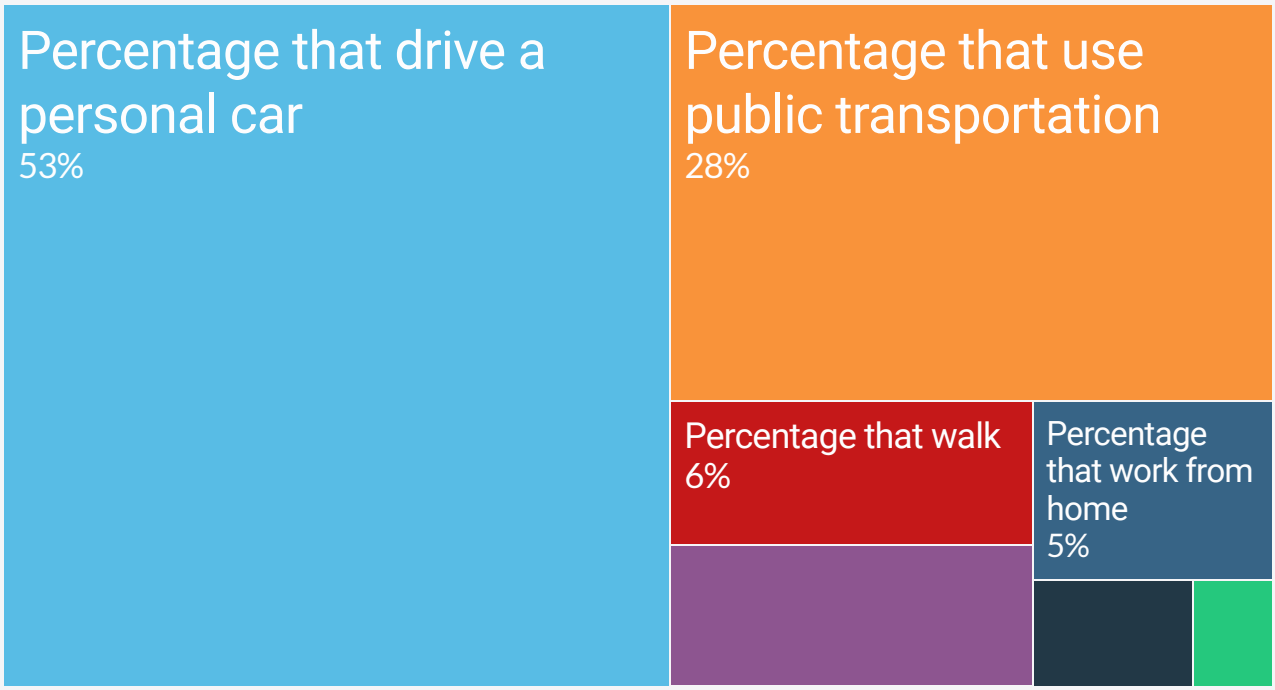
Charging stations over time, according to the United States Department of Energy's Alternative Fuels Data Center.

ELECTRIC VEHICLE LAWS AND INCENTIVES

	Strength	Number	Compared to National Average
Number of EV laws & incentives	High	28	90%
Number of HEV laws & incentives	High	6	191%
Number of PHEV laws & incentives	High	27	103%
Number of NEV laws & incentives	Medium	1	-4%
Number of fuel economy/efficiency laws & incentives	High	3	159%

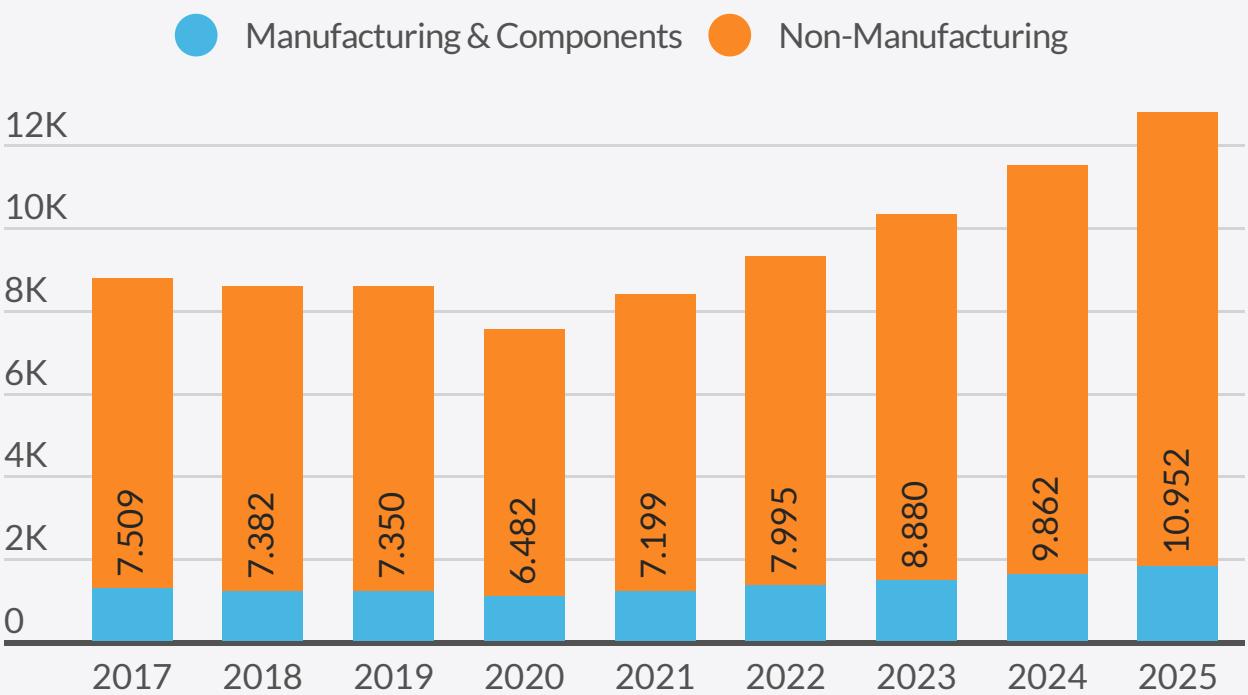
Quantity of state laws and incentives on electric vehicles, in comparison to national average, according to the Alternative Fuels Data Center.

PROFILE OF A NEW YORK 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

New York is ranked 5th on ACEEE's 2020 State Energy Efficiency Scorecard, reflecting the state's strong efforts to improve energy efficiency. The state has 68 financial incentives for energy efficiency, including an active PACE financing programme, corporate and property tax incentives and a programme that provides grants to low-income residents for energy efficiency upgrades in their homes. New York requires residential buildings to disclose utility data at the time of sale or rental, and state-owned facilities over 25,000 square feet to benchmark and disclose energy performance data on ENERGY STAR Portfolio Manager.

In an effort to achieve the state's goal of increasing energy efficiency 23 percent from 2012 levels, the state has already announced a $6 million, pay-for-performance energy efficiency effort in which service providers will be paid to reduce energy use in National Grid customers' homes through retrofits and other efficiency measures. New York has several research and development institutions focused on energy efficiency, including the New York State Energy Research and Development (NYSERDA), Center for Sustainable & Renewable Energy (CSRE), Building Energy and Environmental Systems Laboratory (BEESL) and Clean Energy Fund (CEF).

Key players: Central Hudson Gas & Electric Corporation Service, Consolidated Edison Company of New York Inc., New York State Electric & Gas Corporation (NYSEG), New York State Energy Research and Development Authority (NYSERDA), National Grid, Orange & Rockland, PSEG Long Island, Rochester Gas & Electric Corporation (RG&E).

ENERGY EFFICIENCY RANKINGS BY CATEGORY

5

Energy Efficiency Rank

5

Utilities Rank

7

Government Rank

2

Transportation Rank

7

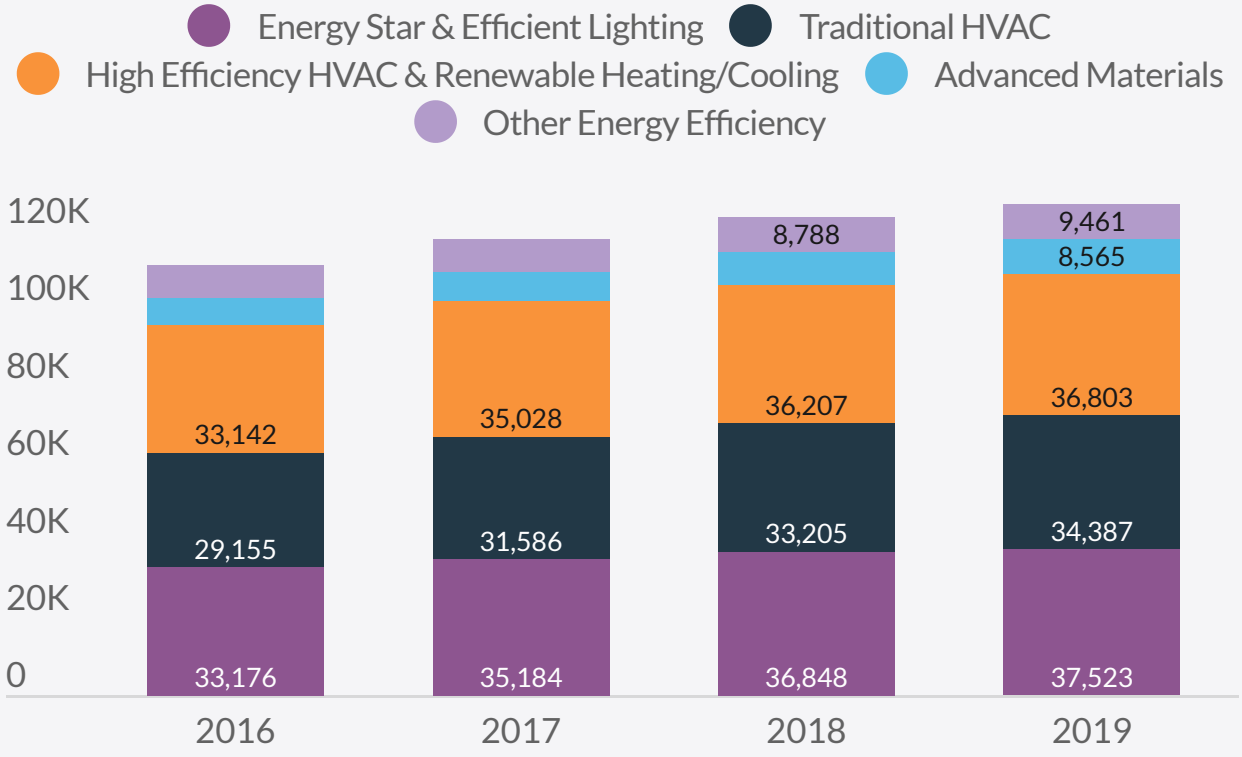
Buildings Rank

7

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



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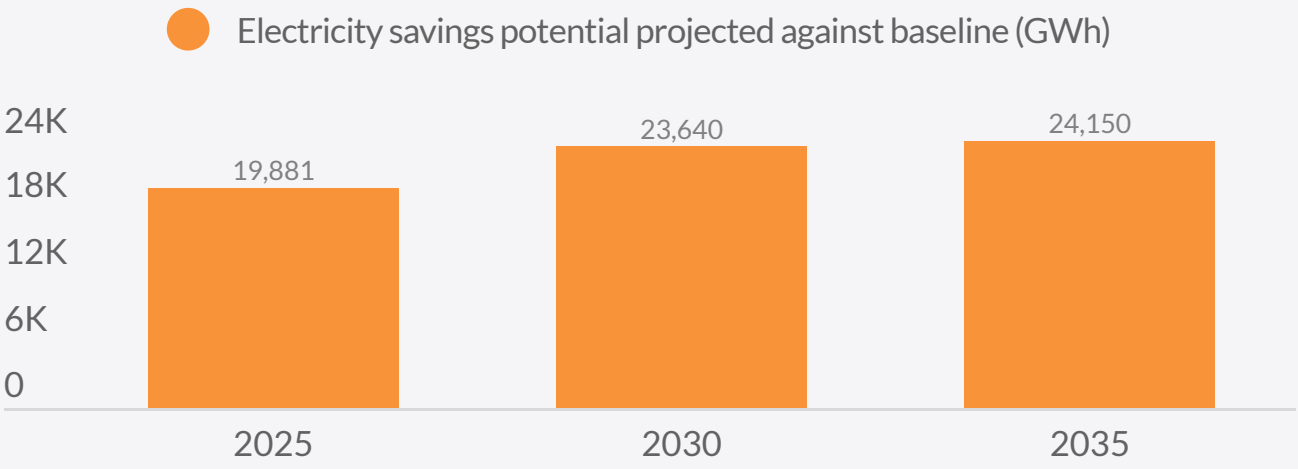
Categories of energy efficiency jobs, according to the United States Energy and Employment Report.

ENERGY EFFICIENCY ELECTRICITY SAVINGS POTENTIAL PROJECTED AGAINST BASELINE



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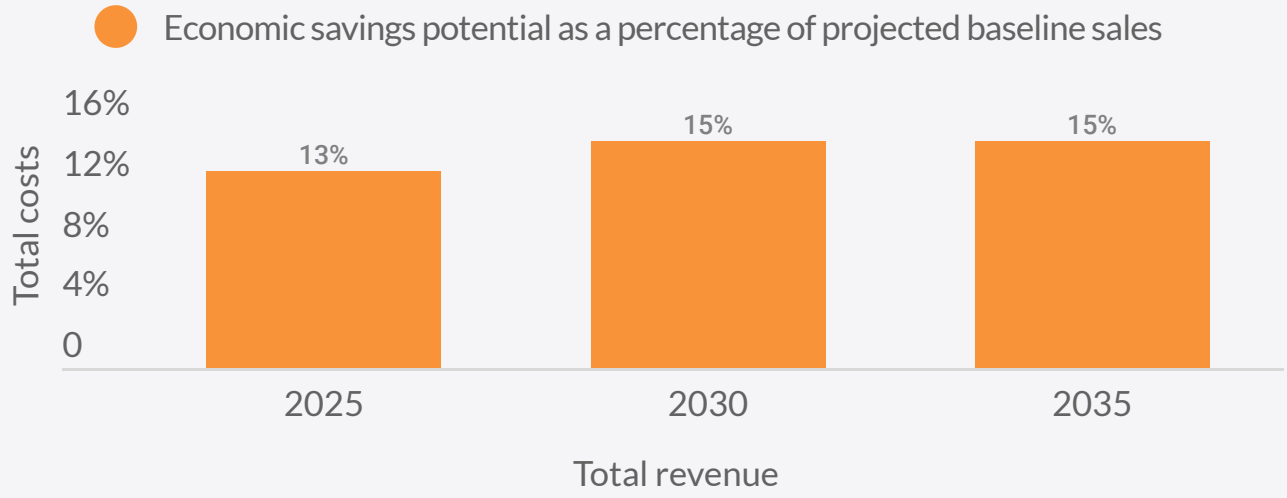
Electricity savings projected by the the United States Office of Energy Efficiency and Renewable Energy.

ENERGY EFFICIENCY ECONOMIC SAVINGS POTENTIAL AS A PERCENTAGE OF BASELINE SALES



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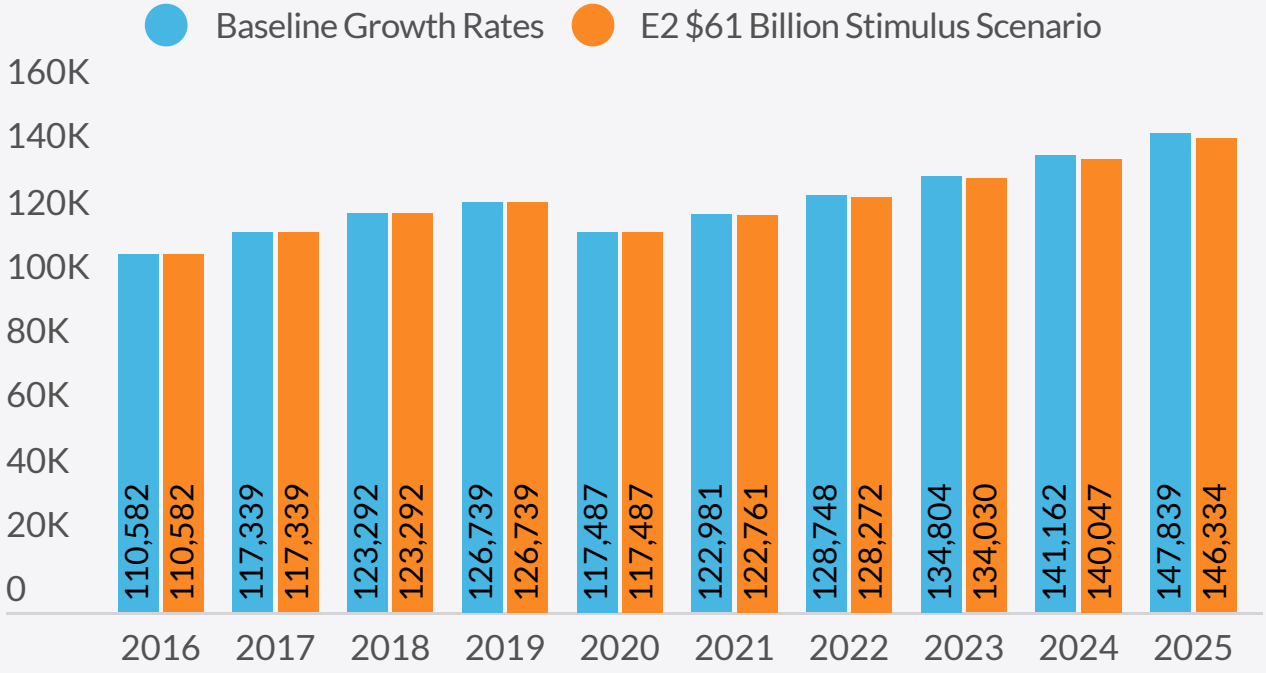
Electricity savings projected by the the United States Office of Energy Efficiency and Renewable Energy.

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

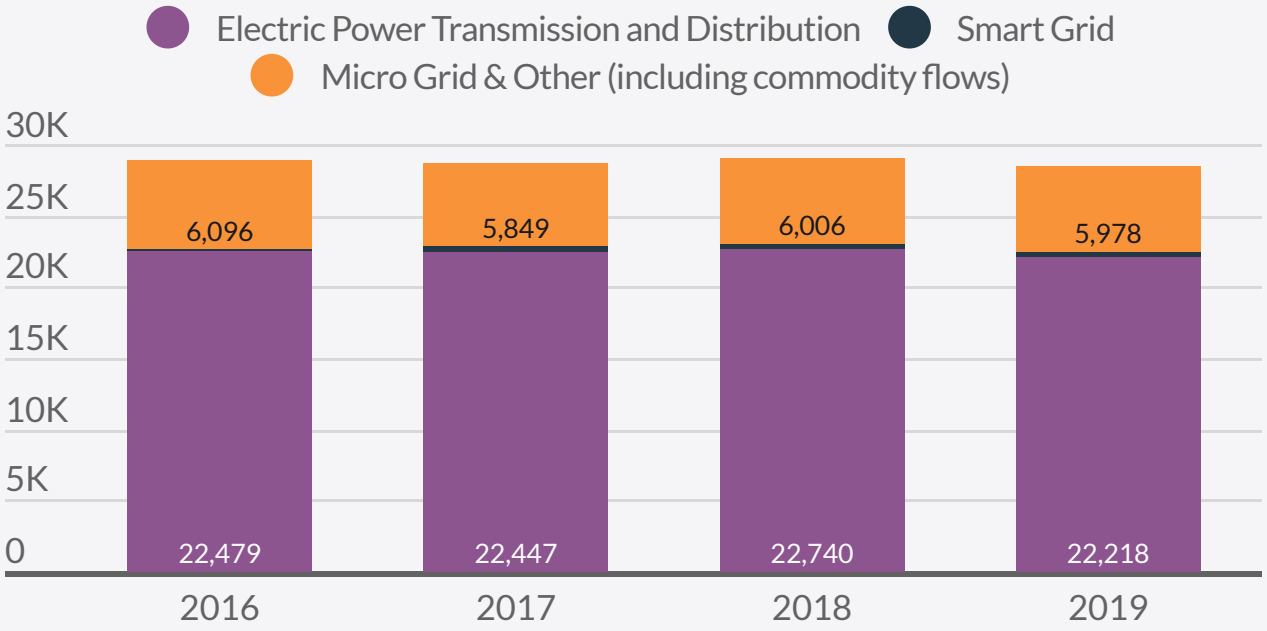
New York ranks 7th in the 2018 Grid Modernization Index, indicating high overall progress on grid modernisation policies, practices and investments. The state is a leader across many grid improvement criteria, and consistently undertakes the most aggressive grid modernisation actions.

Major grid-related developments include conducting a power grid study to identify where transmission upgrades are needed, funding $110 million towards grid modernisation projects under NYSERDA's leadership through 2022 and building a 250-mile green energy transmission superhighway – all of which align with the state's Reforming the Energy Vision (REV) initiative.

In 2020, 78 bills relating to energy infrastructure and regulations were introduced, of which 3 were enacted and 3 were passed by one or both chambers. With regards to demand response, New York enrols 94,139 customers, helping save 5,826 MWh. As it stands, Climate Advisers anticipates above-average growth in this sector.

Key Players: Consolidated Edison, National Grid, Central Hudson Gas and Electric, NY State Energy Research and Development Authority, NYISO, New York Public Service Commission, NY State SmartGrid Consortium

GRID JOBS BY CATEGORY OVER TIME



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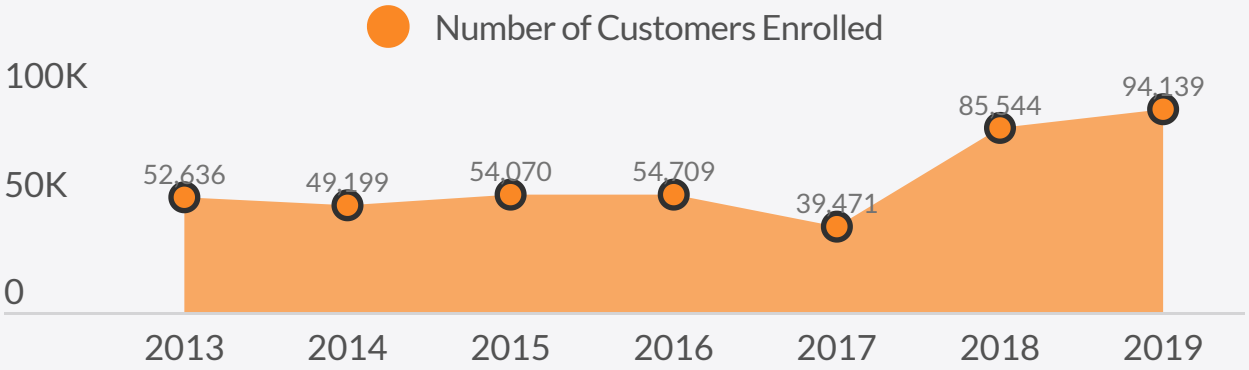
Categories of grid-related jobs, according to the United States Energy and Employment Report.

DEMAND RESPONSE ENROLLMENT AND INCENTIVES



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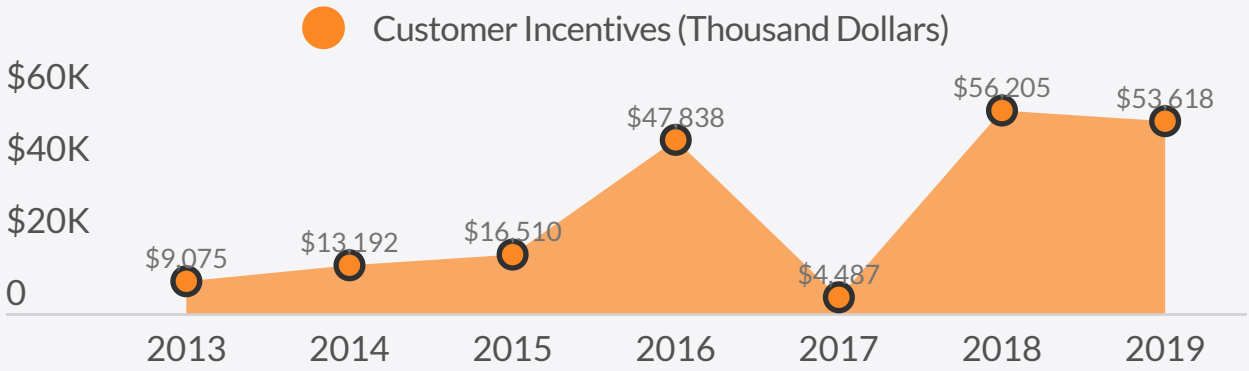

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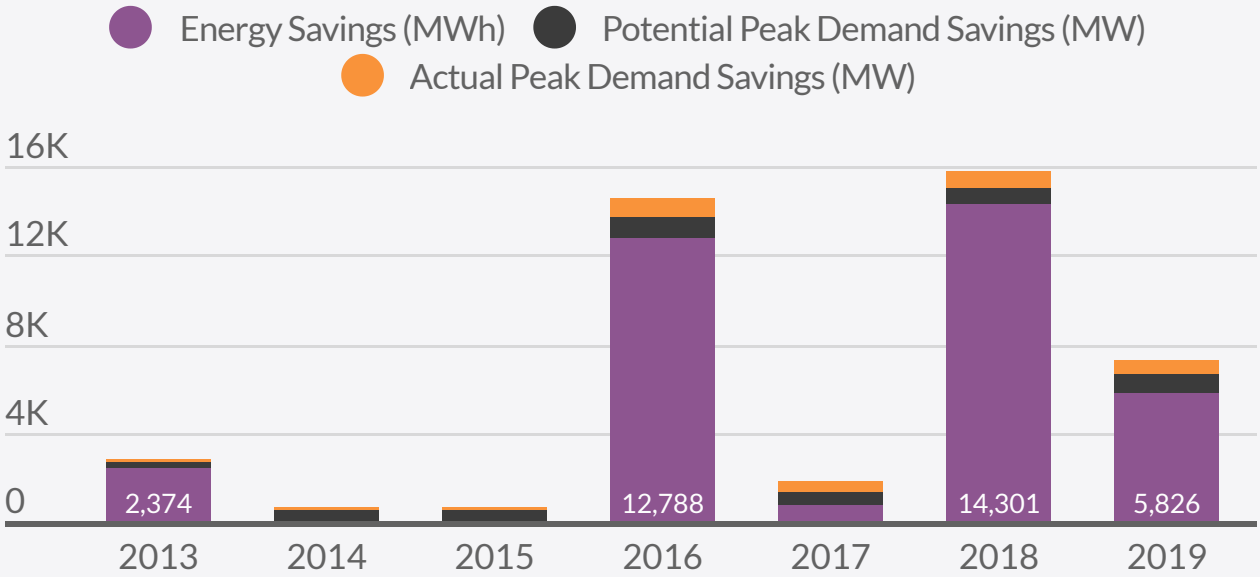
Enrollment and incentive data sourced from the Energy Information Administration.

DEMAND RESPONSE ENERGY SAVINGS OVER TIME



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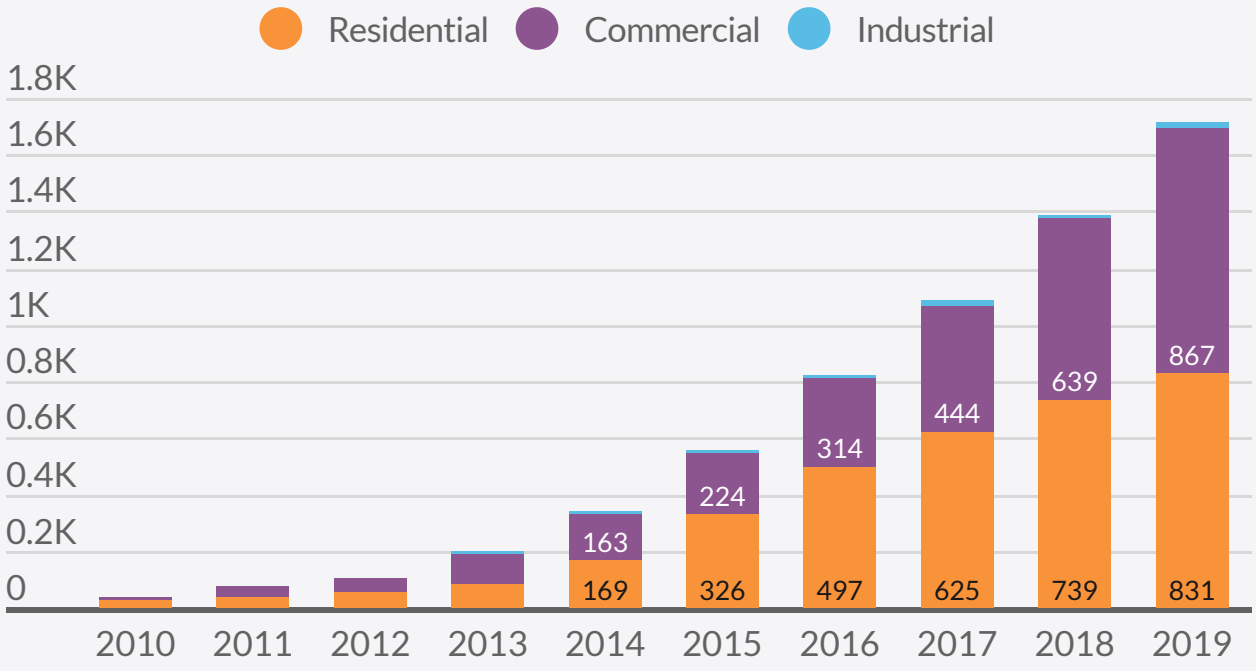
Demand response savings data sourced from the Energy Information Administration.

DISTRIBUTED GENERATION: NET METERING CAPACITY



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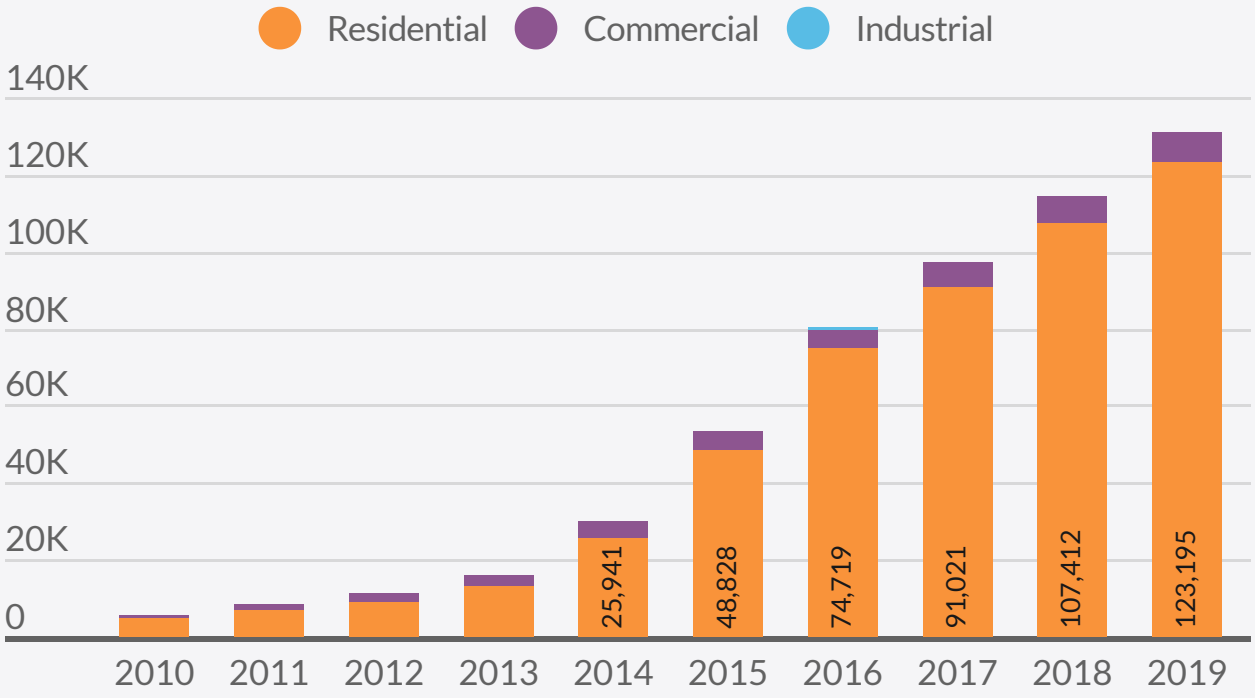
Net metering capacity over time sourced from the Energy Information Administration.

DISTRIBUTED GENERATION: NET METERING CUSTOMERS



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

OFFSHORE WIND

Since the CLCPA includes a goal of 3,000 MW of offshore wind capacity by 2025 and 9,000 MW by 2035, the outlook in New York is strong for offshore wind. In 2019, the state completed its first offshore solicitation. The two winners were Orsted and Eversources' 880-MW Sunrise Wind project and Equinor's 816-MW Empire Wind project. NYSERDA signed a contract to procure Offshore Renewable Energy Credits (ORECs) from both projects for a 25-year period in October 2019. New York announced a second offshore wind solicitation for up to 2,500 MW of projects in 2020, demonstrating its continued efforts to meet offshore wind generation targets.

Key Players: Con Edison, Long Island Power Authority (LIPA), New York Power Authority (NYPA), Orsted, Eversource Energy, Equinor, Deepwater Wind, National Grid, General Electric, 25x25 Alliance, Alliance for Clean Energy New York, Bureau of Ocean and Energy Management, Clean Energy States Alliance, New York Offshore Wind Alliance, New York State Research and Development Authority (NYSERDA).

12%

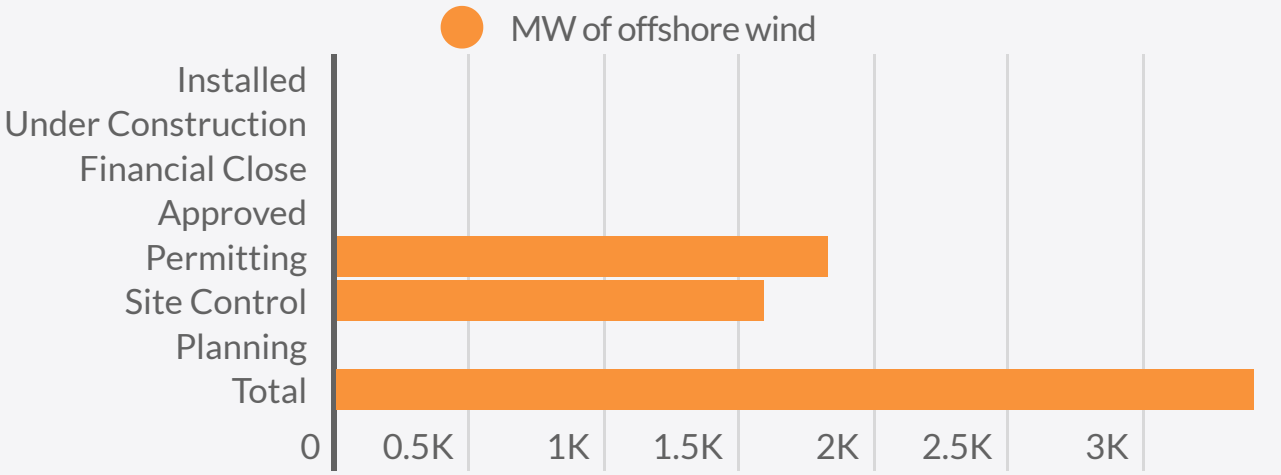
Of electricity generation potentially supplied by wind

4730 MW

Of offshore wind economically recoverable

Offshore wind potential based on data from Oceana.

OFFSHORE WIND PROJECT PIPELINE STATUS



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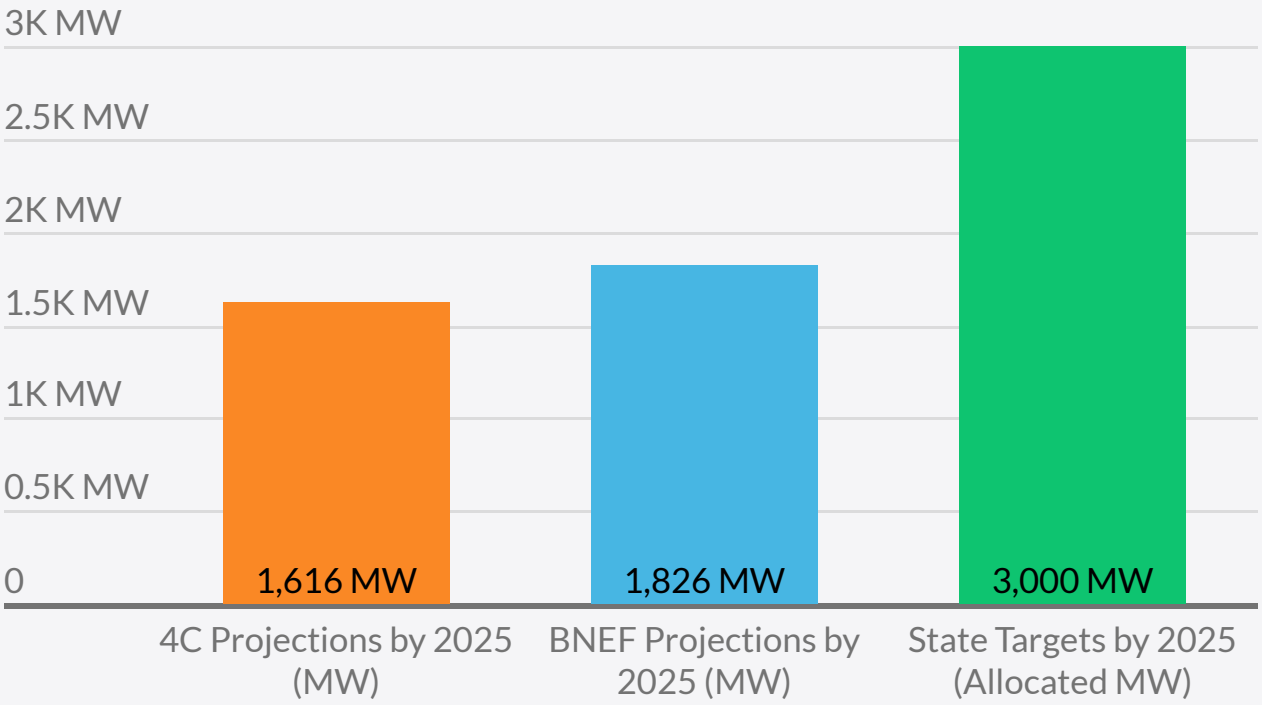
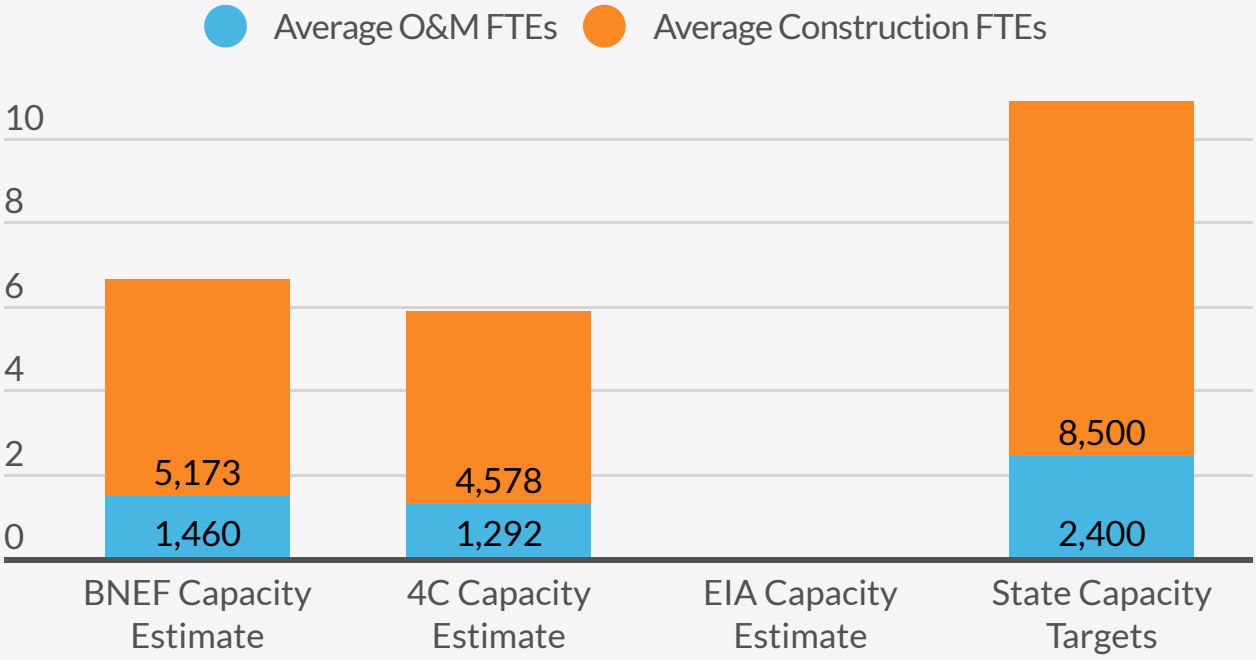
Offshore wind pipeline sourced from the Office of Energy Efficiency and Renewable Energy 2018 Wind Technologies Market Report.

OFFSHORE WIND PROJECTED PROJECT PIPELINE TO 2025



Pipeline based on 4C Offshore , BloombergNEF, the EIA and state procurement target announcements. Data available in the Office of Energy Efficiency and Renewable Energy 2018 Wind Technologies Market Report and the EIA.

PROJECTED OFFSHORE WIND FTE ADDITIONS BY 2025



Methodology: Average FTEs between 2020 and 2020 based on MW estimates per year from BNEF, 4C Offshore, the EIA and announced state targets, along with jobs per MW assumptions from the NREL. Additional details can be found in the Appendix

ENERGY STORAGE

New York currently has 1,442.4 MW of energy storage and aims to have 1,500 MW by 2025 and 3,000 GW by 2030. There are 40 grid-level energy storage projects in the state and the Public Service Commission's 2018 energy storage order authorises a total of $350 million in incentives to accelerate the energy storage market. As such, Climate Advisers anticipates significant growth in this sector in the coming years, even though pumped storage is not expected to return to previous high levels seen in the 1990s due to geological constraints, costs and permitting challenges

Key players: New York Battery and Energy Storage Technology Consortium (NY-BEST)

ENERGY STORAGE: POLICIES AND CAPACITY INSTALLED

1,444 MW

Capacity installed

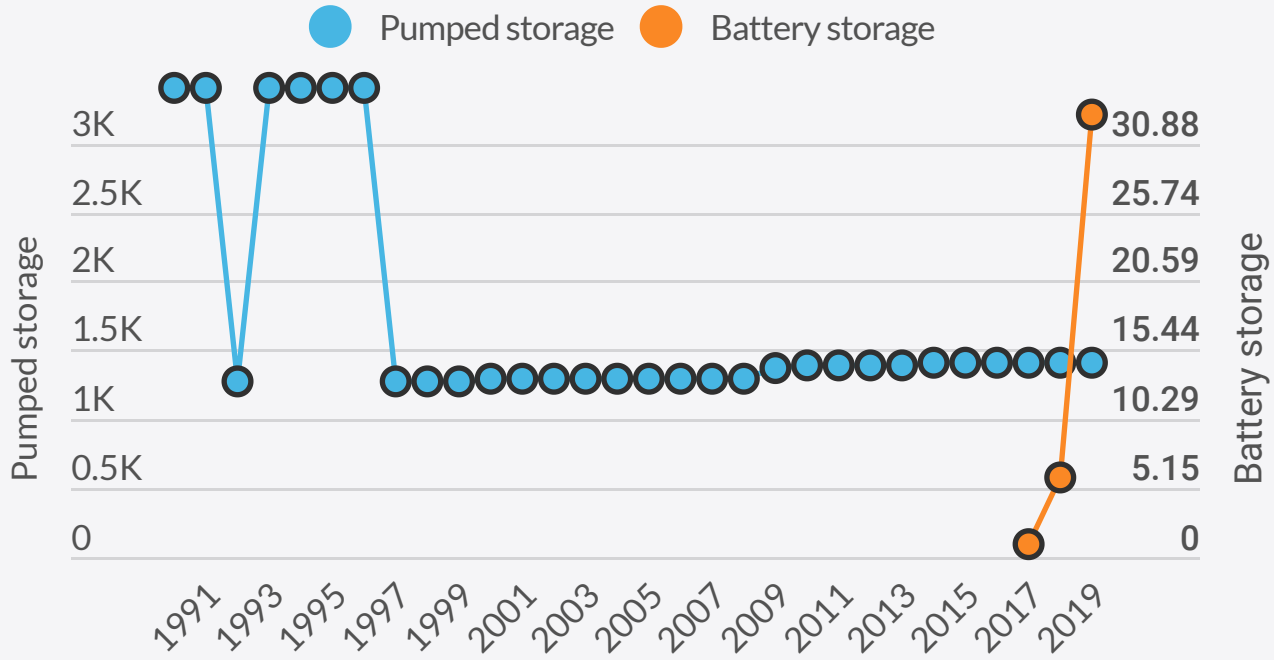
1,913

Energy storage jobs

	Yes/No
Procurement Targets	Yes
Regulatory Requirements	Yes
Demonstration Programs	Yes
Financial Incentives	Yes
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.

NEW YORK CURRENT ENERGY STORAGE CAPACITY



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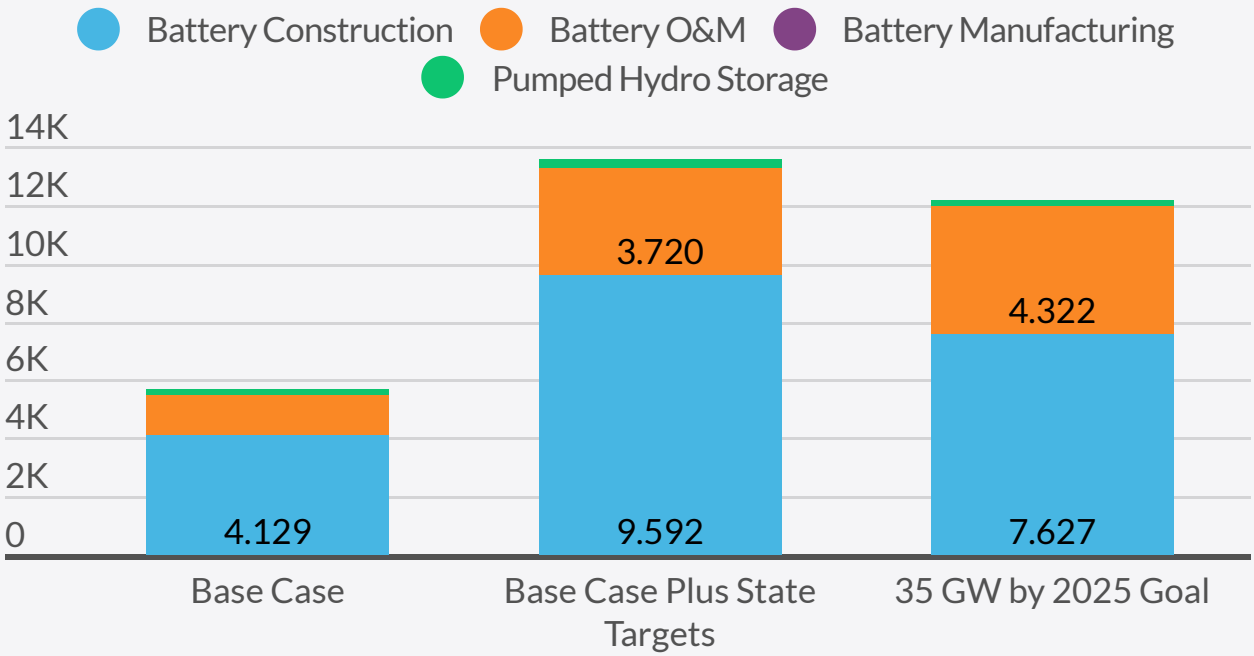
Energy storage generation capacity over time available through the Energy Information Administration.

PROJECTED ENERGY STORAGE FTE ADDITIONS (2021-2025)



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 New York, there are currently 4,170 environmental consultants employed, earning an average salary of $73,600. New York's renewable energy consultancy sector is promised strong growth as a result of the state's renewable energy potential of 2,642,615 GWh, driven primarily by rural utility-scale PV and offshore wind. Even though New York ranks 37th in the nation for renewable energy potential, there are growing opportunities for green consulting projects and assessment amid the state's aggressive plans in the renewable sector.

Key proposed projects in the state include the state's largest onshore wind turbine and solar PV projects to be operated by Invenergy Services, along with battery facilities proposed Helix Ravenswood and Key Capture Energy. Given the strong policies, Climate Advisers expects New York's green consulting sector to grow above the national average of 11 percent (from 2016 to 2026.

CARBON CAPTURE, UTILISATION AND STORAGE

In 2017, New York commissioned a study on the ways CCUS could help the state achieve its climate goals. This study found that the state's geography was conducive to CO2 sequestration. There are currently no government incentives or policies that have been enacted to encourage CCUS projects nor are there any CCUS projects currently under development in the state. Looking to the future, one piece of legislation is under consideration, which incentivises low-carbon concrete through CCUS, which could help build the industry in the state.

WASTE TO ENERGY

Biogas: New York is ranked 7th for biogas production potential with an estimated 52.3 billion cubic feet of renewable methane per year. The highest future potential is in manure (285 systems), wastewater (122 systems), food waste (121 systems) and landfill (4 systems). These systems would result in a combined $1.59 billion in capital investments, 13,291 construction jobs, and 882 permanent jobs. Furthermore, estimated emissions reductions would be equivalent to having 5.16 million cars fewer cars on the road. New York currently operates 118 wastewater, 49 landfill, 30 manure and 13 food waste biogas systems.

Transport: Through the New York State Energy Research and Development Authority (NYSERDA), the state provides funding for and annually solicits projects under its Clean Transportation Program. In addition, the state can subject fuel distributors to small fines if they enter into fuel exclusivity contracts.

Biomass: Biomass fuels accounted for less than 2 percent of New York's utility-scale net generation in 2019, though renewables made up almost 30 percent of total generation. One-fourth of the state's biomass-fueled generation comes from three utility-scale wood- and wood waste-fueled generating facilities.

Key players: New England Wood Pellet LLC, Northeast Regional Biomass Energy Program, Biomass Crop Assistance Program (Project Area 10), New York Bioenergy Association

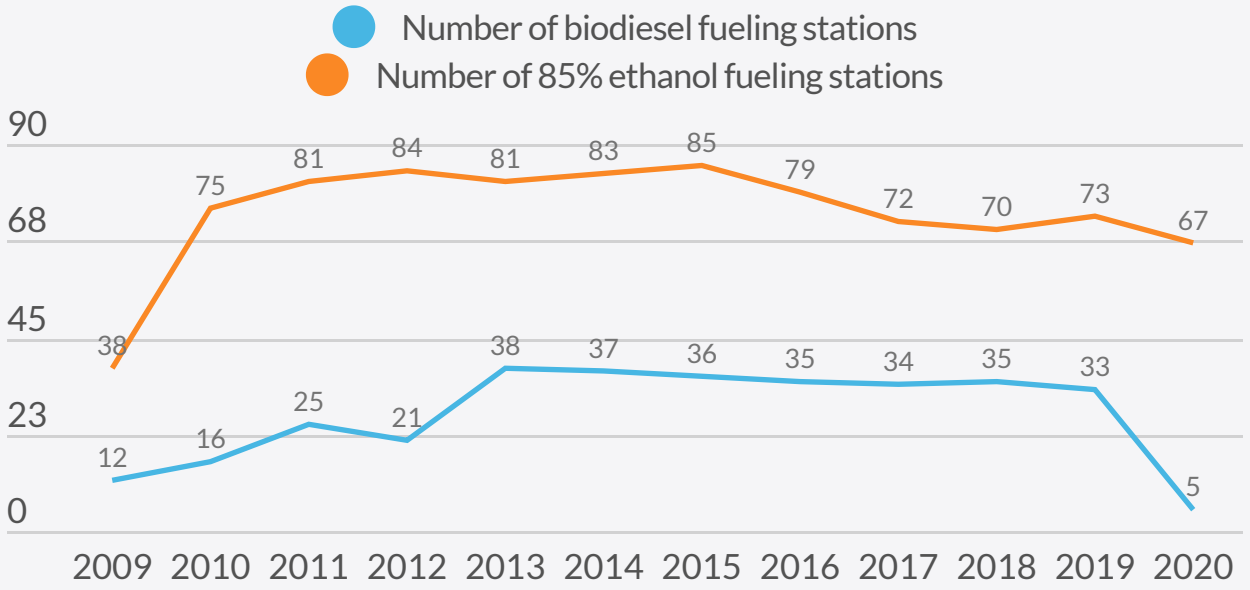
WASTE TO ENERGY: BIOMETHANE POTENTIAL

Biomethane Type	Output (Tonnes/Year)	National Rank
Methane Emissions from Landfills	11,966	34th
Biogas Generation Potential from Wastewater	171,295	3rd
Biogas Generation Potential from Industrial, Commercial and Institutional Organic Waste	70,772	4th
Biogas Generation Potential from Animal Waste	9,049	31st

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	Low	2	-66%
Number of ethanol laws & incentives	Low	2	-63%



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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	116	5
Municipal Solid Waste	261	2
Wood/Wood Waste Biomass	156	19
Other Waste Biomass	1	26
Co-Firing Biomass	-	-

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

HYDROGEN

New York has in place a variety of programmes that are likely to drive an increase in hydrogen fueling infrastructure in the coming years, including tax credits, a voucher programme and funding for research projects. Moreover, a utility, the Long Island Power Authority, provides a feed-in tariff for fuel cell systems with an output of at least 1,000 kW.

Looking to the future, hydrogen storage and dispensing company Plug Power, which employs about 400 workers in New York, will build a major new fuel cell factory upstate with outputs used in the generation of green hydrogen.

Key Players: Plug Power, Rochester Gas and Electric, Empire State Development, New York State Energy Research and Development Authority

HYDROGEN PRODUCTION POTENTIAL NATIONAL RANKING

28th

Rank of hydrogen production potential in the biomass sector

38th

Rank of hydrogen production potential in the solar sector

28th

Hydrogen production potential in the wind sector

38th

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

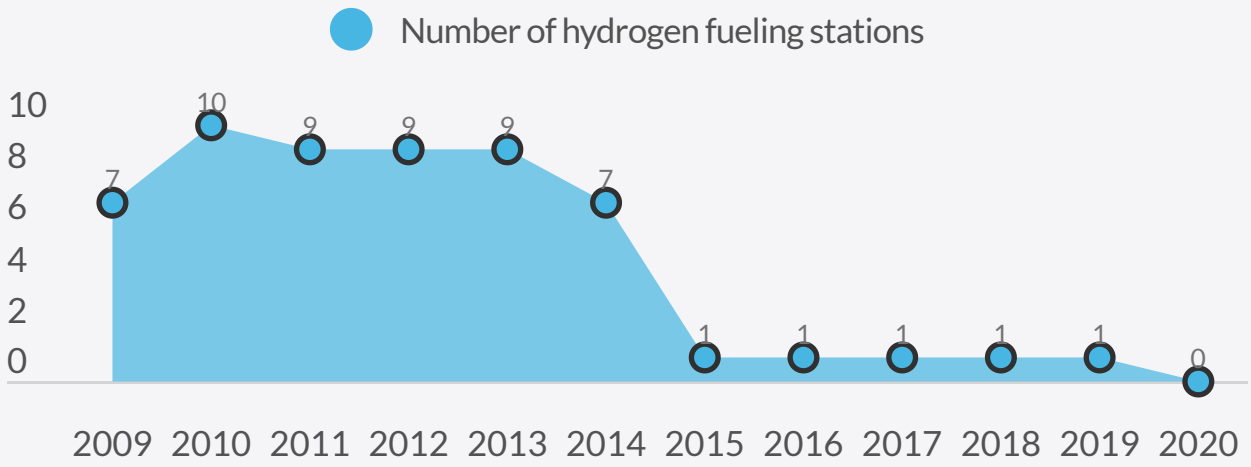
Hydrogen Electrolysis Costs	USD/kg	Rank (Low to High)
Commercial	639	39
Industrial	618	45
Residential	672	42

Hydrogen Steam Methane Reforming Costs	USD/kg	Rank (Low to High)
Commercial	286	23
Industrial	266	23
Residential	313	23

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	Medium	6	8%



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