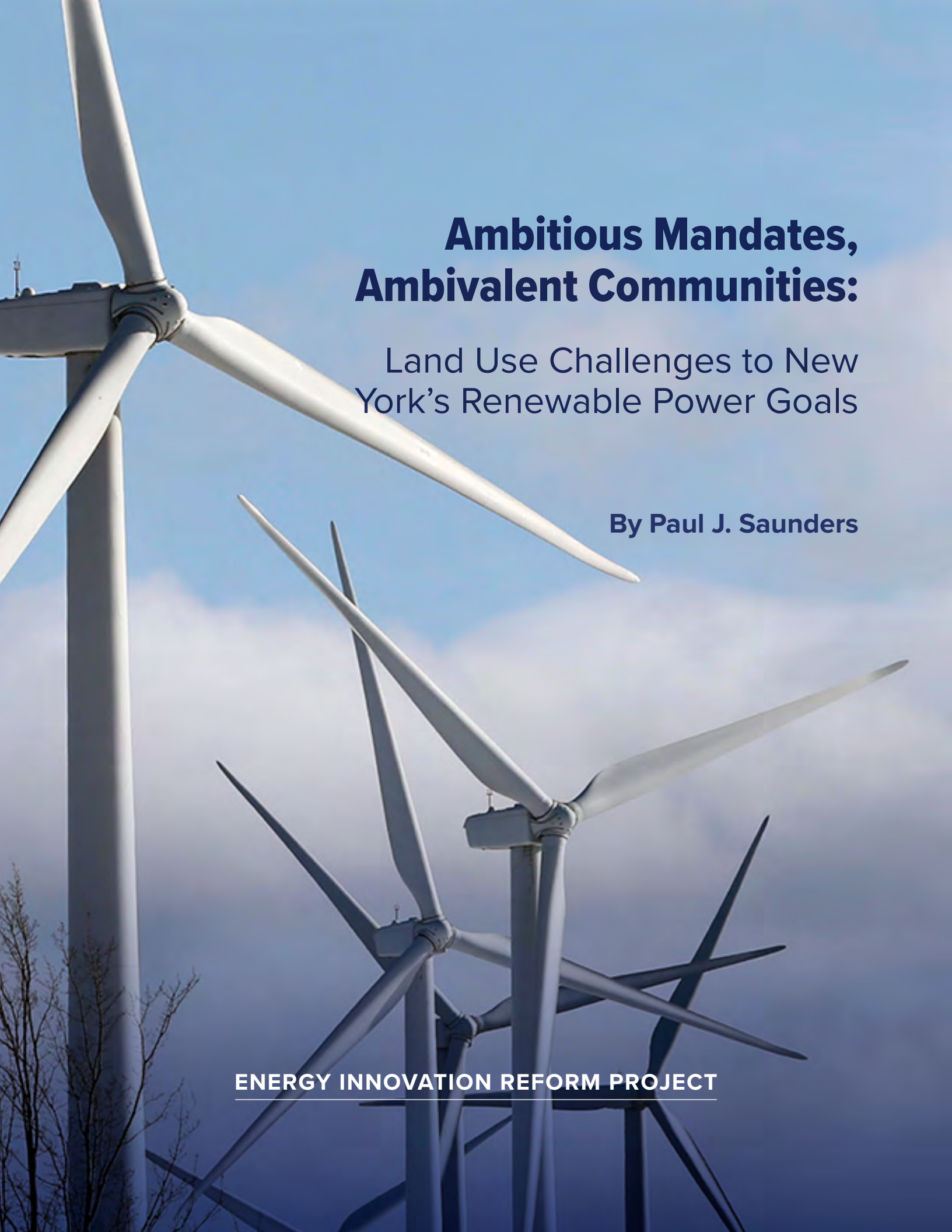

Ambitious Mandates, Ambivalent Communities:

Land Use Challenges to New York's Renewable Power Goals

By Paul J. Saunders

ENERGY INNOVATION REFORM PROJECT

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Energy Innovation Reform Project
3100 Clarendon Boulevard, Suite 200
Arlington, VA 22201
Phone: (703) 828-9919
E-mail: info@innovationreform.org
www.innovationreform.org

Cover design and layout by Gabriella Turrisi
Editing and proofreading by Anne Himmelfarb
Cover photograph: Wind turbines at the Noble Ellenburg Windpark in Ellenburg, New York. AP Photo/Mel Evans.

Energy Innovation Reform Project is a non-partisan non-profit organization dedicated to promoting policies that advance innovation in energy technologies and practices to improve the affordability, reliability, safety, and security of American energy supplies and our energy economy. EIRP was founded in Washington, DC in 2013. Its work combines policy reports, scholarly research, and economic modeling with creative efforts to bridge partisan differences over energy policy.

Contents

Abbreviations

AREGCBA	Accelerated Renewable Energy Growth and Community Benefit Act
BOEM	Bureau of Ocean Energy Management
CES	Clean Energy Standard
CLCPA	Climate Leadership and Community Protection Act
CO_2	carbon dioxide
DPS	Department of Public Service
EEPS	Energy Efficiency Portfolio Standard
EIA	Energy Information Administration
EPA	Environmental Protection Agency
GHG	greenhouse gas
GW	gigawatt
GWh	gigawatt-hours
IPP	independent power producer
ISO	independent system operator
kV	kilovolt
kWh	kilowatt-hour
LCOE	levelized cost of electricity
m/s	meters/second
MW	megawatt
MWh	megawatt-hour
NREL	National Renewable Energy Laboratory
NYISO	New York Independent System Operator
NYSERDA	New York State Energy Research and Development Authority
ORES	Office of Renewable Energy Siting
PSC	Public Service Commission
REV	Reforming the Energy Vision
RGGI	Regional Greenhouse Gas Initiative
RPS	Renewable Portfolio Standard
RTO	regional transmission organization
SEQRA	New York State Environmental Quality Review Act
ZEC	zero-emission credit

Executive Summary

Over the last two decades, New York State has led America in setting ambitious renewable power targets but has struggled to meet them. These targets have catalyzed extensive state policy efforts to promote solar and wind power—but despite many years of effort, solar and wind power's shares of the state's electricity generation continue to lag national averages, and the build rate remains far below the level necessary to meet the state's targets. Land use disputes surrounding wind developments have been especially visible in delaying many projects, though other factors also contribute to the state's challenges in deploying solar and wind power.

This report contains several important findings that provide insights into the causes of (and possible solutions to) the gap between New York's aspirations and outcomes for renewable power development:

- The land use decisions required in siting solar and wind projects slow renewable power development in New York; there are political limits to streamlining such processes.
- Land use decisions are unavoidably political and local.
- Working cooperatively with host communities, addressing their concerns, and ensuring that they have a stake in proposed solar and wind projects is essential—but the state and renewable power developers may not have done enough in these areas.
- The Build-Ready Program in New York will likely facilitate development in specific locations but might not reach the scale necessary to meet the state's renewable energy targets.
- It will be more costly and difficult for New York to achieve ambitious renewable power targets than it would be in many other states, given the state's poor solar and limited onshore wind resources.
- Offshore wind development will likely have fewer land use impacts and lower costs than onshore wind, but offshore turbines have also faced opposition and require significantly more material inputs.
- A less restrictive approach to clean energy could accelerate efforts in New York to reduce and eliminate greenhouse gas emissions while also cutting costs.

This report assesses policies and experiences in New York in an effort to identify lessons that could be relevant to other states planning to expand solar and wind generation as a component of policies to limit greenhouse gas emissions. The report does not comprehensively address other important factors in solar and wind development, such as federal policy, financing, technology, or electricity market structures. Also, because the study concentrates on utility-scale power generation, it does not examine either small-scale community projects or commercial and residential rooftop solar installations.

New York is an unusual state in important respects. Although of average land area, New York has the fourth-largest population, third-largest economy, and second-highest state budget among the 50 states. A substantial portion of the state's population and economic activity are in and around New

York City; 87% of the state's nonfederal land is rural (NRCS 2018, p. 3-15). New York generates more electricity than 47 states and has the ninth-highest electricity rates in the country.[1]

Relative to other U.S. states, New York has poor solar energy resources, middling onshore wind resources, and superior opportunities for offshore wind. New York has above-average shares of hydroelectric and nuclear power, which contribute substantially to its ability to generate emissions-free power. Nuclear energy provided one-third of the state's electricity supply and about 56% of its emissions-free electricity in 2019.[2]

Although New York is an unusual state in some ways, its policies and experiences raise several important issues that are likely to be significant for other states with renewable power targets.

First among these is the value of planning on the basis of each state's circumstances—in the case of New York, its mixed solar and wind resources and its existing clean energy options, including hydroelectric power and nuclear energy.

Second is the usefulness of firm, dispatchable electricity generation within a diverse electricity supply, both in controlling costs and in ensuring reliability and resilience—among the state's original goals in its first State Energy Plan, adopted in 2002.

Last, and perhaps most difficult, are the complex dilemmas that surround subordinating local land use decisions to state (or federal) policies, a process that necessarily raises challenging questions in any democratic society.

1 U.S. Energy Information Administration, "State Electricity Profiles," https://www.eia.gov/electricity/state/.

2 U.S. Energy Information Administration, State Electricity Profiles, "Table 5. Electric Power Industry Generation by Primary Energy Source," https://www.eia.gov/electricity/state/newyork/state_tables.php.

Introduction

Solar and wind power generation have grown considerably in the United States in recent years, driven by federal, state, and local policies to promote renewable power as well as decreasing prices for solar and wind energy. Nevertheless, neither has expanded as rapidly as some advocates had hoped. In some communities, proposed solar and wind projects prompted great controversy; in New York, this has been most visible in opposition to large-scale wind farms, especially in the state's southwest.

Seeking to contribute to public understanding of the land use impacts of solar and wind power, Energy Innovation Reform Project published a major report in 2020 reviewing over 100 academic and US government studies that address the issue (Saunders 2020). That report contained several key findings:

- There is no consensus on definitions and assumptions used in solar and wind land use analyses.
- The potential space impacts of solar and wind facilities depend on many factors and can vary widely.
- Solar and wind are likely to affect significantly more land than other electricity sources.
- Solar and wind facilities are associated with significant quality impacts, such as habitat fragmentation and visual and noise impacts.
- Developing a 100% renewable energy system would be challenging from a land use policy perspective.

This paper expands upon that earlier work by presenting a detailed case study of policy and practice relating to solar and wind power in New York State.

Over the last two decades, New York has set some of the nation's most ambitious renewable power targets. Though about one-quarter of states have established 100% clean energy targets through legislation or executive orders, New York has the earliest target—2040—and has established it through a legislative mandate that includes a 70% renewable power target for 2030.[3] Yet the state's top grid manager has warned of the challenges of meeting such ambitious targets without "something other than just wind, solar and batteries." (Behr 2021).

New York has struggled to meet its targets, and the shares of solar and wind power in overall electricity generation in New York are below national averages. Land use disputes surrounding wind developments have delayed or functionally terminated many projects. In some cases, these disputes have drawn extensive media attention.

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3 The District of Columbia has a 2032 target for 100% renewable energy, legislated in the Clean Energy DC Act, but will rely heavily on electricity generation outside its borders. See District of Columbia Department of Energy and Environment, "Clean Energy DC Act," https://doee.dc.gov/service/clean-energy-dc-act. Connecticut also has a 2040 target date for 100% clean energy, but via executive order and not legislation; in Colorado, the governor has announced a declaratory goal—not a mandate—of 100% renewable power by 2040.

Because this report concentrates on utility-scale power generation, it does not examine either community renewable power projects or rooftop solar installations, whether residential or commercial. Likewise, it does not address wider issues such as federal policy, financing, technology, or market structures.

The first section of the study offers an overview of New York's geography, including its solar and wind resources, a brief comparison of the state's population and economy to other US states, and information about New York's electricity generation and markets. The second section presents a detailed account of the evolution of the state's policies to promote renewable energy and its laws and regulations governing the siting of renewable electricity–generating facilities. The third section analyzes New York's circumstances, policies, and experiences; the fourth section presents key findings; and the last section discusses lessons for other states.

1. Background

New York is an average-sized state by land area with the fourth-largest population[4] and third-largest economy of US states (BEA 2020, 7–8). New York generates more electricity than 47 other states, and New Yorkers pay the seventh-highest electricity rates in the US.[5] Compared to other states, the state has poor solar energy resources, middling onshore wind resources, and superior opportunities for offshore wind. New York has above-average shares of hydroelectric and nuclear power, which contribute substantially to its ability to generate emissions-free power.[6] Including nuclear energy, New York already has a 61% clean electricity system. This is one reason that despite having the third-largest economy of the 50 states, New York ranks ninth in greenhouse gas emissions (EIA 2020a).

Geography

With a total area of 54,555 square miles, New York ranks in the middle of America's 50 states by size, slightly smaller than the median area of 57,904 square miles. However, more than 13% of the state's total area is covered by water, including New York's share of the Great Lakes; excluding water, New York's total land area is 47,126 square miles, or 30.16 million acres.[7]

Less than 1% of New York's land area is federally owned, a distinction that the state shares with only four other states, Connecticut, Iowa, Kansas, and Rhode Island (CRS 2020, 7–8). For comparison, federal lands comprise an average of about 27% of the land area of the 50 states and the District of Columbia, though Alaska's federal lands alone constitute more than 36% of all federal land in these jurisdictions (CRS 2020, 7-8). Many large western states also have unusually high shares of federal land. The median share of federal land in states is just 5.2%.[8]

In 2015, developed areas occupied about 13% of New York's nonfederal land area, with rural areas accounting for the other 87% (NRCS 2018, p. 3-15). Within the nonfederal rural land, nearly 68% was forested, more than 19% was cropland, and almost 10% was pastureland; the remainder was reserved cropland, farmsteads, barren land, marshland, and other miscellaneous rural land (NRCS 2018, p. 3-33). New York's nonfederal rural land is far more heavily forested than such land is in most states; excluding Alaska, only about 30% of nonfederal rural land in the United States is forested (NRCS 2018, p. 3-39). Only 10 states are more heavily forested than New York (NRCS 2018, pp. 3-23–3-29).

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4 U.S. Census Bureau, "Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1, 2019 (NST-EST2019-01)," https://www2.census.gov/programs-surveys/popest/tables/2010-2019/state/totals/nst-est2019-01.xlsx.

5 U.S. Department of Energy, "State Electricity Profiles," https://www.eia.gov/electricity/state/.

6 U.S. Energy Information Administration, State Electricity Profiles, "Table 5. Electric Power Industry Generation by Primary Energy Source," https://www.eia.gov/electricity/state/newyork/state_tables.php.

7 Total area and total land area are from U.S. Census Bureau, "State Area Measurements and Internal Point Coordinates," https://www.census.gov/geographies/reference-files/2010/geo/state-area.html. The median value and the figure in acres are the author's calculations based on U.S. Census Bureau data. The majority of New York's water area is in Lake Ontario, though some is in Lake Erie, in inland lakes, and off the state's Atlantic Coast (to three nautical miles). Lake Ontario is divided between New York and Canada's Province of Ontario; New York shares Lake Erie with Michigan, Ohio, Pennsylvania, and Ontario.

8 Author's calculation based on CRS (2020, 7–8).

Photo credit: shutterstock/Colin D. Young

New York's Adirondack Mountains include some of the state's extensive forested land. This image shows Phelps Mountain, Mount Marcy, and Mount Colden overlooking the Marcy Dam Pond. The mountains and the reservoir are in the High Peaks region, near Lake Placid, the site of the 1932 and 1980 Winter Olympic Games.

Solar and wind resources

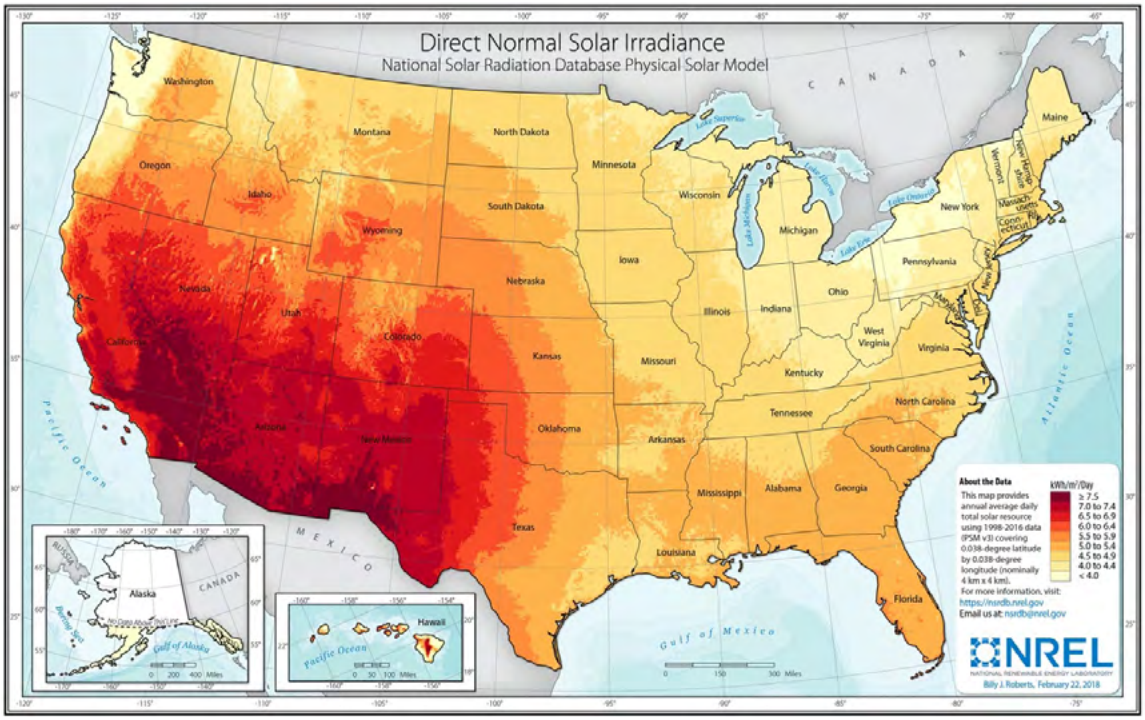
As a northern state, and the fourth cloudiest (Kanuckel 2021), New York receives less energy from the sun than states in the south and especially in the southwest, where solar irradiance is highest in the continental United States. Figure 1 shows annual average direct normal irradiance (the amount of energy that a flat surface would absorb from sunlight striking it at a perpendicular angle) across America. These differences matter because the irradiance values in figure 1 establish the theoretical maximum solar energy that a 100% efficient solar power system could generate in a given location.

Dark red areas of figure 1 have the highest solar irradiance; irradiance levels decrease as the shading moves from red to orange to yellow. Much of New York falls into the lowest energy band, receiving less than 4.0 kilowatt-hours (kWh) per square meter per day, although substantial areas of the state receive 4.0 to 4.4 kWh/m^2/day. Long Island and areas immediately surrounding New York City receive an annual average of 4.5 to 4.9 kWh/m^2/day. The sunniest parts of New York—on Long Island, and near New York City—receive at least 30% less direct normal irradiance than most of Arizona, most of New Mexico, and much of southern California; the least sunny areas in New York receive at least 46% less direct normal irradiance than the sunniest areas in the southwest. Those areas receive over 7.5 kWh/m2/day.

In practice, solar facilities will produce significantly less electricity than the theoretical maximum. Reasons for this include lower actual irradiance (for example, if a facility uses single-axis tilt solar panels that do not that do not track the sun, or under unfavorable weather conditions or at night) and energy conversion losses (typical silicon solar photovoltaic panels generate electricity with 16% to 18% efficiency [Gronewold 2020], though researchers at the Department of Energy's National Renewable Energy Laboratory in Colorado have produced an advanced solar cell with 39% to 47% efficiency in controlled conditions [NREL 2020]). Regular maintenance (especially removing dust or dirt) helps sustain efficiency. Electricity production can also vary widely across seasons, with changes in daily hours of sunlight and the sun's intensity. As one might expect, New York's monthly average direct normal irradiance varies substantially, with low values in winter months (December through February-March) and peak values in summer months (July and August).[9]

9 See monthly average direct normal irradiance maps for the United States at National Renewable Energy Laboratory, "Solar Resource Data, Tools, and Maps," https://www.nrel.gov/gis/solar.html.

Figure 1: Solar energy potential: Direct normal solar irradiance in the United States



Source: National Renewable Energy Laboratory, https://www.nrel.gov/gis/assets/images/solar-annual-dni-2018-01.jpg, drawing on Sengupta et al. 2018.

Figure 2 shows New York's potential wind power in comparison with that of the continental United States, represented by annual average wind speeds at 100 meters above ground level. The black areas—on the California and Oregon coasts, and in select areas along the Rocky Mountains—have annual average wind speeds above 10 meters/second (m/s; 10 m/s is about 22 miles per hour) at this altitude. Most of New York has average annual wind speeds between 4 m/s and 7.9 m/s, with higher values offshore in Lake Ontario, Lake Erie, and the Atlantic Ocean and in isolated areas in the state's northeast and southeast. Without assessing land available for wind project development, New York's wind potential relative to other U.S. states appears more favorable than its solar potential, in that its average annual wind speeds seem higher than those in many western and southeastern states.

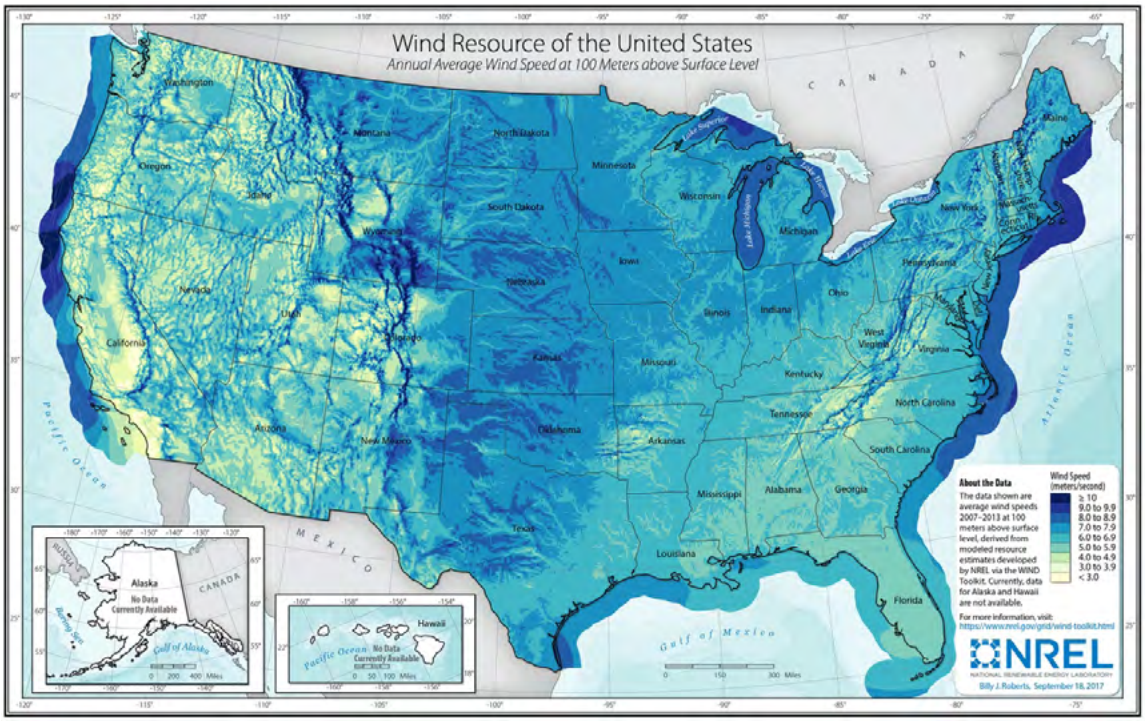
For reference, wind turbines typically require minimum wind speeds of 8–16 mph (3.6–7.2 m/s) to generate electricity and will shut off if wind speeds exceed 55 mph (24.6 m/s).[10] Wind turbines are becoming increasingly tall to benefit from faster and more consistent wind speeds further above surface level; research suggests that increasing turbine hubs from 80 m to 160 m above ground level increases the annual average wind speed by 1.0–1.5 m/s (Lantz et al. 2019, vi).

Like solar potential, wind potential in New York varies seasonally, as is demonstrated in figure 3, which presents average monthly wind speeds at 100 m above ground level. In the figure, lighter colors represent lower speeds; darker colors indicate higher speeds. Comparing monthly average

10 U.S. Department of Energy, "The Inside of a Wind Turbine," https://www.energy.gov/eere/wind/inside-wind-turbine.

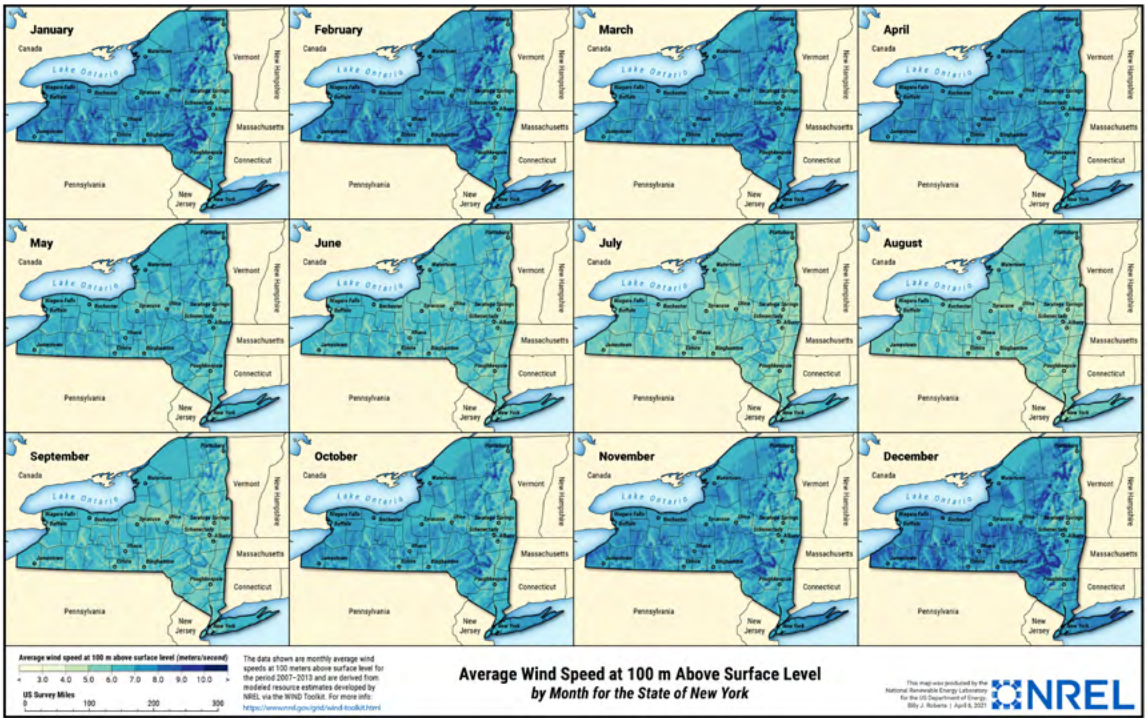
wind speeds with monthly average solar irradiance illustrated in NREL's Internet-based maps reveals substantial complementarity between solar and wind resources in New York. In principle, this complementarity could help to mitigate their variability. That said, monthly averages can obscure shorter-term variations with potentially significant consequences for electricity generation. With respect to wind power, if wind speeds are below turbine shutoff thresholds for hours or days at a time, the turbines will not generate electricity. Day/night differences in solar irradiance produce similar impacts on a daily basis, with additional variation imposed by could cover.

Figure 2: Wind energy potential: Wind speeds at 100 m above ground level



Source: National Renewable Energy Laboratory, https://www.nrel.gov/gis/assets/images/wtk-100m-2017-01.jpg, drawing on Draxl et al. 2015.

Figure 3: Monthly average wind speed in New York



Source: National Renewable Energy Laboratory, provided directly to the author.
Note: Wind speeds are at 100 meters above ground level, averaged monthly, with darker colors reflecting higher average speeds.

Population and economy

New York's population was approximately 19.4 million in 2019, about 6% of the total U.S. population of 328 million[11] and considerably larger than the median population of U.S. states, which is about 4.5 million.[12] New York is ninth among states in population density, according to the 2010 Census.[13] About 12.6 million New York residents—roughly 65%—live in eight of its 62 counties.[14] Six of these counties are in the southeast, in and around New York City; the remaining two surround Rochester, on the southern shore of Lake Ontario. Thirty-four counties have populations under 100,000 and another 10 have populations between 100,000 and 200,000.[15]

With a state gross domestic product (GDP) of $1.77 trillion, New York accounted for 8.3% of the U.S. GDP in 2019 (BEA 2020, 7–8). In 2018, six sectors made up a combined 86.3% of the state's economy:

11 U.S. Census Bureau, "Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1, 2019 (NST-EST2019-01)," https://www2.census.gov/programs-surveys/popest/tables/2010-2019/state/totals/nst-est2019-01.xlsx.

12 Author's calculation based on ibid.

13 U.S. Census Bureau, "2010 Census: Population Density Data (Text Version)," https://www.census.gov/data/tables/2010/dec/density-data-text.html.

14 U.S. Census Bureau, "New York," https://www2.census.gov/programs-surveys/popest/tables/2010-2019/counties/totals/co-est2019-annres-36.xlsx.

15 Ibid.

financial activities (28.5%), business and professional services (13.8%), transportation, trade, and utilities (13.3%), government (10.5%), information (10.5%), and education and health services (9.7%) (Office of the New York State Comptroller 2019, 27–28). Like its population, New York's economic activity is concentrated near New York City, which had an estimated GDP of $937 million in 2017 (Federal Reserve Bank of New York 2020). The Orange-Rockland-Westchester area and Long Island have GDPs of $118 million and $186 million, respectively.[16] Adding these figures to New York City yields about 70% of the state's economic activity.

Partly because of New York City's status as an international financial center, New York State's per capita GDP is 29.6% higher than the national average (BEA 2020). However, 28 counties—predominantly near the New York–Pennsylvania state line, near the shores of Lake Ontario, and in a north-south band from the Canadian border south of Ottawa through Cooperstown to the Pennsylvania border—had median household incomes lower than $54,999 in 2014–2018, compared to a national median household income of $60,293.[17] During that period, 11 counties in New York had estimated median household incomes above $65,000, nine of them in and around New York City. Twenty-three counties had median household incomes between $55,000 and $64,999, largely in the corridor between Buffalo and Syracuse, in the northeast, and adjoining the wealthier region surrounding New York City.

State budget

New York has a state budget that is the second-largest in the country ($170.9 billion in 2019).[18] Excluding California ($300.4 billion), New York, and Texas ($121.0 billion), which are the only three states with budgets greater than $100 billion, the average budget of the remaining 47 states is $32.1 billion. New York is also the second leading recipient of federal funds, collecting $60.4 billion in 2019. For comparison, California collected $97.2 billion in 2019 and Texas collected $42.6 billion. Major categories of state expenditures in New York include Medicaid benefits (37.1%), education (25.7%), and transportation (9.3%); smaller amounts are allocated to corrections (2.7%) and public assistance (1.6%) (NASBO 2020, 16). Other expenditures (27.9%) include most state government agencies, various public health and child welfare programs, economic development and unemployment, debt, state police, and environmental, natural resource, and parks programs (NASBO 2020, 78).

New York's total environment, energy, and agriculture spending was $2 billion in 2019, about 1.2% of the overall state budget.[19] However, many energy programs are funded outside of the state budget or via other financing arrangements; for example, the state supports its $5 billion Clean Energy Fund largely through gas and electric ratepayer assessments.[20] A new $3 billion fund for environmental restoration and climate mitigation projects relies on bond financing (Governor's Press Office 2020).

16 Ibid.

17 U.S. Census Bureau, "2014–2018 Median Household Income in the United States by County," https://www.census.gov/library/visualizations/interactive/2014-2018-median-household-income-by-county.html. New York's poorest county at the time was Bronx County; it was the only county in the state with a median household income below $44,999.

18 All state budget figures are from NASBO (2020, 8). Federal funds reflect strictly federal contributions to state budgets and do not include state contributions to federal tax revenue.

19 New York State Division of the Budget, "FY 2020 Executive Budget Briefing Book," 74, https://www.budget.ny.gov/pubs/archive/fy20/exec/book/briefingbook.pdf. Of this, $169 million went to the state's Department of Agriculture and Markets.

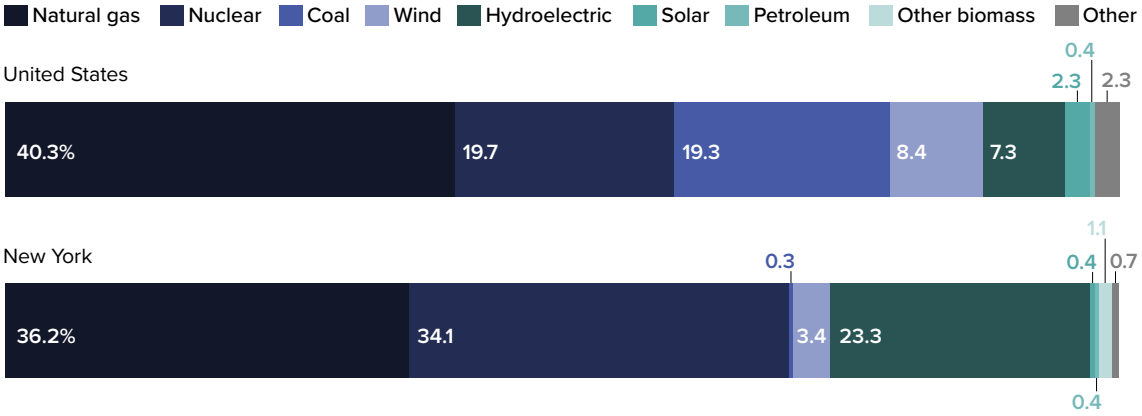
20 New York State Division of the Budget, "Energy Research and Development Authority, New York State," https://www.budget.ny.gov/pubs/archive/fy21/exec/agencies/appropdata/EnergyResearchandDevelopmentAuthorityNewYorkState.html.

Electricity

Total net electricity generation in New York was about 132 million megawatt-hours (MWh) in 2019, ranking seventh among U.S. states.[21] The state had the ninth-highest average retail electricity price that year, at $0.1434/kWh, 27% higher than the average retail electricity price among the 50 states and the District of Columbia ($0.1126/kWh).[22] Transmission capacity constraints contribute to high electricity prices in New York (Patton 2019, 9). New York was a net recipient of electricity from outside its borders in 2019, importing 16.3 million MWh (net) from Canada and receiving 9.4 million MWh (net) in transfers from other U.S. states.[23]

Figure 4 compares New York's electricity generation by source to overall U.S. electricity generation by source.[24] In 2019, New York generated significantly higher shares of electricity from nuclear and hydroelectric facilities than the nationwide average generation from those sources: it generated 34% of its electricity from nuclear and 23% from hydroelectric, compared to U.S. averages of 19% and 7%, respectively. In 2019, the share of coal-fired power production in New York was less than one-half of 1%, compared to about 23% nationally. In early 2020, workers shut down the last coal-fired power plant in the state (Barnard 2020).

Figure 4. Electricity generation by source: New York vs. United States



Source: EIA 2020c (for U.S.); U.S. Energy Information Administration, State Electricity Profiles, "Table 5. Electric Power Industry Generation by Primary Energy Source," https://www.eia.gov/electricity/state/newyork/state_tables.php (for New York).

By the end of 2019, the shares of solar and wind power in New York lagged significantly behind national averages. Those sources comprised only 0.4% and 3.4% of the state's electricity generation in 2019, respectively, compared to 1.7% and 7.1% nationally.[25] Figure 5 shows the evolution of New York's generation

21 U.S. Department of Energy, "State Electricity Profiles," https://www.eia.gov/electricity/state/.

22 Author's calculation based on ibid. This is not the national average price, but the average of the state-level averages, provided for comparability among states. According to the U.S. Energy Information Administration, the national average retail price of electricity is $0.1048 per kWh.

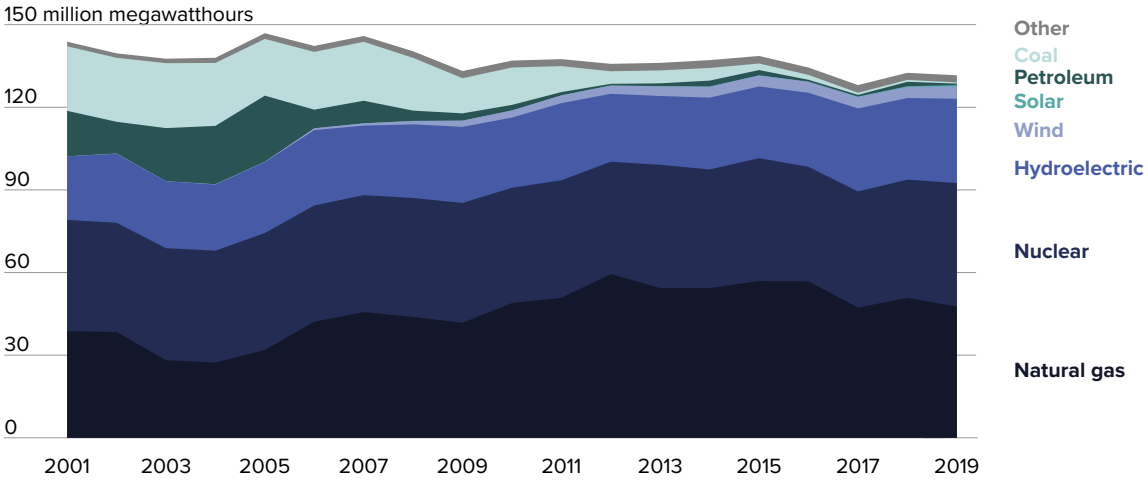
23 See U.S. Energy Information Administration, State Energy Data System (SEDS): 1960–2018 (Complete), "All Consumption Estimates, in Physical Units," https://www.eia.gov/state/seds/seds-data-complete.php?sid=US. Electricity imports, exports, and interstate flows are denoted by ELIMP, ELEXP, and ELISP, respectively.

24 U.S. data in this paragraph and in figure 3 are from EIA (2020c). New York data are from U.S. Energy Information Administration, State Electricity Profiles, "Table 5. Electric Power Industry Generation by Primary Energy Source," https://www.eia.gov/electricity/state/newyork/state_tables.php.

25 Solar photovoltaic generation produced 1.7% of U.S. electric generation; solar thermal provided an additional 0.1%.

mix from 2001 to 2019, including steady generation output from nuclear and hydroelectric sources, growth in natural gas generation (which today is responsible for more generation than any other source in the state), and the near elimination of coal and petroleum from the power sector. Solar power is effectively invisible.

Figure 5. New York's electric power generation mix, 2001–2019



Source: U.S. Energy Information Administration, State Energy Data System (SEDS): 1960–2018 (Complete), "All Consumption Estimates, in Physical Units," https://www.eia.gov/state/seds/seds-data-complete.php?sid=US.

New York is one of only three states with its own independent system operator (ISO) that manages the transmission system and wholesale power markets.[26] The New York Independent System Operator (NYISO) continuously balances electricity supply and demand while maintaining reliability. NYISO also evaluates and plans for future electricity system needs, including generation and transmission. One of NYISO's principal challenges is managing flows of electricity from the north and west to the greater New York City area.

The other two states with single-state ISOs are California and Texas; the latter maintains its own electricity grid, the Texas Interconnection, largely separate from North America's Western Interconnection and Eastern Interconnection (each of which includes not only U.S. states but also Canadian provinces).[27] As participants in multistate interconnections, both NYISO and California's CAISO are regulated by the Federal Energy Regulatory Commission (FERC)—unlike the Electric Reliability Council of Texas (ERCOT), whose activities generally do not extend across state lines. Other states with ISOs or comparable regional transmission organizations (RTOs) are members of multistate groups. Ten western states and six southeastern states (as well as significant portions of two other states) do not participate in ISOs or RTOs.

26 See Federal Energy Regulatory Commission, "Electric Power Markets," https://www.ferc.gov/industries-data/market-assessments/overview/electric-power-markets, for further information on ISOs and a map of America's power markets.

27 Interconnection boundaries, as well as ISO/RTO boundaries, are often congruent with but not identical to state boundaries. NYISO's boundaries are very closely aligned with state boundaries. For a map that overlays interconnection and ISO/RTO boundaries in the United States, see EIA (2016). Alaska and Hawaii are special cases, as they are wholly separate from the North American power grid.

The competitive retail electricity market in New York allows consumers to choose among electricity suppliers, something possible in about half of U.S. states.[28] The New York power market includes six investor-owned utilities and the Long Island Power Authority, many local utilities, and many independent power producers (IPPs).[29] Utilities generate, transmit, and distribute electricity, whereas IPPs generate electricity and rely on other companies to transmit and distribute it. IPPs generate most of New York's electricity—more than 60% according to the New York IPP trade association.[30] As of 2018, IPPs were the sole providers of electricity from utility-scale solar and wind power facilities in the state.[31]

Greenhouse gas (GHG) emissions

Despite having the third-largest state economy, New York ranked ninth among U.S. states in energy-related carbon dioxide (CO_2) emissions in 2018, producing 167.7 million metric tons, or about 3% of the country's total energy-related emissions (EIA 2020a). By 2018, New York's energy-related CO_2 emissions were 19.5% lower than in 1990; they were 16.3% lower than in 2002, when the state set its first emissions reduction target (EIA 2020a). In 2018, energy-related emissions in New York were less than one-quarter of those in Texas, a leading energy-producing state, and less than half of energy-related emissions in California. Emissions levels in New York in 2018 were similar to emissions levels in Michigan, even though New York's population was twice as large as Michigan's and its economy three times as large (EIA 2020a). (The two states' economies are structured differently; the top industry in Michigan is manufacturing, while finance and insurance lead in New York.[32]) GHG emissions reductions have been a policy priority in New York State for nearly two decades.

28 U.S. Environmental Protection Agency, "U.S. Electricity Grid & Markets," https://www.epa.gov/greenpower/us-electricity-grid-markets.

29 Power 2 Switch, "New York Electricity," https://power2switch.com/NY/index.html.

30 Independent Power Producers of New York, "About," https://www.ippny.org/page/about-1.html.

31 U.S. Energy Information Administration, State Electricity Profiles, "Table 5. Electric Power Industry Generation by Primary Energy Source," https://www.eia.gov/electricity/state/newyork/state_tables.php.

32 Data available at Bureau of Economic Analysis, U.S. Department of Commerce, "GDP by State," https://www.bea.gov/data/gdp/gdp-state.

2. Renewable Power Policies

New York's renewable power policies are among the most ambitious of state efforts to reduce power sector GHG emissions. Eleven states have established 100% clean energy goals through legislation or executive orders, but New York has set the most aggressive deadline for achieving such a target—by 2040—and enshrined the target in law via a legislative mandate.[33] Connecticut also has a 2040 target date for 100% clean energy, but via executive order and not legislation; Colorado's governor has announced a declaratory goal—not a mandate—of 100% renewable power by 2040. The increasingly demanding clean energy targets in New York have catalyzed policies intended to promote solar and wind power.

The governors of New York have been instrumental in defining clean energy policies for the state. Successive governors have established declaratory targets and sought to enforce those targets through executive orders and directives to state regulatory agencies. In 2019, the state legislature enacted into law a clean energy target spearheaded by the presiding governor. Table 1 summarizes the various clean energy targets in New York from 2002 to 2019.

Table 1. New York's Clean Energy Targets, 2002–2019

Date	Policy	Type	Targets
2002	State Energy Plan	Declaratory goal	25% reduction in energy intensity by 2010 15% renewable primary energy by 2020 5% reduction below 1990 GHG emissions by 2010 10% reduction below 1990 GHG emissions by 2020
2004	Renewable Portfolio Standard	Regulatory mandate	25% renewable electricity by 2013
2008	Energy Efficiency Portfolio Standard	Regulatory mandate	15% reduction in projected electricity use by 2015
2009	Executive Order Number 24	Declaratory goal	80% reduction below 1990 GHG emissions by 2050
2009	State Energy Plan ("45 by 15")	Declaratory goal	30% renewable electricity by 2015 15% reduction in projected electricity use by 2015
2010	Renewable Portfolio Standard	Regulatory mandate	30% renewable electricity by 2015
2015	State Energy Plan ("50 by 30")	Declaratory goal	50% renewable electricity by 2030 40% reduction below 1990 GHG emissions by 2030 23% reduction in projected electricity use by 2030
2016	Clean Energy Standard	Regulatory mandate	50% renewable electricity by 2030, including nuclear
2019	Climate Leadership and Community Protection Act (CLCPA, "70 by 30")	Legislative mandate	70% renewable electricity by 2030 100% zero-emission electricity by 2040 85% reduction below 1990 GHG emissions by 2050

Source: Author's compilation from New York State online resources.
Note: Energy intensity refers to energy consumption per unit of GDP. Primary energy refers to energy in its original form (e.g., natural gas consumed to generate electricity is primary energy, but the resulting electricity is not).

33 New York State Senate, New York State Climate Leadership and Community Protection Act, S-06599, https://www.nysenate.gov/legislation/bills/2019/s6599.

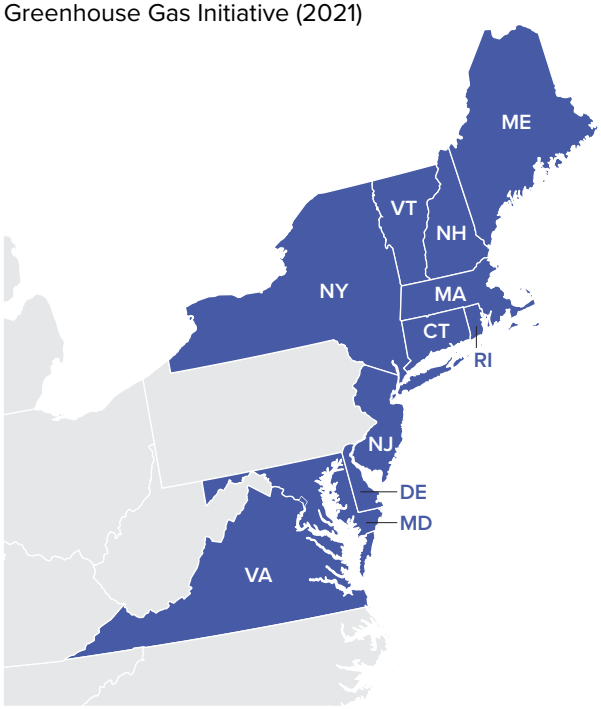
The first target: The 2002 State Energy Plan

Governor George Pataki called for the first energy plan for New York State in the wake of the September 11, 2001, attacks on the World Trade Center in New York City. In addition to studying the risks and vulnerabilities of the energy systems in New York, the 2002 New York State Energy Plan included three concrete clean energy targets: a 25% reduction in energy use per unit of GDP below 1990 levels by 2010, an increase in renewable energy use to 15% of primary energy consumption by 2020, and a reduction in GHG emissions to 5% below 1990 levels in 2010 and to 10% below 1990 levels in 2020 (New York State 2002b, S-3–S-5). The 2002 State Energy Plan also required the New York State Energy Research and Development Authority (NYSERDA) to assess whether a Renewable Portfolio Standard (RPS) was feasible, how it would affect the state's economy, and how guidance could be provided on integrating an RPS into the New York electricity market and electricity system planning procedures (New York State 2002a, p. 1-39).

Governor Pataki likewise proposed a plan for regional cooperation to reduce greenhouse gas emissions; in 2003, the Regional Greenhouse Gas Initiative (RGGI) became a reality (Barnett 2006). New York and nine other northeast states joined in establishing a nonprofit corporation that would in turn create and manage a cap-and-trade system to control GHG emissions in the region (RGGI 2019, 1).

In 2004, the New York Public Service Commission (PSC) issued the first RPS in New York, which established a target of 25% renewable power by 2013 (New York PSC 2004, 3). The RPS included two components, state procurement of renewable power (expected to account for most of the necessary increase) and a voluntary "green market." In the procurement component, investor-owned utilities would collect surcharges from customers and transfer the funds to NYSERDA, which would award the proceeds as incentives to renewable energy producers through contracts. The green market anticipated that some customers would pay a premium for renewable power.

Figure 6. States Participating in the Regional Greenhouse Gas Initiative (2021)



Note: New Jersey withdrew in 2011 and rejoined in 2019; Virginia joined in 2021.
Source: Regional Greenhouse Gas Initiative

According to the PSC's order establishing the RPS, the objective of state procurement is to stimulate the renewable power market in New York so that "competitive markets, not government mandates, sustain renewable activity after the RPS program ends" (New York PSC 2004, 4). The commission saw NYSERDA's role as establishing an incentive-based system that contrasted with penalty-driven regulations in other states, where individual utilities or other power generators had to meet fixed targets or pay into "alternative compliance funds" (New York PSC 2004, 5).

The PSC reported that 19.3% of the state's electricity came from renewable sources in 2004. For meeting the 25% target, the commission defined a "Main Tier" (later known as Tier 1) for "medium to large scale electric generation facilities" in which eligible renewable technologies included solar photovoltaic, wind, hydroelectric, fuel cells, biogas, biomass, liquid biofuels, and ocean or tidal power (New York PSC 2004, 8).[34] Notably, this definition excluded nuclear power.

Pursuing energy efficiency—and missing targets

Three years later, in 2007, Governor Eliot Spitzer established a target of a 15% improvement in energy efficiency by 2015 (Gralla 2007). The New York PSC formalized the target in 2008 by adding an Energy Efficiency Portfolio Standard (EEPS) to the existing RPS (New York PSC 2008, 3).

Governor Spitzer also moved forward with the Regional Greenhouse Gas Initiative, which worked to assist participating states in building and operating a common system to track GHG emissions and CO_2 allowances and to manage an auction system for CO_2 allowances. RGGI aimed to facilitate a gradual reduction in emissions by limiting growth in the number of allowances relative to projected growth in GHG emissions, using auctions to fix an allowance price intended to discourage emissions, and managing trade in allowances. The first auction took place on September 25, 2008.[35]

In 2008, Governor David Paterson issued an executive order calling for a new State Energy Plan (New York Codes, Rules and Regulations 2008), and later announced new clean energy goals through which the state would achieve a 30% renewable power target and the 15% efficiency goal established previously by Governor Spitzer, both by 2015 (syracuse.com/The Post-Standard 2009). The "45 by 15" goals (30% renewable power plus 15% energy efficiency by 2015) would define the 2009 State Energy Plan (New York State 2009, 6).[36] However, the 30% renewable target—incorporated into New York's RPS in early 2010—did not materially impact the existing 25% renewable target; the PSC remarked that if the state met the 15% EEPS consumption reduction, "the amount of renewable resources required to attain the 2013 RPS 25% goal is greatly reduced" (New York PSC 2010, 3). To set a longer-term, aspirational target, Governor Paterson issued an executive order calling for an 80% reduction in the state's greenhouse gas emissions below 1990 levels by 2050 (New York Codes, Rules and Regulations 2009).

In addition to defining renewable energy and energy efficiency goals, the 2009 State Energy Plan included strategies and recommendations intended to "improve the State's energy independence and fuel diversity by developing in-state energy supply resources" (New York State 2009, xiii). In 2012, NYSERDA filed a petition with the PSC arguing that its procurement of renewable electricity should be limited to projects within New York to ensure that the state gained the greatest environmental, energy security, and economic benefits from NYSERDA's investments in clean energy. The commission largely backed this view, issuing an order to this effect in 2013 (New York PSC 2013).

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34 The September 2004 commission order also provided for a "Customer-Sited Tier" to include solar photovoltaic, wind, and fuel cells; this was to allow utilities or other electricity providers to receive NYSERDA contract payments in order to assist their customers in developing these smaller-scale systems.

35 Regional Greenhouse Gas Initiative, "Supply and Bid Statistics," https://www.rggi.org/Auctions/Auction-Results/Supply-Bid.

36 The shorthand "45 by 15" refers to the sum of the 30% RPS goal and the 15% EEPS goal—45%—and the target year, 2015. The 30% and 15% figures represent two different concepts, however—a share of demand and a reduction in demand—and are thus not additive.

These changes may have reflected concern over increasing transfers of electricity into New York from other states. Interstate electricity transfers into New York almost quadrupled between 2008 and 2010, with annual totals rising from 3,259 gigawatt-hours (GWh) in 2008 to 8,832 GWh in 2009 and 12,490 GWh in 2010, before declining thereafter.[37] Such a trend is consistent with values reported by RGGI, which show that average annual electricity generation within the RGGI states fell by 8.1% in the 2006–2008 and 2011–2013 periods, while electricity generation provided by sources outside RGGI states increased by 8.7% (RGGI 2015, 11). In practice, however, interstate transfers of electricity into New York appear to have come largely at the expense of imports from Canada. Electricity imports from Canada fell as interstate transfers increased and rose as the transfers later decreased.[38]

By mid-2014, the PSC acknowledged that the state's 2015 RPS and EEPS goals "appeared to be unattainable" and noted that by the end of 2013, the state had achieved only 49% of the RPS target for new renewable generation and 55% of the EEPS energy savings target (New York PSC 2014, 2). With only two years remaining in the program, the state had developed about half of the additional renewable power called for in the RPS target and achieved slightly over half the reduction in consumption targeted by the EEPS. The commission and other state officials began to reevaluate the RPS and EEPS programs.

The 2015 State Energy Plan: Stronger action, more distant deadlines

After the failure of New York to meet its 2015 RPS and EEPS targets, the 2015 State Energy Plan—built around Governor Andrew Cuomo's 2014 Reforming the Energy Vision (REV) initiative[39]—increased the renewable power target for the state from 30% to 50% and extended the target date from 2015 to 2030 (New York State 2015, 112). The REV initiative and the 2015 State Energy Plan also established goals to reduce GHG emissions by 40% below 1990 levels by 2030 and to increase energy efficiency by 600 trillion Btu, a 23% reduction of energy consumption in buildings relative to 2012 (New York State 2015, 112).

In December 2015, Governor Cuomo directed the PSC to develop a Clean Energy Standard (CES) that would supersede the state's RPS and to "explore ways to keep emission-free nuclear power facilities operational to continue New York's greenhouse gas emissions reductions."[40] In 2015, nuclear plants provided 32% of electricity in the state, almost 10 times as much as its combined solar and wind generation and roughly 50% more than the total output of hydroelectric, solar, and wind

Photo credit: shutterstock/Gregory Dixon

The Nine Mile Point nuclear power station is located in Oswego, New York, on Lake Ontario. Unit 1 began commercial operation in 1969 and is America's oldest operating commercial nuclear reactor. State officials have determined that keeping New York's nuclear plants running is essential in meeting emissions reduction targets.

37 U.S. Energy Information Administration, State Energy Data System (SEDS): 1960–2018 (Complete), "All Consumption Estimates, in Physical Units," https://www.eia.gov/state/seds/seds-data-complete.php?sid=US.

38 Ibid.

39 New York Department of Public Service, "About the Initiative," https://www3.dps.ny.gov/W/PSCWeb.nsf/All/CC4F2EFA3A23551585257DEA007DCFE2?OpenDocument.

40 New York Department of Public Service, "Case 15-E-0302: CES," https://www3.dps.ny.gov/W/askpsc.nsf/All/74928CF52AF4E59085257FC4006F7C5C?OpenDocument.

facilities in New York.[41] A January 2016 report by the Department of Public Service (DPS), the agency whose staff supports the PSC, assessed policy options for a CES that could meet the targets established in the 2015 State Energy Plan. The DPS recommended establishing tradeable zero-emission credits (ZECs) for nuclear power purchases "to ensure the State does not backslide on its efforts to meet its ambitious GHG reduction goals" (New York DPS 2016, 5–6).

The PSC established a Clean Energy Standard in August 2016. The standard contained two principal components, a renewable energy standard that required 50% renewable power by 2030, and a zero-emissions credit requirement through which load-serving entities would buy ZECs from NYSERDA, which would itself purchase ZECs from nuclear power plants (New York PSC 2016, 154–57). This mechanism in essence requires ratepayers in New York to provide financial support to nuclear facilities.

Importantly, the PSC intended that the ZEC program help nuclear plants remain open as a "bridge to the clean energy future" dominated by renewable power (New York PSC 2016, 1). Thus, the commission stated, nuclear power "carbon benefits . . . will not count toward achieving the required number of renewable resources to satisfy the 50% by 2030 goal" (New York PSC 2016, 66).

A 70% renewable goal—and a 100% clean power goal—as law

New York established its current clean energy mandate in 2019. The Climate Leadership and Community Protection Act (CLCPA), proposed by Governor Cuomo and passed in 2019 by the state legislature, mandates 70% renewable power by 2030 and 100% emissions-free power by 2040, and requires an 85% reduction in statewide GHG emissions below 1990 levels by 2050.[42] The 2040 target is broadly written, indicating that "the statewide electrical demand system will be zero emissions."[43] This language appears to allow considerable flexibility in how load-serving entities provide 30% of electricity in New York in 2040.

With respect to the 70% renewable target in the state, CLCPA defines renewable power as solar thermal and solar photovoltaic power, onshore and offshore wind power, hydroelectric power, geothermal heat and electric power, tidal energy, wave energy, ocean thermal energy, and nonfossil fuel cells.[44] The CLCPA also established a Climate Action Council and assigned it several tasks, such as developing the plans to achieve net-zero GHG emissions in all sectors of the economy and recommending measures to achieve 3 gigawatts (GW) of energy storage capacity by 2030, 6 GW of distributed solar energy capacity, and 9 GW of offshore wind capacity by 2035.[45]

In a subsequent order intended to align the existing CES with the CLCPA, the PSC noted that New York would require an additional 42,858 GWh, of which 24,990 GWh would come through the CES (primarily through Tier 1 procurement) and the remaining 17,868 GWh would come from offshore wind (of which about 20% is already under contract) to meet the 70% renewable power target by 2030 (New York PSC 2020a, 22, 24-27). To accomplish this, the commission fixed the annual quantity of renewable power that NYSERDA would be required to procure at 4,500 GWh per year for each year from 2021 to 2026, but it gave NYSERDA flexibility to adjust its purchases up or down as needed. (This is in addition

41 U.S. Energy Information Administration, State Electricity Profiles, "Table 5. Electric Power Industry Generation by Primary Energy Source," https://www.eia.gov/electricity/state/newyork/state_tables.php.

42 New York State Senate, New York State Climate Leadership and Community Protection Act, S-06599, https://www.nysenate.gov/legislation/bills/2019/s6599. See p. 12 for GHG reductions, p. 17 for the renewable and zero-emission energy targets, and p. 18 for the solar and wind mandate.

43 Ibid., 17.

44 Ibid., 18. The New York's CES allowed biomass, biogas, and fossil fuel cells, which CLCPA excluded. Conversely, the CES set tighter rules for hydroelectric power. See New York PSC (2020a, 15–19).

45 New York State Senate, New York State Climate Leadership and Community Protection Act, S-06599, 18, https://www.nysenate.gov/legislation/bills/2019/s6599.

to contracting for the remaining offshore wind capacity.) However, in the same order, the commission reduced the renewable power obligations for load-serving entities in 2021 and 2022 "to reflect the permitting and construction delays associated with projects" (New York PSC 2020a, 38). The 2022 obligation decreased from 8.40% to 5.61%, a one-third reduction in the required share of renewable power (New York PSC 2020a, 40).

3. Land Use Policies

In 2011 and 2020, the New York state legislature passed laws to expedite renewable energy project development. An earlier state law governing the siting of electric generating facilities had expired in 2003,[46] leading to a situation in which developers followed a process governed by the New York State Environmental Quality Review Act (SEQRA) and other state regulations and local laws (Kass et al. 2011). Absent state law on siting, local laws and regulations had emerged as a powerful tool for rural communities seeking to block the development of new electricity-generation facilities, whether renewable or otherwise. The Power New York Act (2011) and the Accelerated Renewable Energy Growth and Community Benefit Act (2020) each seek to streamline land use decisions by empowering state officials, while also engaging—but diminishing the influence of—local communities.

Power New York Act of 2011

The Power New York Act established new procedures for siting generation facilities by amending the New York public service and environmental conservation laws.[47] Revisions to Article 10 of the public service law, which had lapsed in 2003, are at the core of the Power New York Act. One of most important features of Article 10 is its provision permitting siting boards dominated by state officials to set aside "unreasonably burdensome" local laws.

The new Article 10 established a seven-member New York State Board on Electric Generation Siting and the Environment and required that companies seeking to build, repower, or expand a "major electric generating facility" secure a certificate from the siting board before beginning construction. The chair of the PSC serves as chair of the siting board; other members include the commissioners of the Department of Environmental Conservation, Department of Health, and Department of Economic Development; the NYSERDA chair; and two ad hoc members from the affected community.[48] This structure provides state officials with five of seven seats on the siting board, meaning that if the PSC chair can win support from three of four other state officials, they collectively constitute a majority.

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46 New York State Department of Public Service, "Article 10 Law," https://www3.dps.ny.gov/W/PSCWeb.nsf/All/D12E078BF7A746FF85257A70004EF402#:~:text=Article%2010%20provides%20for%20the,to%20apply%20for%20numerous%20state.

47 Office of the New York State Comptroller, "Assembly Bill #A8510 Same as Senate Bill UNI #S5844: Laws of New York, 2011, Chapter 388," https://nysosc9.osc.state.ny.us/product/mbrdoc.nsf/0f9d113765ae06b58525666700653b6d/26551a1f8f57023e852579370048c298/$FILE/LAWS%20OF%20THE%20STATE%20OF%20NEW%20YORK%20-%20CHAPTER%20388%20%20OF%202011.docx.

48 Ibid., 2. The president pro tempore of the State Senate and the speaker of the State Assembly each appoint one of the ad hoc members; they select among four candidates nominated by the chief executive of the county and another four candidates nominated by the chief executive of the municipality. Should either fail to appoint a member within 30 days, the governor makes the appointment. Section 161 of Article 10 describes the selection system; the process is slightly different for New York City.

Article 10 defines a major electric generating facility as a facility with a capacity greater than 25 MW and makes no distinction between renewable and nonrenewable generation.[49] The capacity threshold had been 80 MW in the previous version of the law. In addition, the Power New York Act based its applicability on nameplate capacity ratings; this was done to prevent developers from accepting local permit conditions that limited their actual generation but not their capacity and thus avoiding the Article 10 process (New York PSC 2010). Projects with capacities under 25 MW would continue to follow the SEQRA process and work with localities to satisfy their varied laws and regulations. Though the SEQRA process requires evaluations of environmental and health impacts similar to those required by the Article 10 process, it allows for agency decisions rather than a siting board decision and lets the lead agency decide whether to hold a public hearing.[50]

Photo credit: shutterstock/Matt Valentine

New York's legislature meets at the State Capitol Building, in Albany. Since winning control of the State Senate in 2018, Democrats have controlled both houses in the state legislature as well as the governorship.

The law's certification process includes interconnection transmission lines if those lines are not subject to a separate certificate process under Article 7 of the public service law.[51] Article 7 applies to transmission lines with a capacity of 125,000 volts—125 kilovolts (kV)—extending 1 mile or longer or to transmission lines with a capacity between 100 kV and 125 kV extending 10 miles or longer; it excludes transmission lines that are wholly underground in cities with a population above 125,000 and primary transmission lines approved by the Federal Energy Regulatory Commission for hydroelectric dams.[52] Because 115 kV transmission lines are widespread in New York, the 10-mile limit in Article 7 could apply in many cases and thereby allow developers to avoid separate transmission certification if they select sites sufficiently close to existing transmission lines.[53]

The Article 10 process

Recognizing that community acceptance of major generating facilities is important, the Power New York Act creates a public information office within the Department of Public Service to facilitate public participation in the siting board's decision-making.[54] Subsequent regulation requires developers to begin a public involvement program at least 150 days before taking the formal steps to launch the siting review and certification process.[55] The public involvement program thus is the first step in seeking siting board approval of a new generating facility above 25 MW in capacity.

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49 New York Department of Public Service, "Article 10 [Enacted August 4, 2011]," https://www3.dps.ny.gov/W/PSCWeb.nsf/96f0fec0b45a3c6485257688006a701a/d12e078bf7a746ff85257a70004ef402/$FILE/Article10LawText%20.pdf. In addition to excluding normal repairs or improvements, the law created exemptions for certain federal facilities, for generation located on and used to power industrial sites, and for sites where developers had already submitted a permit application or begun construction at the time when the state legislature passed the law.

50 New York Department of Environmental Conservation, "Stepping Through the SEQR Process," https://www.dec.ny.gov/permits/6189.html.

51 New York State Department of Public Service, "Article 10 Law," 2, https://www3.dps.ny.gov/W/PSCWeb.nsf/All/D12E078BF7A746FF85257A70004EF402#:~:text=Article%2010%20provides%20for%20the,to%20apply%20for%20numerous%20state.

52 New York State Senate, "Section 120: Definitions," https://www.nysenate.gov/legislation/laws/PBS/120.

53 New York Independent System Operator, "New York State Electric System Map, 2019," https://www.nyiso.com/documents/20142/11738080/11_Preliminary_70x30_Scenario_Pocket_Map.pdf/af355880-a89c-68f5-1938-15409f73e0d8.

54 New York State Department of Public Service, "Article 10 Law," 2–3 and 8–9, https://www3.dps.ny.gov/W/PSCWeb.nsf/All/D12E078BF7A746FF85257A70004EF402#:~:text=Article%2010%20provides%20for%20the,to%20apply%20for%20numerous%20state.

55 New York State Energy Research and Development Authority, "Article 10," https://www.nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Siting/Siting-for-Large-Scale-Renewables/Article-10.

The second step is to submit a preliminary scoping statement that describes the facility, assesses its potential environmental and health impacts, outlines the developer's plans to assess and minimize those impacts, and presents other information such as a list of other permits the facility would require (New York PSC 2013, 8–9). The submission of the preliminary scoping statement to the chair of the PSC triggers the selection of the two ad hoc siting board members from the community and the convening of a siting board for that project. When submitting a preliminary scoping statement, developers pay a fee to municipal governments and other local parties for consultants, expert witnesses, lawyers, or administrative staff to assist those parties in evaluating the project (New York PSC 2013, 9).

After completing necessary scoping activities, developers submit a comprehensive and detailed application to the siting board to request the certificate needed to begin construction. The application includes a second, larger fee, which is also made available to local parties to support parties' continuing involvement in the siting board's work (New York PSC 2013, 11–14). After this, the siting board chair determines whether the application complies with the requirements of Article 10 and sets a date for a public hearing. The law stipulates a 60-day deadline for determining compliance (New York PSC 2013, 17) but does not fix a similar deadline by which the hearing should occur. The law states only that the hearing "shall be conducted in an expeditious manner" (New York PSC 2013, 22). After this the siting board issues a decision, but again the law provides no specific deadline.

Local communities

Article 10 involves communities in renewable power project–siting decisions in several ways: it requires developers to implement a public involvement program and provide application materials to local governments; it allows not only local governments but also nongovernmental organizations and individual citizens to be parties in its hearings and other processes; and it includes two appointed local representatives on the siting board. However, Article 10 simultaneously empowers the siting board—and, in practice, its state officials—to set aside any local laws or rules that would be "unreasonably burdensome" with respect to available technologies or the "needs of or costs to ratepayers" (New York PSC 2013, 25). In practice, siting boards do not always set aside local laws or rules, and thus developers cannot not know in advance whether local laws and regulations would block any specific project (Renewables on the Ground Roundtable 2017, 5).

The New York Constitution provides the basis for the state's approach to local communities. The state constitution grants local governments broad powers to manage local affairs as long as such affairs are consistent with the state and federal constitutions (New York DOS 2015).[56] However, the state legislature has the authority to restrict local government powers on "matters of state concern" and may also preempt local government by declaring its intent to act on a specific issue.[57]

Renewable power project timelines

Following the Power New York Act, renewable power development remained a slow process in New York. During the period 2012–2019, five wind projects successfully completed the Article 10 certificate process, the first in January 2018; no solar projects received certificates.[58] Three additional wind projects and

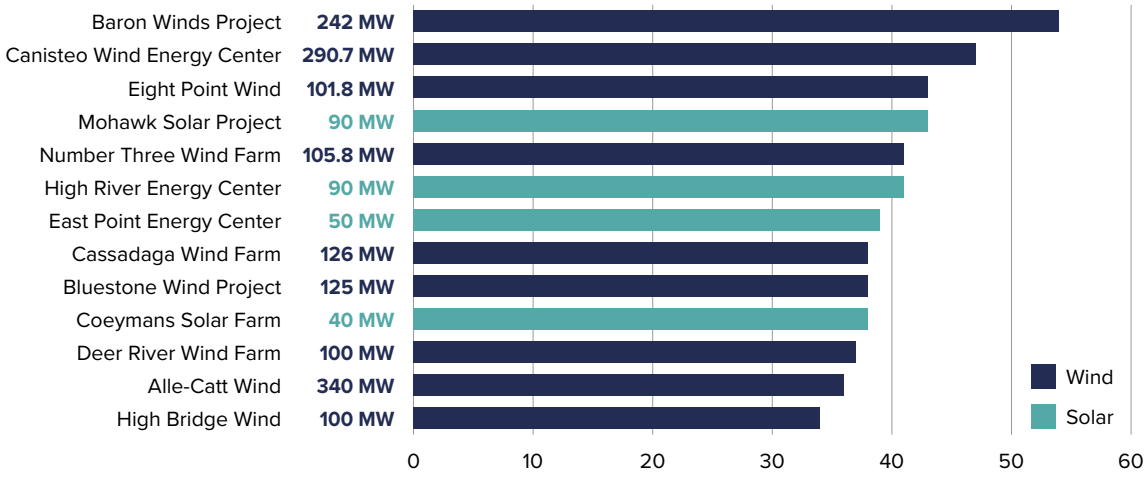
56 The relevant articles are VIII (on local finances) and IX (on local governments). See also New York State Department of State, "Local Government Home Rule Power," https://www.dos.ny.gov/lg//handbook/html/local_government_home_rule_power.html.

57 New York State Department of State, "Local Government Home Rule Power," https://www.dos.ny.gov/lg//handbook/html/local_government_home_rule_power.html.

58 New York Department of Public Service, "Active Article 10 Queue (Updated: June 14, 2021)," https://www3.dps.ny.gov/W/PSCWeb.nsf/All/763B187DD5A792DE8525847400667D6B?OpenDocument. The only solar project that has received a certificate won approval in November 2020 after commencing the Article 10 process in 2017.

one solar project obtained certificates in 2020. Together, the nine projects required an average of about 42 months to complete the process from beginning (public information program) to end (issuance of certificate).[59] Among these nine projects, the three fastest projects received certificates in 36–38 months, and the slowest took 54 months. The solar project—the 90 MW Mohawk Solar Project, in Montgomery County—needed 44 months. In early 2021, three solar projects and one wind project obtained certificates; the three solar projects did so after 38–41 months, while the wind project took just 34 months. Figure 7 displays the time required for all 13 projects to receive Article 10 certificates.

Figure 7. Time required by projects to receive Article 10 certificates (months)



Source: New York State Department of Public Service, "Active Article 10 Queue (Updated June 14, 2021)," https://www3.dps.ny.gov/W/PSCWeb.nsf/All/763B187DD5A792DE8525847400667D6B?OpenDocument.
Note: Months are rounded down to nearest whole month.

After the 2016 introduction of the New York Clean Energy Standard, a coalition of conservationists and renewable power developers convened by The Nature Conservancy and the Alliance for Clean Energy New York expressed concern that the state would have to accelerate solar and wind development in order to meet its "50 by 30" target (Renewables on the Ground Roundtable 2017, 5). The group stated that "getting wind development projects up and running is a lengthy and costly process in New York" and sought to identify barriers. Members reported that one key barrier to development was uncertainty as to whether the siting board would exercise its authority to overrule local ordinances that could block projects (Renewables on the Ground Roundtable 2017, 16).

Accelerated Renewable Energy Growth and Community Benefit Act

In April 2020, the New York state legislature passed the Accelerated Renewable Energy Growth and Community Benefit Act (AREGCBA) in a new effort to streamline siting of large-scale renewable projects (NYSERDA 2020). This time, the legislature established a new process for renewable facilities that was entirely separate and different from the Article 10 process, which remains in place for nonrenewable generating facilities. The 2020 law establishes strict timelines for renewable project approvals, attempts to define clearer criteria surrounding the applicability of local laws (while retaining the state's ability to preempt local laws), and requires developers to provide benefits to host communities in the

59 Author's calculations, with incomplete months rounded downward.

hope that this will limit local opposition. Finally, the AREGCBA seeks to expedite renewable projects by proactively identifying and preparing potential sites for developers and launching a transmission planning process.

AREGCBA exempts renewable energy facilities with capacities above 25 MW from the existing Article 10 process and creates an Office of Renewable Energy Siting (ORES) within the Department of State (not the Department of Public Service, which supports the PSC) with the authority to issue siting permits for these projects.[60] The law directs ORES to develop uniform standards for "common" environmental impacts of large-scale renewable projects and to identify steps to address impacts.[61] As a part of this process, ORES was mandated to hold four public hearings throughout the state and was directed to issue the new standards and regulations within one year of those hearings.[62] ORES released draft standards and regulations in September 2020.[63] As of June 2021, ORES had organized two in-person hearings (in Albany and on Long Island) as well as five virtual hearings, all of which occurred in November 2020.[64]

Notably, the law requires that the office act on complete permit applications within one year or—in the case of some former industrial or commercial sites—six months. If ORES fails to meet this deadline, and the office and the applicant do not both agree to an extension of up to 30 days, the permit is automatically granted.[65] Developers proposing renewable projects with capacity between 20 and 25 MW are allowed to choose between pursuing the ORES process and the SEQRA/local processes for smaller facilities.[66] As of March 17, 2021, developers of 13 solar and two wind projects had submitted applications to transfer their proposals from the Article 10 queue to the ORES process.[67] Table 2 lists the transferred projects and dates of their transfer applications.

60 New York State Assembly, "Bill A09508," 106, https://nyassembly.gov/leg/?default_fld=&leg_video=&bn=A09508&term=2019&Text=Y.

61 Ibid., 106–07.

62 Ibid.

63 New York State Office of Renewable Energy Siting, "Regulations," https://ores.ny.gov/regulations.

64 New York State Office of Renewable Energy Siting, "Events," https://ores.ny.gov/events.

65 New York State Assembly, "Bill A09508," 111, https://nyassembly.gov/leg/?default_fld=&leg_video=&bn=A09508&term=2019&Text=Y.

66 Ibid., 109.

67 New York Department of Public Service, "Active Article 10 Queue (Updated: June 14, 2021)," https://www3.dps.ny.gov/W/PSCWeb.nsf/All/763B187DD5A792DE8525847400667D6B?OpenDocument.

Table 2. Solar and wind projects transferred to ORES siting process

Project	Capacity	Transfer application date
Heritage Wind Project	200.1 MW	12/21/2020
Homer Solar Energy Center	90 MW (plus battery storage)	1/4/2021
Prattsburgh Wind	147 MW	1/4/2021
Moraine Solar Energy Center	94 MW	1/22/2021
Tracy Solar Energy Center	119 MW	1/25/2021
Orleans Solar	200 MW	2/4/2021
White Creek Solar	135 MW	2/4/2021
Bear Ridge Solar	100 MW	2/9/2021
South Ripley Solar	270 MW	2/10/2021
Brookside Solar	100 MW	2/17/2021
Empire Solar	125 MW	2/25/2021
New Bremen Solar	100 MW	2/25/2021
Sugar Maple Solar	125 MW	2/25/2021
Columbia Solar Energy Center	350 MW	3/4/2021
Genessee Road Solar Energy Center	350 MW (plus battery storage)	3/4/2021
Watkins Glen Solar Energy Center	50 MW	4/13/21
Greens Corners Solar	120 MW	4/30/21
Rich Road Solar	240 MW	5/4/21
Shepherds Run Solar	60 MW	5/4/21
Verona Solar	250 MW	5/17/21

Source: New York State Department of Public Service, "Active Article 10 Queue (Updated: June 14, 2021)," https://www3.dps.ny.gov/W/PSCWeb.nsf/All/763B187DD5A792DE8525847400667D6B?OpenDocument.

Local communities

The 2020 law also changes the role of local communities in the permitting process. Rather than granting localities two seats (and, more importantly, two votes) on a PSC siting board, the law mandates that developers submit proof of consultation with the host community regarding local laws and procedures, directs localities to submit a statement (during the 60-day public comment period) indicating whether the facility would comply with local laws and regulations, and requires the siting office to consider local laws in issuing permits.[68] If the locality declares that the facility does not comply with local laws and regulations, ORES can either schedule an adjudicatory hearing before an administrative law judge or, alternatively, organize a non-adjudicatory public hearing in the impacted community.[69] Under the law, final siting permits must include a requirement that the developer provide a "host community benefit," such as discounts or credits on utility bills, environmental benefits, or other compensation.[70] If the permit includes a plan to address risks to endangered or threatened species, developers are also required to contribute to a new Endangered and Threatened Species Mitigation Bank Fund.[71]

68 New York State Assembly, "Bill A09508," 110, https://nyassembly.gov/leg/?default_fld=&leg_video=&bn=A09508&term=2019&Text=Y.

69 Ibid.

70 Ibid., 111 (on the requirement), 120 (on potential benefits).

71 Ibid., 121–22.

In February 2021, the PSC formally defined the Host Community Benefit Program. The PSC's order mandated annual fees (for ten years) of $500 per MW in nameplate capacity for solar projects and $1,000 per MW in nameplate capacity for wind projects (New York PSC 2021, 38). The fees are required for NYSERDA's Tier 1 renewable energy contracts and paid by renewable owners to specified electric distribution utilities, which are to provide bill credits to residential customers in affected towns or cities.

Whether or not comments from a local government or the public force an adjudicatory hearing depends on whether a particular comment "raises a substantive and significant issue, as defined in regulations."[72] ORES draft regulations state that "an issue is substantive if there is sufficient doubt about the applicant's ability to meet statutory or regulatory criteria applicable to the project, such that a reasonable person would require further inquiry." An issue is also considered significant "if it has the potential to result in the denial of a siting permit" or in major modifications or conditions.[73] Five town governments, community groups opposed to specific renewable projects, and Audubon and other bird-related interest groups filed a lawsuit challenging the new process in June 2021; they objected to AREGCBA's provisions allowing ORES to overturn local laws and to looser environmental impact requirements (French 2021).

Build-Ready Program

In parallel with the new permitting process, the 2020 law establishes a Clean Energy Resources Development and Incentives Program. The core of this effort is a new Build-Ready Program, through which NYSERDA is directed to identify, assess, and facilitate the development of suitable sites for renewable power–generating facilities.[74] This effort could include negotiating and concluding agreements with site owners, securing permits, and transferring sites to developers through a competitive bidding process.[75] The law instructs NYSERDA to give priority to "previously developed sites" and "existing or abandoned commercial sites" such as brownfields, landfills, or other disused or underutilized sites.[76] The Public Service Commission issued an order formally approving the Build-Ready Program in October 2020 (New York PSC 2020b). In April 2021, New York's governor announced a lease-option agreement for the first program site, at a former mine in St. Lawrence County (NYSERDA 2021c).

Transmission

A final important component of the AREGCBA is the law's forward-looking focus on electricity distribution and transmission. The act directs the DPS—with input from NYSERDA, NYISO, and utilities—to conduct a comprehensive study of the distribution and transmission infrastructure necessary to implement the CLCPA's renewable power mandate.[77] The DPS is required to share its preliminary findings no later than 270 days after the enactment of the law; and to begin a proceeding (its formal rule-making process) to develop distribution and transmission capital plans for each utility, including a prioritized schedule, within 60 days after that.[78] Also within 60 days of the DPS's initial findings, the Public Service Commission is to commence a parallel proceeding on developing a bulk transmission investment program, to present that plan to NYISO for incorporation into its grid planning, and

72 Ibid., 110.

73 Office of Renewable Energy Siting, "Chapter XVIII, Title 19 of NYCRR Part 900, Office of Renewable Energy Siting, Subparts 900-1–900-5; 900-7–900-14," https://ores.ny.gov/system/files/documents/2020/09/draft-regulations-chapter-xviii-title-19-subparts-900-1-900-5-900-7-900-14.pdf

74 New York State Assembly, "Bill A09508," 114–15, https://nyassembly.gov/leg/?default_fld=&leg_video=&bn=A09508&term=2019&Text=Y.

75 Ibid., 115.

76 Ibid., 115.

77 New York State Assembly, "Bill A09508," 117, https://nyassembly.gov/leg/?default_fld=&leg_video=&bn=A09508&term=2019&Text=Y.

78 Ibid., 118.

through that process to identify priority projects.[79] The law instructs the commission to assess no later than January 1, 2023 (and every four years thereafter) progress toward the development of the grid aligned with CLCPA targets.[80] In early 2020, NYISO released a detailed analysis of likely transmission constraints in achieving the "70 by 30" renewable power plan (Cohen and Yang 2020).

As with renewable power facilities, AREGCBA also seeks to accelerate transmission permitting decisions. This aim includes requiring the Public Service Commission to act on complete permit applications within 12 months, with provisions for a six-month extension.[81] Separately, the law directs the commission to develop rules for an expedited nine-month process for major transmission facilities if those facilities are within existing rights-of-way, would not have significant environmental consequences, or require expanding rights-of-way due to electromagnetic fields.[82]

79 Ibid., 118.

80 Ibid., 119.

81 New York State Assembly, "Bill A09508," 120, https://nyassembly.gov/leg/?default_fld=&leg_video=&bn=A09508&term=2019&Text=Y.

82 Ibid., 120–21.

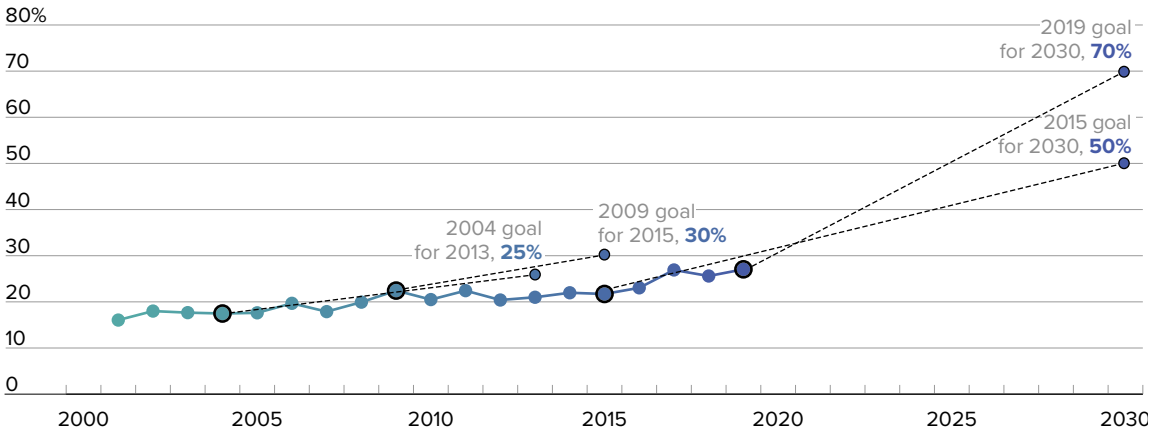
4. New York's Uncertain Energy Future

Over the last two decades, governors and state officials in New York have sought to reduce GHG emissions in the state, especially in the power sector. Former governor George Pataki, a Republican, inaugurated such efforts with the first New York State Energy Plan and the first Renewable Power Standard. Former governors Eliot Spitzer and David Paterson—and the current governor, Andrew Cuomo—each sought to expand upon the foundation established by Governor Pataki. Nevertheless, efforts to develop additional solar and wind power to meet ambitious renewable energy targets in the state have fallen short of goals and continue to face serious challenges. Greater flexibility could contribute substantially to attempts to build an emissions-free power system.

New York is struggling to meet its ambitious goals to develop solar and wind power.

New York failed to reach its 2013 and 2015 renewable power and energy efficiency targets, as described above. Nevertheless, Governor Cuomo set more ambitious—but also more distant—targets in the 2016 Clean Energy Standard and the legally binding 2019 CLCPA. Yet even by 2019, renewable power in New York had not yet reached the 2015 target set in 2009. The track record in the state suggests that achieving the CLCPA target of 70% renewable power by 2030 will be quite challenging. Figure 8 illustrates the share of renewable power in the New York electricity generation mix, and the successive renewable power goals in New York.

Figure 8. New York's renewable electricity progress and goals



Source: U.S. Energy Information Administration, State Energy Data System (SEDS): 1960–2018 (Complete), "All Consumption Estimates, in Physical Units," https://www.eia.gov/state/seds/seds-data-complete.php?sid=US.
Note: Progress reflects EIA combined shares of utility-scale hydroelectric, solar, and wind generation in New York and does not exactly match the state's definition of renewable power.

Photo credit: shutterstock/Elena Berd

The Robert Moses Niagara Hydroelectric Power Plant, shown here from Canada's side of the Niagara River, and the Lewiston Pump Generating Plant comprise the Niagara Power Project. According to the New York Power Authority, they form New York's largest single electricity producer, with 25 turbines and a capacity of 2,600 MW. They are downstream from Niagara Falls.

After the introduction of the 2016 CES, the share of renewable power generation increased from 25.9% in 2014 (the baseline year in the 2016 CES) to 28.1% in 2017; but it then fell to 26.8% in 2018. In 2019, the share increased slightly to 27.0% (NYSERDA 2021b, 16). State officials attribute the 2018 decrease to increasing electrical loads, greater imports from other states with lower renewable electricity shares, and a reduction in hydroelectric generation due to low rainfall (NYSERDA 2019, ES-1). As mentioned previously, the Public Service Commission cut by one-third the share of renewable power that load-serving entities are required to provide (or purchase in the form of credits) in 2022.

In fairness to New York—and to other states pursuing aggressive renewable power targets—some of the factors that have slowed solar and wind development are beyond the control of decision-makers within the state, such as low natural gas prices, related declines in wholesale electricity prices, and uncertainty with respect to federal energy and climate policy such as federal tax credits (Morris et al. 2013, 10–11). Nonetheless, decision-makers have understood such factors for many years and should have considered them in to developing and implementing state renewable power targets. Moreover, despite the challenges exogenous to New York, New York (and other states) have benefited from an unexpectedly rapid decline in the levelized cost of energy (LCOE) for solar and wind power, decreases of 89% and 70%, respectively, in the decade ending 2019 (Lazard 2019, 8). Absent these cost reductions, the state would have either deployed less or paid more for solar and wind generation.

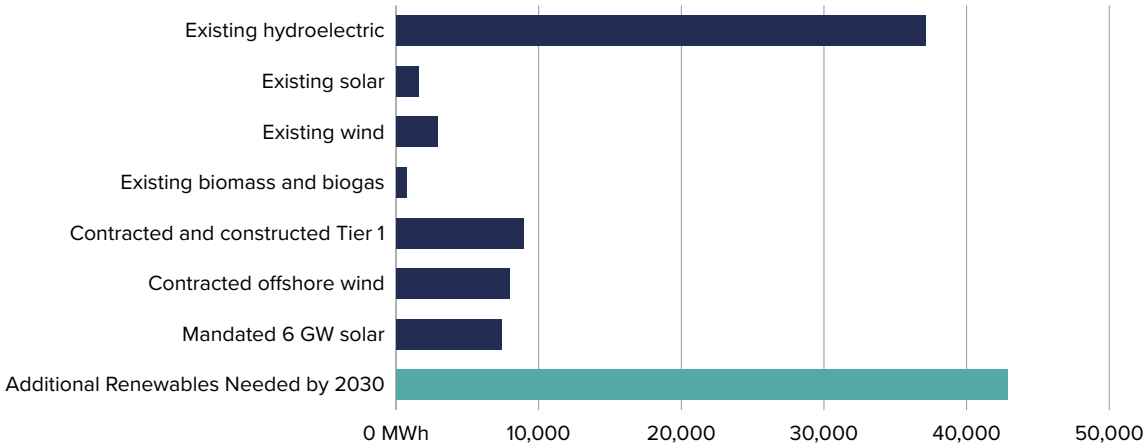
A particular challenge for New York is that its large supplies of hydroelectric power generation—New York produces about 10% of all U.S. hydropower and ranks third among U.S. states in hydro production (EIA 2020b)—obscure the exponential growth in solar and wind power generation required to meet the CLCPA target. As noted, hydroelectric power provides 23.2% of the state's electricity while solar and wind provide just 0.4% and 3.4% (2019).[83]

Figure 9 illustrates the magnitude of the difference between existing solar and wind generation in New York and the generation necessary to meet the 70% renewable power mandate in 2030. In 2018, total solar and wind generation in the state were 1,575 GWh and 2,921 GWh respectively (NYSERDA 2019, 16); by 2030, the CLCPA requires an additional 42,858 GWh in solar, wind, and other renewables, nearly 10 times the combined solar and wind power available in 2018 (New York DPS 2020, 21). Importantly,

83 U.S. Energy Information Administration, State Electricity Profiles, "Table 5. Electric Power Industry Generation by Primary Energy Source," https://www.eia.gov/electricity/state/newyork/state_tables.php.

this comes on top of 6 GW in new solar capacity required under CLCPA as well as already contracted onshore and offshore projects.

Figure 9. Existing, contracted/constructed, and mandated renewable generation in New York vs. additional renewable generation needed for CLCPA's 70% by 2030 target



Source: New York Department of Public Service

New York is unlikely to expand its in-state hydroelectric generation substantially (Phoenix Energy 2018); the DPS has recommended significant limits on new hydroelectric facilities due to potential "negative environmental impacts" (New York DPS 2020, 48). Instead, officials and planners have focused on modernizing existing facilities such as the massive hydroelectric plant at Niagara Falls (Governor's Press Office 2019). While New York City hopes to import hydroelectric power from Canada, the Champlain Hudson Power Express transmission project—necessary to bring the power from Canada to New York City—is controversial and, even if successful, will replace zero-carbon generation from the Indian Point nuclear power plant and thus will not reduce GHG emissions in the state (Cruz 2020).

The land use decisions required in siting solar and wind projects slow efforts to meet the renewable power goals in New York; there are inherent political limits to streamlining these processes.

New York's record in siting solar and wind projects has been mixed. The Power New York Act reformed the siting process for power generation in part to facilitate development of solar and wind facilities to meet prior renewable power mandates. Following the introduction of its 2016 Clean Energy Standard—at a time when not a single new project had won final approval through the Article 10 process since the passage of the 2011 law[84]—a coalition of climate advocates, conservationists, developers, and others recommended that officials "make New York's energy siting processes more efficient and less expensive" (Renewables on the Ground Roundtable 2017, 17). Renewable power projects continued to face delays, however; later projects required 3½ to 4½ years to secure permits, and others either stalled or terminated with the withdrawal of proposals. The 2020 Accelerated Renewable Energy Growth and Community Benefit Act restructured the siting process a second time in an effort to streamline approval and construction of solar and wind facilities.

84 New York Department of Public Service, "Active Article 10 Queue (Updated: June 14, 2021)," https://www3.dps.ny.gov/W/PSCWeb.nsf/All/763B187DD5A792DE8525847400667D6B?OpenDocument.

Experiences with two existing large-scale solar facilities in the state are instructive. One—the Long Island Solar Farm—is sited on federal land at the Department of Energy Brookhaven National Laboratory.[85] A Department of Energy history of the project suggests that the Long Island Solar Farm succeeded as a large-scale project only because the National Laboratory made federal land available for it: the alternative was to develop many smaller projects on other types of land with a combined similar capacity (Anders 2013, 14). The second large-scale facility, Shoreham Solar Commons, is located in the town of Brookhaven on Long Island. It was a controversial project constructed on the site of a well-regarded but financially troubled public golf course (Golf on Long Island 2016).

Notably, both the Long Island Solar Farm and Shoreham Solar Commons avoided the Article 10 siting process. The Long Island Solar Farm did so through its use of federal land, while the Shoreham Solar Commons had a 24.9 MW capacity, just below the 25 MW threshold triggering Article 10, presumably through a deliberate choice made in cooperation with a sympathetic local government (Misbrener 2018). As of March 17, 2021, however, four new solar projects had received Article 10 certificates, the Mohawk Solar Project (90 MW),[86] the East Point Energy Center (50 MW),[87] the High River Energy Center (90 MW),[88] and the Coeymans Solar Farm (40 MW).[89]

Siting any project—whether a power generation facility, factory, school, church, or shopping center—can be politically fraught. In many cases, a project's immediate neighbors bear a disproportionate share of the negative impacts of the project in the forms of obstructed lines-of-sight, noise, environmental externalities, traffic, or economic damages. Local efforts to avoid such impacts, sometimes characterized derisively as "not in my backyard" (NIMBY) efforts, touch on a fundamental question of democracy: when and how should majorities have the power to impose outcomes on others? Recently, minority communities have framed siting decisions as a matter of justice, and especially of environmental justice in relation to power plants, manufacturing, or other environmentally consequential facilities.

In New York, wind projects have thus far been more common than large-scale solar development and have often provoked opposition. In two cases, developers have withdrawn Article 10 certificate applications, though factors other than local opposition may have contributed to those decisions.[90] Many wind projects have been planned in rural areas with little pre-existing large commercial development; local officials and residents in these areas tend to assert, with justification, that the projects detract from the landscape, reduce property values, and damage ecosystems (Iaconangelo 2020). According to an Energy Innovation Reform Project review of more than 100 academic studies and government reports that assess the land use requirements of solar and wind power, such projects have demonstrable quality impacts on natural and environmental systems and on human enjoyment of the land, although some such impacts can be mitigated with appropriate policies (Saunders 2020, 24–27).

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85 Brookhaven National Laboratory, "Long Island Solar Farm," https://www.bnl.gov/lisf/.

86 Avangrid Renewables, "Mohawk Solar," https://www.avangridrenewables.com/wps/portal/aren/aboutus/!ut/p/z0/fYzBCoJAFEW_xvWbMMSWEoEUSUlLfZvhKUNNzsxLZybz73MVtGl3zuFyAaEBdPTSNwqaHZnVW8xkujkfyu1eVHmRFql-pdddXtWluGRwBPw_WB_0YxyxAOzZBfUO0NCknKSOY4g-EV9Yq5qpM8pL7eTCcZI9WxudDksiLN9pHjwbmn4EngO2H7jctxE!/.

87 NextEra Energy, "Proposed Solar Array Layout," https://www.eastpointenergycenter.com/wp-content/uploads/sites/3/2020/03/East-Point-Layout_2019-08-21.pdf.

88 NextEra Energy, "Proposed Alternative Layout," https://highriverenergycenter.com/wp-content/uploads/2020/06/High-River-Energy-Center_overall-plan-sheet.pdf.

89 Hecate Energy, "About Coeymans Solar Farm," https://www.coeymanssolarfarm.info/about/.

90 New York Department of Public Service, "Active Article 10 Queue (Updated: June 14, 2021)," https://www3.dps.ny.gov/W/PSCWeb.nsf/All/763B187DD5A792DE8525847400667D6B?OpenDocument.

Land use decisions are unavoidably political and local.

Land use decisions typically require that competing interests and values be balanced. With respect to siting solar and wind power facilities, interests may be economic (e.g., local government tax revenues or subsidies, developers' profits, site owner's income, neighbors' diminished property values, etc.) and political (e.g., success or failure of renewable power policies, perceived victory or defeat for those involved in siting decisions, etc.). Values shape goals and the priorities that stakeholders assign to achieving those goals. In solar and wind siting decisions, values include climate protection, environmental/wildlife protection, prosperity (creating/protecting jobs, economic development), fiscal responsibility (limiting government expenditures, limiting taxes), distributional justice (environmental and landscape impacts, property values, electricity costs), and various philosophies of government (particularly as they relate to the balance between individual, local, state, and federal powers).

From this perspective, academic studies that assess how much land is "available" for solar and wind power in the United States, or in a particular U.S. state, usually set aside the political reality that land is available for development only if officials make it available. Because elected officials are accountable to voters for the policies that guide appointed and career officials in making siting decisions, some land is more easily available than other land. This "political availability" of land is a function of the interests and values associated with specific sites and cannot be isolated from local politics. As a result, siting can be particularly challenging for out-of-state developers less familiar with these dynamics. In New York's solar and wind sector, most developers are based outside the state.

In the context of land use decisions, interests and values differ significantly: the interests at stake in a specific case are usually those of individual actors—nearby residents, developers, utilities, politicians, and government agencies—while values tend to reflect widely held social aims or political views. This distinction matters because it can transform siting debates into "values" debates in which participants invoke not only economic, environmental, and political arguments, but also moral arguments. While moral arguments can be attractive to advocates on both sides in national and local land use debates, they generally intensify disputes because they implicitly (and, in many cases, explicitly) aim to discredit the moral standing of one side or the other.

At the national level, for example, though the company Amazon had announced a corporate target of 100% renewable power by 2025 and net-zero GHG emissions by 2040,[91] the Sunrise Movement assailed then-CEO Jeff Bezos for "helping to destroy" the Earth through company partnerships with fossil fuel firms.[92] At the local level, the Stop the Solar Farms website—focused on solar development on Long Island—attacks elected officials for "choosing money over our health" in supporting solar projects.[93] Such rhetoric undermines informed and civil discussion of important public policy issues.

Geographic, economic, and partisan divisions in New York have also shaped renewable power siting debates, as was visible in the state legislature's debate over the Climate Leadership and Community Protection Act (Iaconangelo 2020). Contentious large-scale wind projects—such as the Alle-Catt wind project in southwestern New York (Meyer 2020)—have generally been located in poorer and more rural and Republican upstate regions (Bryce 2020), while the political impetus for larger shares of

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91 Amazon, "The Climate Pledge," https://www.aboutamazon.com/planet/climate-pledge. Amazon relies on a combination of on-site solar with global solar and wind offsets to achieve these goals. Offsets involve producing renewable power elsewhere to offset nonrenewable power consumption. See Amazon, "Renewable Energy," https://sustainability.aboutamazon.com/environment/sustainable-operations/renewable-energy?energyType=true.

92 Sunrise Movement, July 18, 2019, https://twitter.com/sunrisemvmt/status/1151909030543147008. On Twitter, the Sunrise Movement quoted Bezos's remarks about investments in space exploration to assert that the billionaire is "openly planning an escape route from the planet he's helping destroy."

93 StoptheSolarFarms.com, "Petition to Stop the Solar Farms Coming Soon," https://www.stopthesolarfarms.com/home.html.

renewable power is predominantly located in the wealthier and more urban and Democratic downstate regions. One report suggests that upstate New York is already "close to having a zero-carbon grid" and that future wind and solar generation will be necessary largely for a transition away from fossil fuels in New York City (Iaconangelo 2021). In October 2020, the PSC established a new renewable power procurement tier, Tier 4, specifically to secure new renewable generation for the New York City area (New York PSC 2020a).

Working cooperatively with host communities, addressing their concerns, and ensuring that they have a stake in proposed solar and wind projects is essential—but it is not clear that New York has done enough in these areas.

Legal requirements to consider host community benefits in the solar and wind permitting process—a key provision of the 2020 Accelerated Renewable Energy Growth and Community Benefit Act—imply that solar and wind projects may not be attractive to local communities, and that developers must be prepared to compensate residents for potential damages to the interests and/or values of local communities. Failures to recognize the extent to which communities might resist renewable energy projects are likely in part a consequence of what analyst and author Robert Bryce describes as the "vacant land myth," namely, the idea that there must be abundant development land in rural areas because those areas seem empty and undeveloped (Bryce 2019). In mandating host community benefits, the New York state government appears to have implicitly acknowledged its prior mistakes.

It is unclear whether the siting reforms enshrined in the AREGCBA and implemented by the state will accelerate solar and wind development to the extent necessary to meet the CLCPA 70% by 2030 renewable power goal. The reforms would have to accomplish three things: (1) speed permitting and construction, (2) make more land "politically available," and (3) sustain both efforts until 2030. The AREGCBA seeks to speed permitting and construction by redesigning the siting process with tight deadlines for regulators and establishing the Office of Renewable Energy Siting. In parallel, the law seeks to make more land "politically available" by enshrining consideration of host community benefits in the siting process.

In colloquial terms, the state government's siting reforms seek both to compel local communities with "sticks" (such as ORES's ability to grant a permit despite local laws to the contrary) and to offer communities "carrots" (the requirement that developers provide community benefits). The test for the state government will be in how it responds if solar and wind deployment rates continue to fall short of what is necessary to meet the CLCPA target.

In essence, siting reforms in New York might accelerate renewable power deployment, but they do not eliminate sources of tension between local communities and state government. A combination of local opposition to solar and wind development in upstate New York, and a "pushing through" of solar and wind development projects under the aegis of the AREGCBA and CLCPA, could provoke political backlash against the permitting process or the renewable energy goals set forth in the CLCPA.

Legal challenges to ORES siting authority reflect existing political opposition that could intensify. Thus far, AREGCBA's host community benefits appear grossly insufficient to overcome local opposition to renewable power development. For example, the PSC's $1,000 per MW mandated fee for wind projects would require the owners of Lighthouse Wind, a 201 MW wind farm proposed near the towns of Somerset and Yates, to pay $201,000 per year toward host community benefits. The combined population of the two towns is approximately 5,200[94] with a mean household size of 2.59 persons in

94 New York Demographics by Cubit, "New York Cities by Population," https://www.newyork-demographics.com/cities_by_population.

New York State;[95] this implies roughly 2,000 households between them, yielding an annual residential bill credit of about $100 (less utility administrative fees), or about $12 per month. It seems notable that four months after the PSC specified the amount of the host community benefit in February 2021, the two towns joined others in filing a lawsuit challenging ORES siting powers.

Such dynamics could constrain the rates of deployment of solar and wind projects. It is not obvious that New York policy makers will be able to overcome community opposition to large-scale renewable projects or to do so sufficiently quickly to meet CLCPA mandates. Moreover, although potential further decreases in the costs of solar and wind power could help state officials meet renewable power goals (Taylor 2020), research suggests that New York is likely to face increasing grid management costs associated with balancing variable solar and wind energy, as the shares of those power supplies grow (Jenkins, Luke, and Thernstrom 2018, 2508).

The Build-Ready Program in New York will likely facilitate development in specific locations but might not reach the scale necessary to meet the state's renewable energy targets.

The Build-Ready Program in New York is a sensible and promising approach to siting renewable energy—especially solar power—on previously developed land. It is best understood as a proactive version of the U.S. Environmental Protection Agency (EPA) RE-Powering America's Land initiative, which identifies and characterizes potential sites for renewable energy projects on contaminated land, landfills, mine sites, and other locations.[96] Like the EPA initiative, the Build-Ready Program relies on academic research suggesting that the United States might be able to meet all of its renewable energy siting needs by redeveloping such sites—and that where renewable projects face local opposition, reusing previously developed sites can help make projects more palatable to local communities and the general public.[97] Still, research suggests that the densely populated northeast region of the United States, including New York, is the region least able to accommodate renewable energy targets using degraded land (Waite 2017).

Efforts like the Build-Ready Program typically target the development of solar generation facilities, as solar photovoltaic panels at such facilities are more densely packed than individual turbines at wind sites. The spacing between turbines at wind sites is usually equivalent in length to four rotor diameters side to side and 10 diameters front to back to avoid mutual interference (Saunders 2020, 16, 20). With rotor diameters of 130–150 m, this would mean about 520–600 m between turbines side to side and 1,300–1,500 m front to back;[98] hence very few previously developed sites would be sufficiently large to accommodate an entire wind project of any considerable size. In New York, the first five "priority sites" selected by the Build-Ready Program are all potential solar power sites.[99] Even so, two sites are limited to 10–15 MW and 10–20 MW projects, respectively. The remaining three sites can accommodate solar facilities that exceed 20 MW.

Despite the potential advantages of repurposing previously developed land for solar projects—for example, avoiding new development costs, supporting rehabilitation of degraded land, and limiting public opposition—reusing previously developed land also poses challenges. Most obviously, the land

95 United States Census Bureau, "QuickFacts: New York," https://www.census.gov/quickfacts/NY.

96 For more information, see U.S. Environmental Protection Agency, "RE-Powering America's Land," https://www.epa.gov/re-powering.

97 For example, see Waite (2017).

98 The cited rotor diameters reflect GE's current 3MW and 6MW turbines; see GE Renewable Energy, "GE's Onshore Wind Farm Technology," https://www.ge.com/renewableenergy/wind-energy/onshore-wind. With 1,609 meters per mile, this spacing would be about one-third of a mile side to side and almost one mile back to back.

99 NYSERDA, "Build-Ready Project Sites," https://www.nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Standard/Landowners-and-Local-Governments/Build-Ready-Program/Build-Ready-Project-Sites.

may not be suitable; or it may be less economically attractive than other potential sites. Factors such as slope, shading, and aspect are important determinants of photovoltaic panel efficiency and project profitability; distance to transmission lines and the capacities of those lines are similarly important factors (Waite 2017).[100] The costs of transmission permits and interconnections may be significant. Yet the most difficult problems in redeveloping degraded land usually relate to environmental cleanup and potential future environmental liability. Unsurprisingly, research suggests that developers prefer to wait until a site has been restored before commencing a project (Waite 2017).

Regardless of who pays for environmental remediation—developers, ratepayers, state or federal agencies, or some combination thereof—restoring contaminated land is likely to slow renewable energy development at a time when New York State policy calls to accelerate it greatly. Due to such pressures, the Build-Ready Program and similar initiatives are likely to concentrate on the least damaged lands, thus limiting the potential environmental benefits associated with rehabilitating degraded land.

Four of the first five Build-Ready Program priority sites are developed but not contaminated; they include sites at a former developmental center, a former medium-security prison, a former county airport, and properties "in close proximity to" two operating correctional facilities.[101] Two of these four sites are already state-owned (NYSERDA 2021a, 15). The fifth site is a tailings pile at the former Benson Mines iron mine in St. Lawrence County, where the state has not found evidence of hazardous waste.[102] While EPA estimated that the Benson Mines site could accommodate up to 600 MW in solar capacity,[103] NYSERDA states that it "could potentially host a 20- to 30- megawatt solar energy facility";[104] the difference may reflect some of the geographic and economic considerations identified above. As noted above, the state government announced a lease-option agreement for the Benson Mines site in April 2021.

In 2020, the Build-Ready Program identified 507 potential sites, of which 85 were ultimately deemed "unsuitable" (NYSERDA 2021a, 12). At the end of the year, 411 sites remained in "active screening," a document-based review process; 201 of the sites were current or former commercial or industrial sites, 71 were brownfield sites, and 23 were landfills (NYSERDA 2021a, 12). An additional 55 sites were on state or municipal property, and 61 were miscellaneous sites including abandoned developer projects, federal property, transmission sites, parcels under 10 acres, or other types. Only six sites progressed to "on-deck" status, which refers to sites selected for closer study, such as outreach to owners and local officials and/or a site visit and further environmental screening (NYSERDA 2021a, 11).

Local governments and private groups or individuals nominated 14 sites, though over one-third of these were on greenfield or agricultural land rather than former industrial, commercial, or other degraded land (NYSERDA 2021a, 11). As of May 2021, New York State's Environmental Site Remediation Database includes 5,384 entries,[105] while the EPA's RE-Powering America mapping database includes 4,498 potential solar sites and 2,452 potential wind sites in New York.[106] However, many of these sites are quite small and thus thus might not be appropriate for utility-scale projects.

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100 Aspect refers to the angle of the solar panels relative to the sun. Solar panels are most efficient when they receive direct normal irradiance, i.e., when sunlight strikes the panels at an angle perpendicular to the surface of the panel.

101 NYSERDA, "Build-Ready Project Sites," https://www.nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Standard/Landowners-and-Local-Governments/Build-Ready-Program/Build-Ready-Project-Sites.

102 Ibid.; New York State Department of Environmental Conservation, Environmental Remediation Databases Details, Site 645051, https://www.dec.ny.gov/cfmx/extapps/derexternal/haz/details.cfm?ProgNo=645051.

103 U.S. Environmental Protection Agency, "Re-Powering Mapper 2.0," https://geopub.epa.gov/repoweringApp/.

104 NYSERDA, "Build-Ready Project Sites," https://www.nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Standard/Landowners-and-Local-Governments/Build-Ready-Program/Build-Ready-Project-Sites.

105 Environmental Site Remediation Database, https://www.dec.ny.gov/cfmx/extapps/derexternal/haz/results.cfm?pageid=3.

106 U.S. Environmental Protection Agency, "RE-Powering America's Land," https://www.epa.gov/re-powering.

Poor solar and onshore wind resources make solar and wind power targets in New York more costly and more difficult to achieve than similar targets in many other states.

As described earlier, the share of utility-scale solar power in New York is well behind the national average share. Moreover, utility-scale solar has developed much more slowly than wind power in New York; while the share of wind power is half the national average, the share of solar power is closer to one-quarter the national average. As of this writing, New York had just two operating large-scale solar facilities, as the majority of solar projects in New York are community based and low (1–3 MW) capacity.[107]

Geography in New York contributes to the challenges of developing solar and wind power. Low onshore wind speeds and especially low solar irradiance, relative to many other states, limit the availability of solar and wind energy and necessitate larger land areas for solar panels and wind turbines than might be necessary elsewhere to generate the same amounts of electricity (Saunders 2020, 18). More solar panels and wind turbines in turn require greater investments and higher electricity prices to yield financial returns attractive to developers and investors.

Research confirms that solar and wind electricity is more expensive in New York than in most of America. The Lawrence Berkeley National Laboratory concludes that the levelized cost of energy for utility-scale solar facilities in the NYISO region was 61.6% higher than the national average in 2017, $118/MWh compared to $73/MWh.[108] Only in Hawaii and the New England region were utility-scale solar LCOE values higher than in NYISO, at $132/MWh and $119/MWh respectively.[109] The LCOE of wind energy in the NYISO region was 20% higher than the national average in 2018, at $42/MWh and $35/MWh respectively.[110] Only in California was the LCOE for wind higher than in New York, at $50/MWh.

If New York continues to focus on developing wind power, the land use impacts and costs of offshore wind development will likely be less than those for onshore wind development, although offshore development also faces opposition and requires significantly more material inputs.

The CLCPA mandate to develop 9,000 MW of offshore wind capacity by 2035[111] demonstrates the state government's focus on offshore wind development. Offshore wind resources in New York are significantly better than onshore wind resources in the state. Thus an offshore wind facility could generate more electricity than an onshore facility with the same capacity.

In a 2020 white paper, the DPS and Public Service Commission stated that offshore wind will be "critical to reducing project costs" in the state (New York DPS 2020, 39), which suggests that officials expect the additional electricity generation from offshore wind to more than offset its higher capital costs. The paper noted further that with 1,826 MW in offshore wind capacity under contract, New York would have to procure 750 MW to 1,000 MW in new offshore capacity each year through 2027 to meet the state's 9,000 MW goal, with the variance depending on the outcome of NYSERDA's 2020 solicitation (New York

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107 Solar Energy Industries Association, "Major Solar Projects List," https://www.seia.org/research-resources/major-solar-projects-list, last updated July 2020.

108 Lawrence Berkeley National Laboratory, "Utility-Scale Solar Data Update," https://emp.lbl.gov/sites/default/files/2020_utility-scale_solar_data_update.xlsx.

109 In Hawaii's case, the solar LCOE likely reflects high construction costs in the state, due to its relative isolation.

110 Lawrence Berkeley National Laboratory, 2020 Data File, https://emp.lbl.gov/sites/default/files/2020_wind_energy_technology_data_update.xlsx.

111 New York State, "Climate Act," https://climate.ny.gov.

DPS 2020, 38). Since NYSERDA selected two projects with approximately 2,500 MW capacity for contract negotiation,[112] future procurements may fall toward the lower end of this range.

Offshore wind facilities avoid direct land use impacts because of their placement in the ocean or, in New York's case, in Lake Ontario or Lake Erie. Offshore facilities may also avoid indirect impacts—such as noise—if they are distant from settled areas.[113] Nevertheless, offshore wind facilities have provoked opposition because of their visual impacts, impacts associated with to-shore landing sites for transmission lines (West 2019), and potential impacts on fisheries (Runyeon 2018). Concerns about the visual impacts of Atlantic coast offshore wind became sufficiently widespread that the U.S. Department of the Interior's Bureau of Ocean Energy Management (BOEM) developed visual simulations of hypothetical projects, including both still images and video at various locations.[114] BOEM reported that it developed the simulations "in response to stakeholder interest regarding visual impacts from potential future renewable energy development"; the simulation shows views of a wind farm off Long Island from the New York and New Jersey shorelines. Two new projects solicited by NYSERDA are each further from shore than the existing Atlantic offshore wind project.[115]

Due to the limited availability of federal leases for offshore wind sites in the Atlantic,[116] the state government and renewable developers are looking to the Great Lakes (Stromsta 2020). The DPS white paper calls for a feasibility study for Great Lakes wind power (New York DPS 2020). Communities along the Lake Ontario shoreline have already expressed strong opposition to the proposed Lighthouse Wind project, an onshore cluster of 47 turbines near the towns of Somerset and Yates (OrleansHub.com 2020); although the developer submitted initial filings in 2014, it had not submitted an Article 10 application or withdrawn its initial filing as of January 29, 2021.[117] It remains to be seen whether other coastal Great Lakes communities would express opposition similar to that mounted in relation to the Lighthouse Wind project. In March 2021, the Biden administration announced new policies to promote offshore wind, including in the New York Bight, between Long Island and New Jersey.[118]

Materials requirements are an important consideration in developing and scaling offshore wind projects. European researchers concluded that offshore wind turbines require approximately four times the materials (by weight) as onshore turbines, although the offshore turbines reviewed by researchers were about double the size in generating capacity terms; hence on an equivalent capacity basis, the offshore turbines required about twice the materials by weight (Bonou, Laurent, and Olsen 2016). The onshore turbines assessed were 72.8% concrete and 20.5% steel, while the offshore turbines in the study were 73% steel, 6.4% iron, and 4.7% concrete (Bonou, Laurent, and Olsen 2016).[119] Producing concrete and steel are both energy-intense activities, especially in their requirements for process heat,

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112 NYSERDA, "Offshore Wind Projects," https://www.nyserda.ny.gov/All-Programs/Programs/Offshore-Wind/Focus-Areas/NY-Offshore-Wind-Projects.

113 Turbine manufacturer GE asserts that in the "stillest, most rural areas" humans cannot separate wind turbine noise from 30-decibel background noise at "about a mile away." See GE, "How Loud Is a Wind Turbine?," https://www.ge.com/news/reports/how-loud-is-a-wind-turbine. NYSERDA reports that New York is currently developing five offshore wind projects; they appear to be at least 15 miles from the shore. NYSERDA, "Offshore Wind Projects," https://www.nyserda.ny.gov/All-Programs/Programs/Offshore-Wind/Focus-Areas/NY-Offshore-Wind-Projects.

114 Bureau of Ocean Energy Management, "Renewable Energy Viewshed Analysis and Visualization Simulation for the New York Call Area," https://www.boem.gov/renewable-energy/state-activities/renewable-energy-viewshed-analysis-and-visualization-simulation.

115 Ibid.

116 State waters extend only to three nautical miles from shore; the federal government controls U.S. territorial waters beyond that point. See U.S. Commission on Ocean Policy (2004).

117 New York Department of Public Service, "Active Article 10 Queue (Updated June 14, 2021)," https://www3.dps.ny.gov/W/PSCWeb.nsf/All/763B187DD5A792DE8525847400667D6B?OpenDocument.

118 The White House, "FACT SHEET: Biden Administration Jumpstarts Offshore Wind Energy Projects to Create Jobs," March 29, 2021, https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/29/fact-sheet-biden-administration-jumpstarts-offshore-wind-energy-projects-to-create-jobs/.

119 The offshore turbines were mounted on steel monopile foundations.

and they are responsible for significant shares of global greenhouse gas emissions. On a ton-for-ton basis, however, steelmaking generates about twice as much CO_2 as cement-making, and cement is the main input in concrete.[120] Other research, in Texas, concludes that relative to onshore turbines, offshore turbines produce greater life-cycle air emissions of methane, ozone, NOx, SO_2, $PM_{2.5}$ particulates, and carcinogens than their onshore counterparts (Chipindula et al. 2018).[121] Large-scale offshore wind deployment has its own environmental implications.

A less restrictive approach to clean energy could accelerate efforts to reduce and eliminate GHG emissions and cut costs.

After renewable electricity development failed to meet its 2015 target, policy makers in New York made the important decision to work to preserve nuclear plants in the state as an essential source of zero-emission power. State legislators and officials confirmed the necessity of nuclear and other nonrenewable clean power in the CLCPA's distinction between its 70% renewable power target, in 2030, and its 100% clean power target, in 2040. This implicitly acknowledges that nuclear energy and/or fossil fuels with carbon capture will remain a substantial part of electricity generation in the state.

There are sound, research-based reasons for incorporating nuclear power and fossil fuels with carbon capture technologies into future clean electricity systems. A 2018 academic review of 40 studies of pathways to deep decarbonization (elimination of 80–100% of power sector emissions) concluded that "firm low-carbon resources are a consistent feature of the most affordable pathways to deep decarbonization of electricity" (Jenkins, Luke, and Thernstrom 2018, 2508).[122] There are many reasons for this, but one of them is the "continent-scale transmission expansion" needed to balance high shares of variable solar and wind power in the electricity grid, something likely not only to make decarbonization more costly, but also to delay it, in part due to transmission siting and cost allocation debates (Jenkins, Luke, and Thernstrom 2018, 2506–2507).

Firm low-carbon electricity is necessary to balance the variability of solar and wind power; batteries are an effective solution in managing intra-day supply variations but are ill-suited to seasonal variation. Even with long-duration battery storage, an enormous amount of storage capacity would be required to compensate electricity for weeks or months of limited sun or poor wind. Considering that such storage capacity might complete only very few charge-discharge cycles per year, due to the seasonal periodicity of wind, solar, and load patterns, such storage is unlikely to be economical or attractive to utilities or ratepayers.

A NYSERDA-commissioned statewide decarbonization pathways analysis conducted by the consultancy E3 concludes that New York could "reliably meet growing electricity loads with 100% zero-emissions electricity by relying on a diverse mix of resources" that includes the state's existing nuclear power generation and "new natural gas-fired combined cycles with carbon capture and sequestration" (E3 2020, 33). Referring to these and other technologies such as hydroelectric power and zero-emissions biogas, the E3 report states that in addition to solar and wind, "other zero-emission resources will also play an important role in balancing the portfolio and ensuring year-round reliability" (E3 2020, 34). A particular challenge for the state is that with the further electrification of transportation

120 Producing one ton of steel results in a global average 1.9 tons in CO_2 emissions. World Steel Association, "Steel's Contribution to a Low Carbon Future," https://www.worldsteel.org/en/dam/jcr:c3acc5fd-e3c2-458c-a2cc-8c4880b9334c/Steel%2527s+contribution+to+a+low+carbon+future.pdf. In one study, academic researchers found that producing one ton of cement generates between 0.793 and 1.06 tons of CO_2. See Barcelo et al. (2014).

121 Material extraction and processing accounted for 71.9% and 81.5% of total impacts for onshore and deep-water turbines, respectively, but only 57.7% of impacts for shallow water turbines. Installation was responsible for 26.5% of impacts for shallow-water turbines. The shallow turbines in the study were at a 13 m depth (42–43 feet).

122 Firm resources are reliable over long periods in any season, e.g., nuclear energy, hydropower, geothermal, or fossil fuels.

and heating, electricity demand is likely to peak in winter in a system in which demand has historically peaked in summer (E3 2020, 30).

The heavy reliance on hydroelectric, solar, and wind energy in the policy targets in New York could be in part a result of state policy makers' reliance on research findings that have since been called into question. Past work by Stanford University professor Mark Z. Jacobson and colleagues sought to demonstrate that hydroelectric power would be sufficient to balance solar and wind variability and would allow a 100% wind, water, and solar energy system in the United States (Jacobson et al. 2015), but a group of 21 scholars strongly contested the modeling and assumptions in that Jacobson study (Clack et al. 2017). The academic controversy erupted into public view when Jacobson filed (and ultimately withdrew) a $10 million defamation lawsuit against the lead author of the critical paper and the *Proceedings of the National Academy of Sciences*, which had published Jacobson's original article and the subsequent critique (Spector 2018).

Jacobson recently claimed that Governor Andrew Cuomo decided to ban fracking in the state in part due to "this alternative plan that we had presented to the governor's office"—a road map to a 100% wind, water, and solar energy system for New York based on Jacobson's other work.[123] Jacobson said that he wrote the core of the document, a 14-page manuscript, after a meeting with actor Mark Ruffalo and film producer Josh Fox, both of whom were looking for alternatives to fracking in the state. Ruffalo and Fox "had all these contacts with policymakers and other celebrities in New York"; they and Jacobson "eventually got the ear of the governor" to present Jacobson's ideas, which he describes as "a conceptual outline for a New York State Energy Plan."

According to Jacobson, Cuomo "was kind of on the fence about fracking . . . . He wanted to ban it but didn't want to make a rash decision." Jacobson stated that Cuomo's fracking ban was "largely due to all this activism and the actual health and environmental concerns" and suggested that his plan provided the governor with what looked like a viable path forward without natural gas. Only later did state officials determine that nuclear energy and carbon capture would be necessary for deep decarbonization. Indeed, by 2019 Governor Cuomo proposed a "Carbon-to-Value Innovation Agenda" to study how best to capture and store or use CO_2 (Cuomo 2019, 323).

In addition to increasing the cost of decarbonizing the power sector (and the economy as a whole), overreliance on solar and wind power has substantial land use consequences. Because these two renewable energy technologies have much lower power density than either nuclear energy or natural gas with carbon capture, they have much greater land use intensity (Saunders 2020, 21–22). As a result, relying on extensive solar and wind power will substantially increase the state's energy footprint[124] and require more siting decisions and potentially more controversy in host communities.

The heavily forested rural land in New York exacerbates this problem, as research has shown that solar projects have the greatest negative impacts on biodiversity and biomass density when pursued in forested areas. In addition, largely due to their access roads, both solar and wind projects produce landscape fragmentation comparable to that of fossil energy extraction (Saunders 2020, 24).

Including nuclear power, New York already has a 61% clean power system. From that starting point, a 70% by 2030 goal that counted nuclear power toward the target would be readily attainable; it would require

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123 John J. Berger, "An Interview with Stanford University Clean Energy Champion Mark Z. Jacobson," *Sustain Europe*, https://www.sustaineurope.com/an-interview-with-stanford-university-clean-energy-champion-mark-z-jacobson-20190419.html#:~:text=For%20example%2C%20after%20meetings%20with,power%20goal%20in%20the%20nation. Quotations in this paragraph and the next are from this source. The interview is undated, though the text refers to 2019. For the academic version of Jacobson's plan for New York, see Jacobson et al. (2013).

124 New York's other renewable options include biomass and biogas—the most land use–intense forms of power generation, due to their agricultural requirements—and fuel cells.

an additional 9% of the state's electricity supply from clean power in a decade, rather than more than 40%. Moreover, with the Idaho National Laboratory working with two firms—X-energy and TerraPower—to demonstrate advanced nuclear designs during the next several years (St. John 2014), cheaper and safer clean energy technologies may well be available by that time. Broadening the definition of renewable energy or converting New York's renewable target to a clean energy target would accelerate efforts to reduce emissions in the state.

5. Conclusions

The experience in New York with land use and broader renewable energy policies offers many useful lessons for other states. Nonetheless, New York is unusual in some important respects that any assessment should acknowledge and address:

- New York has poor solar resources that are comparable to portions of at least a dozen other states—and perhaps most similar to Pennsylvania—but are demonstrably inferior to most. Thus, while some states are likely to face similar challenges in developing solar power, many others (especially in the southwest) are much better suited to solar energy projects.
- New York has superior offshore wind resources. Over half of America's states have direct access to potential offshore sites in the ocean or the Great Lakes. The remainder do not. Using offshore wind in noncoastal states would obviously require importing electricity from other states and building additional transmission.
- New York's citizens are on average wealthier than residents in most other states. Similarly, New York's state budget is considerably larger than most other states'. These factors may provide New York with options and flexibility that other states lack.
- New York receives a substantially greater share of its electricity from both hydroelectric power and nuclear power than most states. This offers great advantages in pursuing aggressive clean energy goals relative to most states.
- Centralized procurement of clean energy through NYSERDA is an unusual arrangement that likely offers some advantages but may not be politically viable in other states. The state government's relationship with NYISO also likely provides certain advantages, in that NYISO has only one state as a stakeholder and thus can avoid tradeoffs among multiple states' preferences. The majority of states participate in multistate ISOs or regional transmission organizations or, alternatively, have no such regional electricity market structures.
- State-level politics in New York have been more favorable to renewable power mandates than the politics in many, if not most other states. Politically viable options elsewhere may be more limited. Also, New York has high visibility nationally and, as a result, is likely a common target for national advocacy and lobbying.[125]

Notwithstanding these differences, the policies and experiences in New York raise several important issues that are likely to be even more significant in states with aggressive renewable power targets. First among these is the value of planning on the basis of each state's circumstances—in the case of New York, its mixed solar and wind resources and existing clean energy options, especially

125 Among 19 states for which 2019 data are available through the National Institute on Money in Politics, New York ranked second for spending on lobbying, at $267 million. California reported $391 million. In 2018, the gap between the two was narrower, with $357 million spent on lobbying in California and $313 million in New York. For comparison, 2019 spending in Montana was just $1.5 million; spending in Maine was $4.6 million. See FollowTheMoney.org, "Q. Show Me State-Level Lobbyist Spending," https://www.followthemoney.org/show-me?dt=3&lby-f-fc=2#[{1|gro=lby-s,lby-y.

hydroelectric power and nuclear energy. Second is the usefulness of firm, dispatchable electricity generation within a diverse electricity supply both in controlling costs and in ensuring reliability and resilience—among the original goals in the first New York State Energy Plan (2002). Last, and perhaps most difficult, are the complex dilemmas that surround subordinating local land use decisions to state (or federal) policies, a process that cannot but raise challenging questions in any democratic society.

The last of these issues—balancing community interests, values, and priorities against broader social concerns—seems likely to become more rather than less contentious in New York and in other states as land-seeking solar and wind project developers gain momentum emboldened by state and federal renewable power policies. Whether efforts to achieve this balance become a constraint on future development or a force to accelerate it depends heavily on political leadership and the abilities of policy makers to build consensus, or compromises, that sufficiently satisfy stakeholders.

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About the Author

Paul J. Saunders is President of Energy Innovation Reform Project. An experienced non-profit executive and thought leader on energy, climate change, and foreign policy issues, he was Executive Director of the Center for the National Interest from 2005 to 2019. At that time, Saunders was also Associate Publisher of the the Center's magazine, *The National Interest.* He remains a member of the Center's board of directors.

Mr. Saunders served as a Senior Advisor to the Under Secretary of State for Global Affairs from 2003 to 2005. In that capacity, he worked on a variety of international issues including energy and climate change and contributed to establishing the U.S.-China Global Issues Forum, a government-to-government dialogue on transnational challenges.

Saunders has written extensively for major newspapers and journals and has been a frequent commentator in national media, including CNN, Fox, and MSNBC. He has written or edited several reports on energy and on foreign policy issues. His recent publications include *Land Use Requirements of Solar and Wind Power: Understanding a Decade of Academic Research* (Energy Innovation Reform Project, 2020). Saunders earned a B.A. and an M.A. in Political Science from the University of Michigan.

Energy Innovation Reform Project

3100 Clarendon Boulevard, Suite 200
Arlington, VA 22201
www.innovationreform.org
info@innovationreform.org