20. Environmental Impacts

Draft New York State Energy Plan

July 2025

Key Findings

- **New York State's emissions control and clean energy programs are contributing to improving air quality and environmental benefits for communities and ecosystems across the state.** Energy market forces and energy-related air quality policies have resulted in substantially reduced emissions and ambient concentrations of criteria air pollutants over the past 20 years, significantly reducing ecosystem stressors such as acid (rain) deposition. These trends in emission reductions and associated benefits are projected to continue under each of State Energy Pathway scenarios modeled in this Plan.
- **New York State has a robust regulatory framework for identifying and mitigating environmental impacts associated with energy development, generation, transmission, and use.** New York State's regulations and programs are implemented to protect and maintain our air quality, water resources, sensitive ecosystems and land resources, and wildlife from any adverse impacts associated with energy. These regulations and programs seek to address any adverse impacts from the full life cycle of an energy project—from construction to operation, decommissioning, and waste.
- **New York State strategies for procuring and siting energy resources can reduce energy project risks and minimize land use conflicts.** For example, the Smart Solar Siting Scorecard is used to evaluate large solar project applications for their avoidance and mitigation of agricultural and forest lands. The New York State Offshore Wind Master Plan was based on extensive environmental and fisheries data collection to inform our understanding of environmental sensitivities and user conflicts associated with potential offshore wind areas. These types of early investments in siting optimization can reduce environmental and project risks, help to inform construction windows and permit conditions, and accelerate project timelines.
- **Opportunities to inform an environmentally responsible energy system transition should be leveraged** through continued research into new and emerging technologies and fuels, best practices, and dual use of energy sites. For example, New York State is funding research to produce data on crop and grazing potential inside large solar projects. To balance the growth of the offshore wind industry with existing marine industries, such as commercial fishing, the State has supported research to maintain and grow the region's sustainable fisheries. Environmental monitoring enables policymakers to evaluate the effectiveness of energy-related regulations, policies and strategies.

Key Terms

- **Agrivoltaics** – the simultaneous use of land for solar photovoltaic power generation and agricultural production of "crops, livestock, and livestock products"
- **Ecosystem** - a dynamic complex of plant, animal [including human], and microorganism communities interacting with each other and the nonliving environment as a functional unit
- **Endangered** – under the Endangered Species Act, plant and animal species that may be in danger of extinction throughout all or a significant portion of its range
- **Ecosystem services** – benefits people obtain from an ecosystem
- **Threatened** – under the Endangered Species Act, plant and animal species that are likely to become endangered within the foreseeable future
- **Wetlands** – an area that is saturated or inundated by water, either surface or ground, at a frequency and duration sufficient to support vegetations adapted to saturated soil conditions[1]

[1] New York State Department of Environmental Conservation (DEC), *Wetlands*, accessed July 11, 2025, https://dec.ny.gov/nature/waterbodies/wetlands#:~:text=Wetlands%20(swamps%2C%20marshes%2C%20bogs,life%20in%20saturated%20soil%20conditions.

1. Overview

1.1. New York's Ecosystems and Natural Resources

New York State contains a diversity of terrestrial and aquatic ecosystems, which provide critical ecosystem services, including food, water, forest products, air and water purification, flood prevention, carbon storage, climate moderation, recreational opportunities, and cultural services.[2] However, ecosystems statewide face significant challenges due to climate change and land use patterns.

1.1.1. Land Use and Development

New York State is predominantly rural, with forest and agriculture making up 75 percent of land use. Agricultural and forest land is present throughout the state but is highly variable among the regions. For example, the Central/Finger Lakes region includes approximately 41 percent agricultural land and 42 percent forested land, and the Mohawk River Valley, Southern Tier, Great Lakes, and St. Lawrence Valley each have more than 20 percent agricultural land and are 55 percent to 65 percent forested. New York's diverse ecosystems support a variety of agricultural and forestry goods, and the State is one of the top producers of dairy and fruit. Forests also provide an abundance of ecosystem services including air and water filtration, wildlife habitat, recreational opportunities, and carbon mitigation. About 11 percent of land is developed, mostly in New York City and Long Island.[3] Disadvantaged communities (DACs) are distributed across both urban and rural areas.

1.1.2. Waterways and Coastal Ecosystems

A total of 13.6 percent of New York State is covered by water, including inland waters, the Great Lakes, and coastal waters.[4] The State has more than 16,000 freshwater lakes, ponds, and reservoirs greater than 0.1 acre, as well as nearly 70,000 miles of rivers and streams. Water resources support biodiversity and provide a variety of critical ecosystem services to society, including drinking water and hydropower, and support regional economies through recreational opportunities, aesthetics, and cultural qualities.

Climate change is increasing lake surface water temperatures, decreasing ice cover, and increasing the length and strength of thermal stratification. Climate-induced changes in temperature, ice cover, and stratification are primary contributors to the deoxygenation of lakes. Ongoing and projected future deep-water deoxygenation represents a major challenge to coldwater fisheries.[5]

New York State has approximately 117 miles of shoreline stretching along the coast of the Atlantic Ocean as well as 577 miles of shoreline within the Great Lakes Basin, the St. Lawrence River, and the Niagara River. New York's marine habitats support abundant natural resources that are both ecologically and economically important. The New York Bight is an area of high primary productivity, supporting regional fisheries, threatened and endangered species, and part of migratory pathway along the Atlantic coast. Climate change is contributing to sea level rise, as well as species range shifts.

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[2] Hess et al. 2024 Climate Impacts: Ecosystems nyaspubs.onlinelibrary.wiley.com/doi/10.1111/nyas.15203
[3] Hess et al. 2024. Climate Impacts: Ecosystems nyaspubs.onlinelibrary.wiley.com/doi/10.1111/nyas.15203
[4] U.S. Geological Survey. (2018). How wet is your state? The water area of each state. USGS Water Science School. https://www.usgs.gov/special-topics/water-science-school/science/how-wet-your-state-water-area-each-state
[5] Hess et al. 2024. Climate Impacts: Ecosystems nyaspubs.onlinelibrary.wiley.com/doi/10.1111/nyas.15203

1.1.3. Wetlands

Wetlands in the state include 2.4 million acres of freshwater wetlands and 25,000 acres of tidal wetlands. Often located at the transition between upland and aquatic habitats, wetlands support a diverse assemblage of plant and animal species including invertebrates, fish, amphibians, reptiles, birds, and semi-aquatic mammals. Many of these species are rare, threatened, or endangered in New York. Wetlands also provide a number of other critical ecosystem services, many of which contribute to climate resilience in watersheds. These ecosystem services include soil retention, groundwater recharge, nutrient and toxin filtration, carbon sequestration, floodwater storage, shoreline protection, and aesthetics. Wetlands have an important impact on water quality, as they intercept, filter, and absorb sediments and pollutants in surface runoff before it enters aquifers, streams, rivers, lakes, and the ocean.

1.1.4. Wildlife and Biodiversity

New York's habitats support a wide variety of species of animals and plants, including threatened and endangered species.[6] The State has 53 endangered species and 41 threated species.[7] Biodiversity, including the conservation of ecosystems, rare species, and genetic diversity, is necessary to maintain valuable ecosystem services and function. More than 600 species of plants and nearly 500 species of animals are at risk of extirpation from New York due to habitat loss and fragmentation, pollution, overharvesting, invasive species, and other factors.[8] Marine wildlife exist within a highly dynamic and human-influenced ecosystem. Natural variations in oceanographic factors, such as sea surface temperature, oceanic currents, and broad scale climate patterns, create substantial seasonal, annual, and long-term changes in wildlife abundance and distributions in marine ecosystems, which can be further influenced by human activities like fishing, shipping, and gravel/sand mining.[9]

1.1.5. Threats to Ecosystems

Climate change and climate hazards, such as sea level rise, temperature change, changes in precipitation amount and intensity, and extreme events present a threat to New York State's ecosystems, as do other pressures—including invasive species that altering New York State's ecosystems.[10] Human activities that result in habitat loss and fragmentation, erosion, sedimentation, and pollution also continue to impact State ecosystems and can account for significant ecosystem impacts.[11] Habitat loss, fragmentation, and degradation are identified as major drivers of biodiversity loss across the globe. Habitat connectivity is another key consideration as large, intact, proximate, and well-distributed conserved natural areas are necessary to ensure populations of flora and fauna have reliable and healthy habitats into the future. As such, strategic conservation of lands and waters are identified as a key mechanism to secure biodiversity, abundance of life, and ecosystem services.

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[6] DEC, *List of Endangered, Threatened and Special Concern Fish and Wildlife Species of New York State*, accessed July 11, 2025, https://dec.ny.gov/nature/animals-fish-plants/biodiversity-species-conservation/endangered-species/list.

[7] Ibid.

[8] Hess et al. 2024 Climate Impacts: Ecosystems nyaspubs.onlinelibrary.wiley.com/doi/10.1111/nyas.15203

[9] NYSERDA. The Dynamic Ocean: Offshore wind energy and other activities in the New York Bight. https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Programs/Offshore-Wind/Dynamic-Ocean-Offshore-Wind-Energy-and-Other-Activities-in-the-New-York-Bight.pdf

[10] Hess et al. 2024. https://doi.org/10.1111/nyas.15203

[11] Ibid.

1.2. Environmental Effects from the Energy System Transition

There are environmental impacts associated with energy development, generation, transmission, and use. Decisionmakers address environmental impacts from the energy sector through regulatory and permitting measures and other strategies that seek to avoid, minimize, and mitigate any adverse effects.

Energy generation technologies and infrastructure that are in operation today and that this Plan projects will continue to operate and/or expand in the future include solar energy, hydroelectric facilities, and onshore and offshore wind; these have been the subject of environmental review in prior State proceedings.[12] The potential environmental issues associated with less mature energy generation technologies or fuels evaluated in this Plan—such as alternative fuels and next generation nuclear energy—are discussed in the Low-Carbon Alternative Fuels and Nuclear chapters of this plan, respectively.

This chapter discusses the environmental impacts and benefits associated with the projected trajectory of New York State's energy system transition and highlight past and current efforts underway to monitor progress and inform responsible energy development.

2. Areas of Potential Environmental Effects

2.1. Air Quality

2.1.1. State Goals

New York State regulates air emissions from facilities in the energy sector and other sectors to ensure air quality meets National Ambient Air Quality Standards (NAAQS) as required by the federal Clean Air Act.[13] State regulators also participate in interstate bodies, such as the Ozone Transport Commission, to engage and shape regional and federal efforts to address interstate air pollutants. State regulations and initiatives aimed at reducing greenhouse gas (GHG) emissions from the transportation sector can also reduce other air pollutants, such as fine particulate matter and nitrogen oxides (NO_x).

2.1.2. Air Quality Impacts

Fossil-fuel combustion: Exposure to air pollutants, such as fine particulate matter or ozone, can pose significant health risks—especially to vulnerable populations and those with preexisting conditions. Emissions from electric generation, heating, and transportation sources can contribute to air quality impacts statewide and in nearby communities, including in DACs. These sources of air pollution include oil and natural gas fired power plants, industrial processes and building heating systems, and mobile sources from on-road and non-road vehicle emissions.[14] Importantly, these emissions and associated impacts can originate from sources within New York State and from sources located in "upwind" states.

[12] See Final Supplemental Generic Environmental Impact Statement for the Climate Leadership and Community Protection Act, September 17, 2020, prepared for New York State Public Service Commission.

[13] DEC, *State Implementation Plans and State Plans*, accessed July 11, 2025, https://dec.ny.gov/environmental-protection/air-quality/plans.

[14] DEC, *Air Emission Inventories: Point Sources*, accessed July 11, 2025, https://dec.ny.gov/environmental-protection/air-quality/air-emission-inventories#Point.

Over the past twenty years, market forces, economic drivers and the implementation of federal, State, and local energy-related air quality regulations have resulted in substantially reduced energy-related emissions and decreases in concentrations of ambient air quality pollutants such as fine particulate matter.[15] A recent research study published the results of a trends analysis for Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), Sulfur Dioxide (SO_2), Ozone (O_3), and fine particulate matter ($PM_{2.5}$) at fifty-four State DEC monitoring sites that are part of the U.S. Environmental Protection Agency's (EPA) Air Quality System for the period 2005–2019. During this time there were substantial reductions in source emissions and in resultant ambient concentrations of all ambient pollutants except O_3.

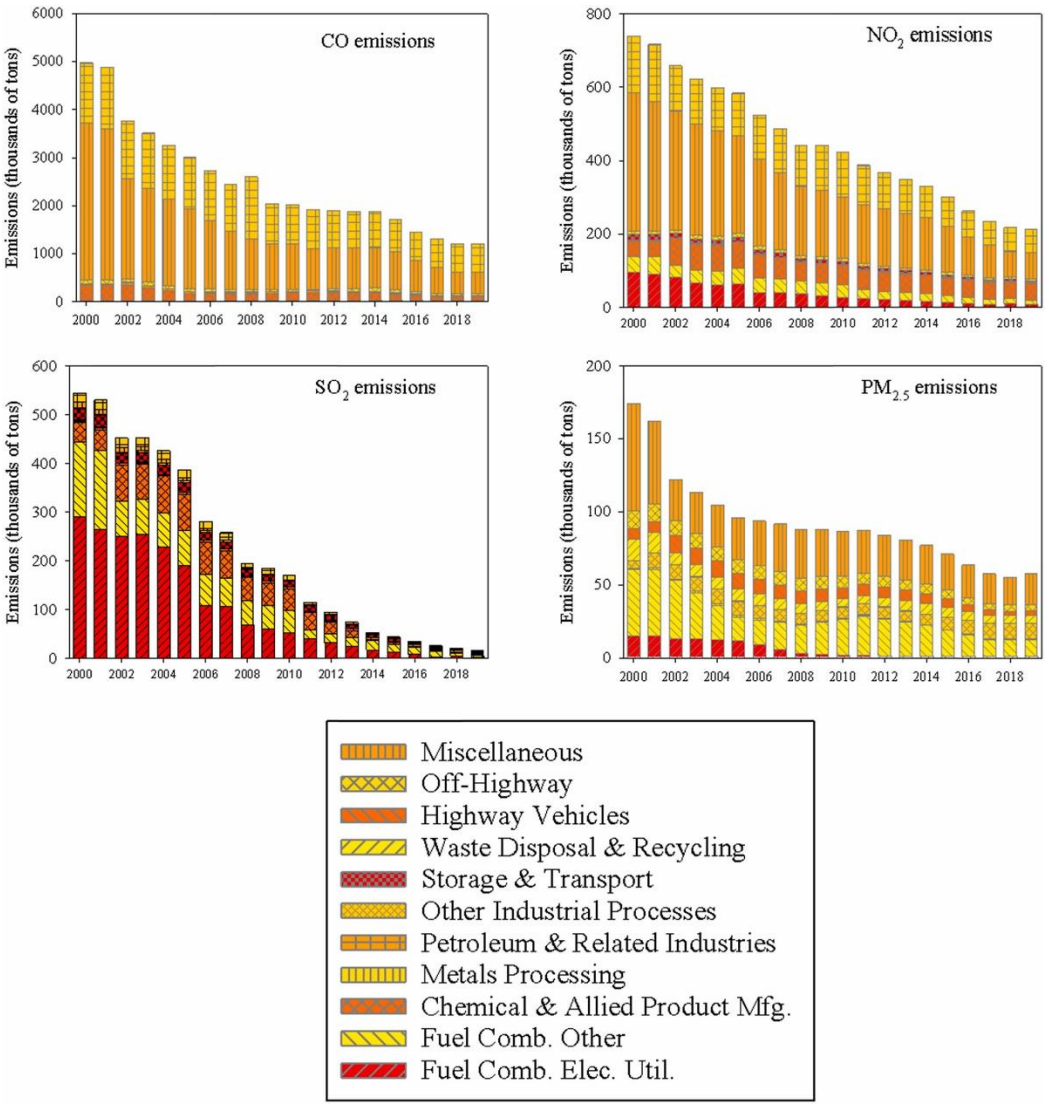

Figure 1. Annual Emissions of CO, NO_2, SO_2, and primary $PM_{2.5}$ in New York State[16]

[15] Yunle Chen, David Q. Rich, Mauro Masiol, Philip K. Hopke, *Changes in ambient air pollutants in New York State from 2005 to 2019: Effects of policy implementations and economic and technological changes*, Atmospheric Environment, Volume 311, 2023, 119996, ISSN 1352-2310, https://doi.org/10.1016/j.atmosenv.2023.119996

[16] Ibid.

2.1.3. Programs and Policies

Federal regulations that have driven these trends include those generally focused on emissions controls and improved fuel quality from mobile sources, and the enactment of new rules to reduce emissions from older, uncontrolled electricity generation units—such as the federal Clean Air Interstate Rule. At the State level, New York has enacted regulations to phase out coal-fired power production and require ultra-low sulfur content in heating oil, as well as initiated the Renewable Portfolio Standard, Reforming the Energy Vision, and Clean Energy Fund during this time. The New York City (NYC) Clean Heat Program phased out #6 heating oil by 2015 and will phase out #4 heating oil by 2030.

In addition, in 2019 DEC adopted a regulation (6 NYCRR Subpart 227-3) to reduce NO_x emissions from Simple Cycle Combustion and Regenerative Combustion Turbines. These turbines are often referred as "peaking units" because they are electricity generating units that tend to operate during periods of high electricity demand to maintain grid stability. As of May 1, 2025, 37 "peaking" units have retired. The retired peaking units represent one gigawatt of older fossil fuel-fired generation and a significant reduction of pollution. In addition to shutdowns, additional emission controls were installed on 43 units totaling 1,267 megawatts (MW).

2.1.4. State Energy Pathways Will Continue to Reduce Energy-Related Emissions and Deliver Air Quality Benefits to Communities and Ecosystems

Air Quality Co-Benefits from State Energy Policies: The core planning scenario of the Draft Plan illustrates the potential for improvements in statewide air quality from decarbonization policies leading to substantial health benefits. The air quality improvements described above are largely the result of policies that were designed to directly reduce air pollutant emissions; for example, the use of cleaner fuels and post-combustion emission controls on vehicles and power plants. The Draft Plan's analysis of public health impacts shows that statewide energy policies focused on electrification would result in additional co-benefits for air quality, broadening the emission reductions by introducing zero emission alternatives, increased efficiency, and expanding beyond the reach of traditional emission control strategies. The majority of statewide air pollutant emission reductions would result from electrification and efficiency improvements in buildings and electrification of on-road vehicles. These improvements in air quality across all regions of the state would also lead to substantial public health benefits across a range of outcomes including reducing premature mortality, hospitalizations, emergency department visits, and incidence of various respiratory conditions, with larger health benefits expected in geographic DACs. A full analysis of the air quality and health modeling framework and results can be found in the Public Health Impacts Analysis chapter of this Plan.

Alternative Fuels Combustion: As discussed in chapters focusing on Electricity, Petroleum and Transportation, State Pathways Analysis scenarios project a decline in fossil fuel consumption between 2025 and 2040. Some of this fossil fuel consumption will be offset by the integration of alternative fuels, such as renewable natural gas (RNG), biodiesel and renewable diesel, sustainable aviation fuel (SAF) and hydrogen. As discussed further in the Low-Carbon Alternative Fuels chapters of this Plan, there are important climate, air quality, and environmental considerations associated with the production and uses of alternative fuels. In general, integration of alternative fuels for specific applications has the

potential to reduce GHG emissions and in some cases reduce co-pollutants. In addition to GHG and co-pollutant emissions, the broader environmental impacts of alternative fuels, including effects on water use, water quality, land use, biodiversity, and waste management, should be considered in New York State's energy planning, policy development, and project evaluation. These impacts vary significantly by fuel type and production pathway and should be evaluated alongside climate and health outcomes to support sustainable decision-making.

Battery Energy Storage Systems: Energy storage technologies, such as battery energy storage systems (BESS), can improve the reliability and stability of the grid, especially when paired with intermittent renewable generation. Battery storage paired with renewables can avoid reliance on peaker plants, contributing to lower levels of both local (i.e., criteria pollutants) and global (i.e., GHG) emissions.[17]

Battery storage systems emit GHGs during all stages of their life cycle (materials production, manufacturing, operation, end-of-life) and during transportation. A life cycle assessment of utility-scale energy storage systems found lithium-ion storage systems, which represent the majority of all stationary and mobile storage deployments in the State, have the lowest GHG emissions of five electro-chemical energy storage systems assessed (sodium-sulfur, lithium-ion, valve-regulated lead-acid, nickel-cadmium, and vanadium redox flow).[18]

As discussed in the Electricity chapter of this Plan, New York created the nation-leading Inter-Agency Fire Safety Working Group in response to fire incidents at energy storage facilities. Lithium is highly flammable when it contacts water, and if handled improperly can flow into surface water or leach into groundwater and cause combustion. Fires involving BESS can emit CO, CO_2, and volatile organic compounds (VOCs), and may emit other trace gases such as HF, HCN, or others depending on the battery chemistry and overall materials of construction of the BESS unit. Air sampling from past incidents at BESS have found that contaminant concentrations beyond the immediate fire scene do not pose a public health risk due to the rapid dispersion of gases limiting the potential for toxic exposure.[19]

2.2. Water and Wetlands

2.2.1. State Goals

The State prioritizes ensuring safe and clean drinking water, protecting diverse water resources, and supporting ecological well-being. Water quality is protected through permitting, compliance, enforcement, and monitoring efforts. Waters are classified for their best uses (fishing, source of drinking water, etc.) and standards are set to protect those uses. The State also seeks to protect, maintain, enhance, and restore freshwater and tidal wetlands ecosystems so they can continue to provide a broad

[17] Lin, Y., J. X. Johnson, J.L. Mathieu. 2016. Emissions impacts of using energy storage for power system reserves. Applied Energy 168 p. 444-456. http://dx.doi.org/10.1016/j.apenergy.2016.01.061.

[18] Rahman et al. 2021. The greenhouse gas emissions' footprint and net energy ratio of utility-scale electro-chemical energy storage systems. Energy Conversion and Management 244. https://www.sciencedirect.com/science/article/abs/pii/S0196890421006737.

[19] Fire & Risk Alliance, L.L.C. 2025. Assessment of potential impacts of fires at BESS facilities. https://cdn.prod.website-files.com/666b00bb91a866df89c4f469/67e44e5991dada623fd2e8f0_Assessment-of-Potential-Impacts-of-Fires-at-BESS-Facilities.pdf

array of ecological functions and benefits to communities and the environment, including carbon sequestration.[20,21]

2.2.2. Potential Environmental Effects

Deposition of Acid and Mercury Compounds from Fossil Fuel Combustion

Acid rain (and other types of acid deposition) forms when SO_2 and nitrogen oxides (NO_x) combine with moisture in the atmosphere to produce sulfuric acid and nitric acid. Historically, the source of SO_2 and NO_x emissions that contributed to acid rain was from fossil fuel combustion, in particular uncontrolled coal fired power plants, including those in states upwind of New York. By the 1960s, it became clear to scientists that acid deposition was significantly impacting natural resources across New York, especially in the Catskill and Adirondack Mountains where soils were becoming too acidic to maintain healthy forests, and many waterbodies were unable to support healthy populations of fish. Decreases in emissions have significantly reduced acid rain in New York, and ecosystems are slowly recovering, and many are now able to support more diverse and abundant wildlife and associated recreational opportunities.[22]

Mercury is a naturally occurring metal that is also emitted as an air pollutant from coal combustion. Mercury has been identified as being one of the most important of the persistent, bio-accumulative, toxic contaminants of concern for New York State. Mercury concentrations exceed human and ecological risk thresholds in many areas of New York State, particularly the Adirondacks, Catskills, and parts of Long Island. Mercury concentrations in the environment of New York State have declined over the last four decades, concurrent with decreased air emissions from regional and U.S. sources, and further controls on mercury emission sources are expected to continue to lower mercury concentrations in the food web, yielding multiple benefits to fish, wildlife, and people of New York State. However, scientists are also observing that fish and wildlife remain highly impacted by legacy Mercury deposition, as evidenced by stable and increasing trends of Mercury concentrations found in certain species and in some regions of the state.[23,24]

Atmospheric carbon dioxide (CO_2), caused by combustion of fossil fuels, is the primary driver of ocean acidification (OA). Localized acidification occurs periodically in some coastal areas, including Western Long Island Sound and the New York-New Jersey Harbor.[25] This addition of carbon dioxide alters the

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[20] DEC, *Freshwater Wetlands Act & Landowners*, accessed July 11, 2025, https://dec.ny.gov/nature/waterbodies/wetlands/freshwater-wetlands-program/conserve/freshwater-wetlands-act-and-owners.

[21] New York State Climate Action Council. 2022. "New York State Climate Action Council Scoping Plan." climate.ny.gov/ScopingPlan

[22] DEC, *Acid Rain*, accessed July 11, 2025, https://dec.ny.gov/environmental-protection/acid-rain.

[23] Evers, D.C., Adams, E., Burton, M., Gulka, J., Sauer, A., and Driscoll, C.T. 2019. New York State Mercury Connections: the Extent and Effects of Mercury Pollution in the State. Biodiversity Research Institute. Portland, Maine. BRI Science Communications Series 2019-12-2. 41 pages.

[24] NYSERDA. 2020. Mercury dynamics in Finger Lakes Fish and Invertebrates. NYSERDA Report Number 20-37. Prepared by Hobart and William Smith Colleges, Geneva, NY. nyserda.ny.gov/publications

[25] Northeast Fisheries Science Center. (2023). *State of the ecosystem 2023: Mid-Atlantic*. National Oceanic and Atmospheric Administration. https://repository.library.noaa.gov/view/noaa/49

oceans' carbon chemistry. Reductions in pH, a process referred to as ocean acidification, make it harder for organisms to create shells and affect other physiological processes. Evidence suggests that increased carbon dioxide concentrations in marine waters have contributed to reductions in the quantity and quality of shellfish and the development and growth of finfish.[26,27] This presents ecological and socioeconomic risks, as the State has a commercial fishing industry with a value added of about $1.6 billion and a recreational industry with a value added of $770 million.[28] In 2016, the New York State Legislature established the Ocean Acidification Task Force to identify contributing factors to ocean acidification and evaluate ways to apply the best available science to address its impacts.[29] The 2024 Task Force report to the Legislature describes potential ways to mitigate the impact of OA, including addressing water quality standards, discharges, and enhancing blue carbon sequestration by seagrasses, kelp beds, and marshes.

Cooling Water Intake and Thermal Discharge

Steam-electric facilities use fossil fuels or nuclear energy to heat water, creating steam used in the power generation process. The steam is cooled through the non-contact cooling system, and the cooling water is returned at an elevated temperature to the source waterbody. Steam-electric generating facilities may also require water for cooling, service water needs, and cooling the thermal discharge effluent. These power plants are significant users of water, withdrawing more than half the of the total water withdrawn from lakes, rivers, and coastal waters.[30] Throughout the State, power-generating facilities can withdraw over 4.8 billion gallons of water per day. [31]

Adverse environmental impacts of a cooling water intake structure include the impingement of fish and other aquatic organisms on the facility's intake screens, and entrainment of smaller fish through the cooling system. Adult fish and some shellfish can experience abrasions and suffocation from being trapped on the intake screens. Juvenile fish and eggs that have been entrained are subject to physical, thermal, and chemical impacts as they move through the cooling system. The heated discharged water can impact local ecosystems by raising the water temperature, which can lead to reduced oxygen levels. The thermal discharge plume may also block migration routes for fish and, if warm enough, could be lethal to some species that directly encounter the plume. Larval fish and eggs are particularly susceptible to impacts of the plume, due to their generally fragile life stage and inability to escape the thermal discharge.

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[26] Talmage, S. C., & Gobler, C. J. (2010). Effects of past, present, and future ocean carbon dioxide concentrations on the growth and survival of larval shellfish. *Proceedings of the National Academy of Sciences*, **107**(40), 17246–17251. https://doi.org/10.1073/pnas.0913804107

[27] Wallace, R. B., Baumann, H., Grear, J. S., Aller, R. C., & Gobler, C. J. (2014). Coastal ocean acidification: The other eutrophication problem. *Estuarine, Coastal and Shelf Science*, **148**, 1–13. https://doi.org/10.1016/j.ecss.2014.05.027

[28] National Marine Fisheries Service. 2018.

[29] Laws of New York. 2016. Chapter 464.

[30] DEC, *Acquatic Habitat* Protection, accessed July 11, 2025, https://dec.ny.gov/nature/animals-fish-plants/biodiversity-species-conservation/aquatic-habitat-protection.

[31] DEC, *Water Use & Conservation*, accessed July 11, 2025, https://dec.ny.gov/environmental-protection/water/water-quantity/water-use-conservation.

Offshore wind converter stations also require cooling systems to manage heat generated during the alternative current (AC) to direct current (DC) power conversion process.[32] The most common method of head exchange is the use of a non-contact once-through cooling water, with flow ranging from 2 to 15 million gallons per day.[33] These facilities can have similar impingement and entrainment impacts as on-shore once-through cooling systems, as well as similar thermal discharge impacts.

Land-Based Energy Generation and Infrastructure

Energy projects can also have hydrologic and ecological consequences if not carefully sited and managed. During construction, activities such as land clearing, grading, and infrastructure installation can alter habitats and compact soils as well as increase sedimentation in nearby wetlands and waterbodies. Energy infrastructure such as electric transmission lines and fuel pipelines often bisect wetlands, grasslands, forests, and waterbodies during construction, which can further fragment these ecosystems; and routine management after construction is complete can lead to further impacts, such as by increasing the risk of chemical runoff from herbicides. New York State regulators, energy companies and utilities seek to avoid, minimize, and mitigate associated impacts through permitting and best practices.

Hydroelectric Dams and Operation

Hydroelectric dams impound water to create a reservoir and divert water to hydropower plants. The dam and reservoir can change water temperatures, water chemistry, aquatic communities, river flow, and sediment loads. In New York State, there are limits on where new hydropower facilities can be sited in order to protect the Adirondack and Catskill Forest Preserves, and State Forests, including Reforestation Areas, and Wildlife Management Areas, and State Nature and Historical Preserves, as well as designated rivers that possess important scenic, ecological, recreational, historical, or scientific values.[34,35] As retired hydroelectric dams are removed, natural hydrology and river functions can be restored; water quality may improve, aquatic connectivity of habitat may be restored, and flood risks may be reduced.[36]

Oil, Gas, and Geothermal Wells

DEC regulates the drilling, plugging, and abandonment of oil, natural gas wells, underground gas storage and solution salt mining wells, in addition to brine disposal, stratigraphic, and geothermal wells drilled deeper than 500 feet to prevent pollution to ground and surface waters. DEC administers regulations and a permitting program to mitigate, to the greatest extent possible, any potential environmental impact of

[32] Middleton, P., and B. Barnhart. 2022. Supporting National Environmental Policy Act Documentation for Offshore Wind Energy Development Related to High Voltage Direct Current Cooling Systems. Washington (DC): U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2022-023. 13 p. Available online at: https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/HVDC%20Cooling%20Systems%20White%20Paper.pdf

[33] NYSERDA. In review. Cooling water use at offshore wind converter stations.

[34] Article XIV of the State Constitution

[35] Wild, Scenic, and Recreational Rivers Act. Environmental Conservation Law Article 15, Title 27

[36] DEC, *Information for Dam Owners,* accessed July 11, 2025, https://dec.ny.gov/environmental-protection/water/dam-safety-coastal-flood-protection/dam-safety/dam-owner-information.

well drilling and well production, as summarized in DEC's 1992 Generic Environmental Impact Statement (GEIS) on the Oil, Gas and Solution Mining Regulatory Program.[37] DEC requires well plugging permits for all regulated wells once a well reaches the end of its useful life. Financial security provided by a well owner is required and held by the DEC for the regulated well's life. The security is released only after DEC staff verify that the well was properly plugged and the surface remediated in accordance with State regulations.

Additionally, DEC is currently undertaking a rule making and the development of a GEIS specific to closed loop geothermal boreholes drilled deeper than 500 feet. The rule making and GEIS are intended to cover the drilling and installation of closed loop geothermal boreholes to ensure the protection of the environment and public health and safety during the development of geothermal energy resources statewide.

Offshore Wind

The development of offshore wind (OSW) energy will result in new structures in the water, including foundations, scour protection, and hard protection for export and array cables. The introduction of foundations may result in alteration of local water currents, leading to increased movement, suspension, and deposition of sediments. Structures may also reduce wind-forced mixing of surface waters and waters flowing around foundations may increase vertical mixing. OSW may also impact atmospheric and oceanographic processes through the presence of structures in the water and the extraction of energy from the wind. There are few studies that have characterized potential hydrodynamic wakes and the interaction of atmospheric wakes with the sea surface. There is also a lack of research on the impact of wakes on regional scale oceanographic processes, such as the Mid-Atlantic Cold Pool, or secondary changes to primary production and ecosystems.[38]

Impacts to water quality from offshore wind activities are expected to be minor, resulting from accidental releases, sediment suspension, the presence of structures, port utilization, and land disturbances.[39] OSW activities are required to comply with regulatory requirements related to the prevention and control of accidental spills and Construction Spill Prevention Control and Countermeasures (SPCCs) are required for every project to provide rapid spill response, clean up, and other measures to minimize potential impacts.[40] Any accidental release would be localized and result in no degradation of water quality in exceedance of water quality standards.

2.2.3. Programs and Policies

Regulations and voluntary programs at all levels of government combine to protect New York's water resources. DEC is the lead state agency for monitoring surface and groundwater quality, administering permits to regulate sources of pollution and water withdrawals. New York's water quality standards serve as foundation for how the state manages programs, enforces regulations, and issues permits to

[37] DEC, Generic Environmental Impact Statement On The Oil, Gas And Solution Mining Regulatory Program (GEIS), accessed July 11, 2025, https://dec.ny.gov/environmental-protection/oil-gas/geis.
[38] BOEM. New York Bight Final Programmatic Environmental Impact Statement (PEIS).
[39] Ibid.
[40] Ibid.

protect surface water and groundwater resources. New York State enforces numerous environmental regulations, such as the Freshwater Wetlands Act, Tidal Wetlands Act, and the Coastal Management Program to minimize and mitigate impacts by ensuring careful environmental review, responsible planning and restoration efforts, all to balance our increasing energy needs with environmental preservation.

In 2022, the State's Freshwater Wetlands Act[41] was amended, increasing the number of regulated freshwater wetlands. The Office of Renewable Energy Siting and Electric Transmission (ORES) have updated Article VIII regulations to align with the changes and expanded the options available for mitigation. In ORES' draft Article VIII regulations, mitigation banking, in lieu fee, and other mitigation fee programs are permissible for unavoidable wetland impacts.

DEC administers the Tidal Wetlands Regulatory Program, which is designed to prevent the despoliation and destruction of tidal wetlands by requiring permits for regulated activities in regulated tidal wetlands and tidal wetland adjacent areas.

The Coastal Management Program is implemented to preserve natural protective features, including beaches, and dunes and bluffs, which are especially effective at protecting storm-induced high water. DEC implements this program through its Coastal Erosion Management regulations, which require a permit to ensure that development, or other actions in erosion hazard areas, is undertaken in a manner that minimizes damage to property and natural protective features, prevents the exacerbation of erosion hazards, and protects human life.

The State Pollutant Discharge Elimination System (SPDES) program[42] regulates wastewater and stormwater discharges to prevent pollution that could degrade water quality. SPDES permits are required for industrial, municipal, and construction-related discharges to protect waters of the state.

Under Section 401 of the Clean Water Act (CWA), a federal agency may not issue a permit or license to conduct any activity that may result in any discharge into waters of the United States unless a Section 401 Water Quality Certification (WQC) is issued, verifying compliance with state water quality requirements. In New York State, applicants for a federal license or permit for activities that may result in a discharge into waters of the United States are required to apply for and obtain a WQC indicating that the proposed activity will comply with New York State water quality standards. The WQC process evaluates whether a project will prevent water pollution, protect aquatic habitats, and maintain water quality standards for designated uses (e.g., drinking water, recreation, and fish and wildlife habitats). A WQC is most commonly required when a project also requires a permit from the U.S. Army Corps of Engineers under Section 404 of the CWA for the placement of fill in waters of the United States. Examples of projects may include energy infrastructure projects, dredging operations, pipeline installations, and large-scale construction developments. To obtain certification, applicants must demonstrate that their project will comply with New York's state water quality requirements and

[41] Environmental Conservation Law, Article 24
[42] Environmental Conservation Law, Article 17

standards. This often involves implementing best management practices (BMPs), sediment control measures, and various mitigation strategies to reduce environmental harm.

SPDES permits contain conditions that will require the permittee to minimize adverse environmental impact at facilities that have a once-through cooling water intake and thermal discharge. These conditions direct such facilities to utilize the Best Technology Available (BTA) for minimizing impingement and entrainment of fish and other aquatic life. Those BTA permit conditions will require the facility to measure through-screen intake velocity, perform studies of fish communities near the intake, provide an assessment of technologies or operational measures to reduce impingement and entrainment, and conduct thermal monitoring. After BTA technologies are installed, the facilities must conduct additional studies to verify that the performance of the technologies and operational measures minimizes adverse environmental impacts.

2.3. Land Use

2.3.1. State Goals

As discussed further in the Smart Growth chapter of this Plan, there are myriad environmental and health benefits associated with smart growth development, which can further complement State goals to conserve open space, protect watersheds, preserve biodiversity and wildlife migration, increase climate resiliency, and sequester atmospheric carbon. Specific State policy goals include supporting a national goal to preserve 30 percent of lands and waters by 2030, plant 25 million trees by 2033, and coordinate efforts to maintain and restore grasslands to address concerns about declines in grassland breeding and wintering birds.[43] The State has also prioritized the protection, restoration and monitoring of working agricultural and forest lands and wildlife management areas.[44] This has included the investment of hundreds of millions of dollars toward protecting agricultural land through the State Farmland Protection Program, and grass and forestland through real property acquisitions by the State.

2.3.2. Potential Environmental Effects

Energy Infrastructure

The State's energy system includes electric transmission lines and natural gas pipelines and refined petroleum product pipelines. Construction and operation of energy transmission facilities can result in direct disturbance to State lands and other terrestrial habitats, e.g., forest fragmentation. In addition to clearing and loss of habitat, construction may result in storm water runoff, siltation of streams and destruction of wetland vegetation. Maintenance of rights-of-way involves periodic clearing of vegetation, use of herbicides and installation of permanent infrastructure and access roads, sometimes in sensitive environments. As discussed further in the Electricity chapter of this Plan, State Pathways Analysis scenarios anticipate the need for additional investments in electric transmission infrastructure to meet

[43] New York State Department of Environmental Conservation (DEC). 2022. *DEC Strategy for Grassland Bird Habitat Management*. https://dec.ny.gov/sites/default/files/2024-04/grasslandbirdsstrategyfinal.pdf New York State Department of Environmental Conservation (DEC). 2024. *30x30: A New York state conservation initiative*. New York State Department of Environmental Conservation. https://dec.ny.gov/nature/open-space/30x30#:~:text=30x30%20is%20a%20New%20York,5390B%2FS

[44] See Final Scoping Plan Chapter 19: Land Use at page 366

electric demand growth and integrate increasing amounts of renewable energy. Decisions on where to upgrade existing transmission lines or build new transmission lines will likely have land use implications if associated with renewable energy interconnection. Energy storage intended to reduce the intermittency of electricity supply from renewable energy sources is typically co-sited with the renewable energy facility, in some cases expanding the footprint of the overall facility.[45]

Solar

State Pathways Analysis scenarios project that increasing amounts of solar energy will be needed to meet state climate goals. Agricultural land generally provides flat clear terrain with minimal contamination that is ideally suited for all types of development, including suburban sprawl and more recently solar energy projects. Studies have documented that agricultural communities are more likely to host solar projects.[46] State stakeholders have expressed concerns about potential future conflicts between solar development and the sustaining of agricultural character, operations, and services, as well as goals to restore and maintain habitat for grassland breeding bird species.

In 2023, NYSERDA commissioned development of a report to characterize the land use and economic implications of solar energy development on New York State's agricultural industry.[47] The focus and contents of this effort are being informed by engagement with a specialist committee comprised of farmers, solar developers, academic advisors, State agency representatives, and other key stakeholders.

To address concerns over agricultural impacts, New York State has steadily adopted procurement and permitting policies intended to avoid or mitigate impacts to sensitive agricultural and forest lands. State procurement of renewable generation from utility scale renewable energy projects ("Tier 1 renewables") require applicants to include plans to minimize potential agricultural and Mineral Soils Groups (MSG) 1-4 impacts, forest impacts, and consider strategies for dual use with agriculture. Key milestones related to the State's solar siting policy as it pertains to agricultural considerations include:

2019 – New York State Department of Agriculture and Markets (NYSAGM) Guidelines for Solar Projects - Construction Mitigation for Agricultural Lands were established and which then became mandatory in 2020.

2020 – The Agricultural Mitigation Payment was implemented for solar project proposed in a certified agricultural district.

2021 – The Smart Solar Siting Scorecard was established (first as voluntary but since 2022 has become mandatory) and is used to evaluate applications for utility scale solar projects for their avoidance and mitigation of agricultural and forest lands.

2022 – The Agricultural Mitigation Payment Deferral Option was introduced to encourage agricultural co-utilization.

[45] NYSERDA. 2017. Clean Energy Fund Investment Plan: Renewables Optimization Chapter. Portfolio: Innovation & Research. Matter Number 16-00681, In the Matter of the Clean Energy Fund Investment Plan.
[46] Katkar et al. 2020. https://www.sciencedirect.com/science/article/pii/S0960148121004900
[47] See A-TWG Regional Agronomic Impacts of Solar Energy (RAISE) committee meeting materials at https://www.nyatwg.com/

2023 – NYSERDA, in collaboration with the Agricultural-Technical Working Group (A-TWG), commissioned the report *Growing Agrivoltaics in New York State* to explore how agriculture and renewable energy can work hand-in-hand to support decarbonization.

2024 – NYSERDA, in collaboration with the A-TWG convened the Regional Agronomic Impacts from Solar Energy (RAISE) Specialist committee to advise and guide inquiries into potential regional agricultural effects from solar energy development (Phase 1 report under development).

In addition, as documented in prior regulatory proceedings, the flat, open landscapes preferred for solar project development are also some the best remaining habitat for grassland nesting and wintering birds in New York State. A significant percentage of the habitat identified within the grassland bird conservation centers outlined in the DEC Strategy for Grassland Bird Habitat Management and Conservation are included in the footprint of proposed large-scale renewable solar facilities. ORES has adopted pre-application procedures and developed standard uniform conditions to help identify when impacts to grassland birds occur and to reduce and mitigate impacts that cannot be avoided.

Onshore Wind

A survey by the National Renewable Energy Laboratory of large wind facilities in the United States found that they use between 30 and 141 acres per megawatt of power output capacity. However, less than 1 acre per megawatt is disturbed permanently and less than 3.5 acres per megawatt are disturbed temporarily during construction.[48] Subsequent studies identify that wind power infrastructure such as the turbines and roads typically occupy only 5 percent of a wind power site, with the rest often used for other purposes, such as agriculture.[49]

Biofuels

To reduce ozone formation, the New York City metropolitan area and Long Island require the use of reformulated motor gasoline blended with ethanol. According to the U.S. Energy Information Administration (EIA), the State consumes about 534 million gallons of fuel ethanol annually, the fourth-largest amount of any state.[50] New York's only fuel ethanol production plant has a capacity of about 62 million gallons per year.[51] New York thus imports about 470 million gallons of fuel ethanol annually. Using rough industry estimates that one acre of corn produces 500 gallons of ethanol,[52] the total land area (within and outside the state) associated with growing corn for ethanol to support New York State consumption could be approximately 1 million acres (assuming all the fuel ethanol is produced from corn

[48] Denholm, P., M. Hand, M. Jackson, and S. Ong. 2009. Land-use requirements of modern wind power plants in the United States. Golden, CO: National Renewable Energy Laboratory.

[49] "Land Resources for Wind Energy Development Requires Regionalized Characterizations" by Tao Dai et al was published in Environmental Science and Technology. https://doi.org/10.1039/D3VA00038A

[50] U.S. EIA, State Energy Data System, Table F29, Fuel ethanol consumption estimates, 2022

[51] U.S. EIA, U.S. Fuel Ethanol Plant Production Capacity (August 15, 2024), Detailed annual production capacity by plant is available in XLSX.

[52] Iowa Renewable Fuels Association, *Distillers Grains Facts*, accessed July 11, 2025, https://iowarfa.org/ethanol-center/ethanol-co-products/distillers-grains-facts/#:~:text=One%20acre%20of%20corn%20produces,1.5%20tons%20of%20distillers%20grains.

grain). According to EIA, New York does not have any biodiesel production, but the State is the nation's sixth-largest biodiesel consumer.[53,54]

2.4. Wildlife

2.4.1. State Goals

New York State seeks to protect and conserve biodiversity, manage wildlife populations, and preserve critical habitats. Conservation of wildlife supports ecosystem services, including food and other goods, pollination of crops, and waste decomposition. The State also prioritizes preventing the disappearance of endangered native species by protecting these species and their habitats.

2.4.2. Potential Environmental Effects

Energy Infrastructure

Land development, including for energy and utility infrastructure, can result in habitat loss, degradation, and fragmentation. If poorly timed, the clearing or modification of habitat can result in the direct loss of individual animals or a decline in productivity. Loss of habitat and vegetation, or fragmentation of habitat, can occur during the construction of infrastructure and operation of energy systems as the result of increased human presence, noise, motion, and alteration of the terrain for roads, buildings, foundations, or other permanent site infrastructure.

Fossil Fuels

Fossil fuel extraction, transportation, processing, and combustion can have negative effects on plants and animals. Transportation and storage of oil and gas can result in spills and leakages, which contribute to water and air pollution.

Vis-à-vis offshore oil and natural gas development, there are no active oil and gas projects or leases in the Atlantic Outer Continental Shelf (OCS) Region. New York State responded to the Bureau of Ocean Energy Management's (BOEM) Request for Information on the development of the 2024–2029 National OCS Oil and Gas Leasing Program petitioning for the removal of the North and Mid-Atlantic Planning Areas from consideration,[55] due to the high risk of adverse impacts to New York's coastal and marine resources and ocean economy, specifically the commercial fishing industry. Seismic surveys during oil and gas exploration produce intense noise that could lead to widespread adverse impacts to marine life, including endangered and threatened species. Oil spills or well blowouts during extraction could also have significant effects on New York's coastline, ocean economy, and protected species.

Combustion of fossil fuels produces air pollutants, which can result in acid deposition or thermal changes in the atmosphere—causing climate change.

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[53] U.S. EIA, U.S. Biodiesel Plant Production Capacity (August 15, 2024), Detailed annual production capacity by plant is available in XLSX.

[54] U.S. EIA, State Energy Data System, Table F30, Biodiesel Consumption Estimates, 2022.

[55] Bureau of Ocean Energy Management. 2025. Request for Information and Comments on the Preparation of the 11th National Outer Continental Shelf Oil and Gas Leasing Program MAA104000. https://www.federalregister.gov/documents/2025/04/30/2025-07479/request-for-information-and-comments-on-the-preparation-of-the-11th-national-outer-continental-shelf

Acid rain (and other types of acid deposition) forms when SO_2 and NO_x combine with moisture in the atmosphere to produce sulfuric acid and nitric acid. Historically, the source of SO_2 and NO_x emissions that contributed to acid rain was from fossil fuel combustion, in particular uncontrolled coal-fired power plants, including those in states upwind of New York. By the 1960s, it became clear to scientists that acid deposition was significantly impacting natural resources across New York, especially in the Catskill and Adirondack Mountains where soils were becoming too acidic to maintain healthy forests, and many waterbodies were unable to support healthy populations of fish. Elevated concentrations of inorganic aluminum (Al_i), mobilized by acidic conditions, led to many water bodies becoming seasonally toxic to biota.[56] Decreases in emissions have significantly reduced acid rain in New York, and waterbodies are slowly recovering, and many are now able to support more diverse and abundant wildlife and associated recreational opportunities.[57]

Mercury is a naturally occurring metal that is also emitted as an air pollutant from coal combustion. Mercury has been identified as being one of the most important of the persistent, bio-accumulative, toxic contaminants of concern for New York State. Mercury concentrations exceed human and ecological risk thresholds in many areas of New York State, particularly the Adirondacks, Catskills, and parts of Long Island. Mercury concentrations in the environment of New York State have declined over the last four decades, concurrent with decreased air emissions from regional and U.S. sources, and further controls on mercury emission sources are expected to continue to lower mercury concentrations in the food web, yielding multiple benefits to fish, wildlife, and people of New York State. However, scientists are also observing that fish and wildlife remain highly impacted by legacy mercury deposition, as evidenced by stable and increasing trends of mercury concentrations found in certain species and in some regions of the state.[58,59]

Hydroelectric

Hydroelectric facilities may impact fish and wildlife resources due to the creation of dams and reservoirs and due, in part, to the way the facility is operated. Hydroelectric dams fragment river and stream systems, preventing upstream and downstream movement of fish and aquatic organisms. Dams can also fragment riparian habitat for semi-aquatic organisms. Anadromous species, fish that live in the ocean and come upriver to spawn, have declined dramatically in the last 150 years due to pollution, overfishing, and habitat destruction. Other effects of the loss of aquatic connectivity through dam creation can include the loss of other aquatic species dependent on the presence of certain fish. Many freshwater mussel species require specific fish species to serve as hosts to complete their life cycle.

[56] Lawrence et al. 2008. Chronic and episodic acidification of Adirondack streams from acid rain in 2003-2005. Journal of Environmental Quality 37:2264-2274. DOI: https://doi.org/10.2134/jeq2008.0061

[57] DEC, *Acid Rain*, accessed July 11, 2025, https://dec.ny.gov/environmental-protection/acid-rain.

[58] Evers, D.C., Adams, E., Burton, M., Gulka, J., Sauer, A., and Driscoll, C.T. 2019. New York State Mercury Connections: the Extent and Effects of Mercury Pollution in the State. Biodiversity Research Institute. Portland, Maine. BRI Science Communications Series 2019-12-2. 41 pages.

[59] NYSERDA. 2020. Mercury dynamics in Finger Lakes Fish and Invertebrates. NYSERDA Report Number 20-37. Prepared by Hobart and William Smith Colleges, Geneva, NY. nyserda.ny.gov/publications

Dams that block fish passage can result in the loss of freshwater mussel populations that are dependent upon the presence of fish species.

All hydroelectric projects in New York State require intake protection and downstream passage sites for fish species to maintain aquatic habitats. Some weaker-swimming aquatic organisms can be restricted from passage, leading to changes in community structure. Most projects already have steel trash racks to prevent debris from entering the turbine, which may protect species of resident and migratory fish from entering intakes.[60]

Solar

Solar development in New York State can have both direct and indirect impacts on wildlife, particularly if large-scale projects significantly alter natural landscapes. One of the primary concerns is habitat loss and fragmentation. Clearing undisturbed land for solar farms can displace native species especially those that are less mobile, including pollinators, amphibians, and small mammals. Grassland birds can be adversely affected because the large, open habitat they require may be segmented by the placement of solar panels. Solar projects built on open fields or shrublands may force species into less suitable habitats, increasing competition for resources and potentially leading to population declines. Birds that nest on grasslands or open fields may be displaced when land is converted into a solar facility. If clearing or grading occurs during the nesting season, individual animals may be killed and productivity for the season may be lost. Even if some vegetation remains or is replaced, panel arrays can reduce habitat suitability and, alter nesting conditions potentially requiring compensatory mitigation. However, emerging research also indicates that some common bird species can quickly adapt to utilizing solar energy facilities for nesting or foraging, and that opportunities exist for biodiversity enhancement through vegetation planning and management.

Onshore Wind

Onshore wind turbines present direct and indirect threats to birds and bats. The main risk is collision with turbines when passing through the rotor swept zone or other parts of the tower structure. The risk of collision can increase when turbines are developed on ridges and upwind slopes or when they are built close to migration routes or concentration areas. Based on monitoring conducted at wind energy projects in New York through 2021, the average fatality rates across all bat and bird species are 7.2 bats per MW per year, and 2.2 birds per MW per year. Additionally, as of April 2025, 15 bald eagle fatalities have been documented at wind energy facilities in New York since 2015. Bat mortality due to turbine collision may have a negative impact on some bat populations, particularly migratory tree-roosting bats. Bat mortality is a concern because many bat populations have experienced steep declines over the past two decades due to white-nose syndrome. While wind turbines are one of the primary causes of mortality for several bat species, research consistently shows that wind turbines are less harmful to songbirds than other human-made structures or predators.[61, 62]

[60] NYSERDA. 2018. Enhanced hydropower database.
[61] USFWS. 2017. https://www.fws.gov/library/collections/threats-birds
[62] See discussion in DPS CES FSEIS, 2016 @p5-34

Construction can also result in habitat loss; tree removal does occur at most project sites for construction needs and road access. This can reduce access to breeding sites and foraging areas. Disturbance caused by rotor movement, noise, vibration, flickering lights, and increased human presence may lead to behavioral changes such as avoidance and changes in flight paths, particularly for species living in open environments such as grasslands.[63]

There have been improvements in wind turbine design, project siting, and operation which have reduced the impact of wind turbines on birds and bats.[64] However, estimates of bird and bat mortality can vary in accuracy due to non-standardized survey methods and limits to accessing data.[65] DEC released an updated Guide for Conducting Bird and Bat Studies at Commercial Wind Energy Projects in 2016.[66]

Energy storage may enable impact reduction strategies for protection of vulnerable species (e.g., bats and birds) that are susceptible to operational impacts. For example, energy storage can enable the curtailment of wind turbine operation to avoid periods of peak wildlife activity in close proximity to wind turbines (e.g., feeding or migratory passage).[67]

Offshore Wind

Offshore wind (OSW) has the potential to impact marine ecosystems and wildlife at different stages of construction and operation. Noise from site characterization, construction, operation, and decommissioning activities can harm marine mammals, sea turtles, and fish by causing behavioral changes, masking communication, or causing physical injuries. Vessel traffic at all stages of OSW can pose a collision risk for marine mammals and sea turtles, especially large whales. However, the observed and projected increase in vessel traffic from OSW activities is small. Benthic habitats may be lost of degraded during construction, displacing organisms and affecting demersal habitats. Species may also be displaced by OSW structures, disrupting migration, feeding, or breeding; conversely, other species may be attracted to the area due to increased habitat complexity or foraging opportunities. Birds and bats are at risk of collision with turbines during operation, which can cause injury or death. Collision impacts are very difficult to assess, as traditional methods to study post-construction fatalities are not practically applied in open water environments. Additionally, subsea power cables generating electromagnetic fields may affect the behavior of electrosensitive species, such as sharks, rays, sturgeon, and some invertebrates. The presence of OSW structures may also lead to displacement of fishing efforts, although fishing is not restricted within OSW areas.

Offshore wind structures are known to act like artificial reef-like habitats, increasing local primary productivity and food availability on and near the structures.[68] Structure-oriented fishes may also be

[63] Dohm, R, Jennelle, CS, Garvin, JC, Drake, D. 2019. A long term assessment of raptor displacement at a wind farm. Front Ecol Environ 2019; doi:10.1002/fee.2089

[64] DOE. https://windexchange.energy.gov/projects/birds

[65] Choi, DY, Wittig, TW, Kluever, BM. 2020. An evaluation of bird and bat mortality at wind turbines in the Northeast United States. PLOS One https://doi.org/10.1371/journal.pone.0238034

[66] DEC. 2016. https://extapps.dec.ny.gov/docs/wildlife_pdf/windguide.pdf

[67] Industrial Economics, Incorporated. 2023. Final Supplemental Generic Environmental Impact Statement.

[68] Degrear et al. 2020. Offshore wind farm artificial reefs affect ecosystem structure and functioning: a synthesis. Oceanography 33(4): https://tethys.pnnl.gov/sites/default/files/publications/Degraer-et-al-2020-Artificial-Reefs.pdf

attracted to these locations. Benthic species dependent on hardbottom habitat may benefit from hard surfaces, resulting in increases in benthic diversity.

Potential impacts to wildlife are first avoided during siting and then reduced through mitigation measures applied under State and federal permit approval processes. Wind Energy Areas (WEAs) are identified by BOEM using a suitability analysis that accounts for both environmental sensitivities and coexistence with other ocean users. Areas of highest conflict are removed from consideration and then further refined in consultation with other government agencies, states, stakeholders, and public comments. Prior to development, OSW projects must receive BOEM approval for their Construction and Operations Plan (COP), which is subject to terms and conditions to mitigate potential impacts to protected species, habitats, and fisheries.

2.4.3. Policies and Programs

The New York State Endangered and Threatened Species Act provides legal protection for species that are at risk of extinction or significant population decline within New York State.[69] It designates species as endangered, threatened, special concern, or extirpated, depending on their risk level. Once listed, these species receive protections that prohibit harming, harassing, capturing, or killing them, as well as destroying or significantly altering their habitats. Additionally, federally listed rare and threatened species also receive protection through coordination with federal laws, such as the U.S. Endangered Species Act (ESA) and the Migratory Bird Treaty Act (MBTA).

The New York State Wildlife Action Plan (SWAP) serves as a comprehensive strategy for conserving the state's diverse wildlife and their habitats, focusing on species of greatest conservation need (SGCN).[70] The plan identifies key threats to wildlife, such as habitat loss, climate change, pollution, and invasive species, while outlining conservation actions to address these challenges. The SWAP emphasizes habitat restoration, species monitoring, public education, and partnerships with conservation organizations to enhance biodiversity protection. By providing a framework to proactively manage wildlife populations and ecosystems, the plan supports long-term ecological health, reduces the need for future regulatory interventions, and aligns with broader federal conservation goals.

The New York Natural Heritage Program, funded by DEC and managed by the State University of New York College Environmental Science and Forestry, facilitates the conservation of New York State biodiversity by providing scientific expertise on rare species and natural ecosystems to resource managers.

In addition, proposed energy facilities must comply with state and federal wildlife permitting requirements. The State Environmental Quality Review Act (SEQRA) mandates an environmental impact assessment that is reviewed at the local level for projects that do not meet the size threshold to fall under ORES jurisdiction. Large scale renewable energy projects—projects with a nameplate capacity of at least 25 MW—are reviewed by ORES to ensure that such projects avoid and minimize impacts to

[69] Environmental Conservation Law Article 11

[70] DEC, *State Wildlife Action Plan (SWAP)*, accessed July 11, 2025, https://dec.ny.gov/nature/animals-fish-plants/biodiversity-species-conservation/state-wildlife-action-plan.

ecological resources and wildlife. To compensate for impacts to threatened and endangered species that cannot be avoided, ORES requires mitigation that will provide a net conservation benefit for the affected species. If federal wildlife laws apply (such as under the MBTA or ESA or the Bald and Golden Eagle Protection Act), coordination with U.S. Fish and Wildlife Service may be required.

Offshore wind energy projects are being developed in federal waters (more than three nautical miles from shore) with transmission infrastructure in State waters, necessitating both State and federal permitting.[71] The Coastal Zone Management Act allows the State to review activities in federal waters and projects with coastal effects to New York to ensure consistency with the federally enforceable policies of New York State Coastal Management Program administered by the Department of State. DEC reviews potential impacts on threatened and endangered species and fisheries conservation and management from offshore wind development under the Environmental Conservation Act. BOEM leases submerged lands and approves Site Assessment Plans and Construction and Operation Plans. The National Oceanic and Atmospheric Administration and U.S. Fish and Wildlife Service manage consultations pertaining to the Magnuson-Stevens Fisheries Conservation and Management Act, Marine Mammal Protection Act, and Endangered Species Act.

2.5. Legacy Sites and Waste from Energy Sectors

2.5.1. State Goals

The development, use, and decommissioning of energy facilities results in waste products that need to be managed. As part of the transition to clean energy, the State initiated the development of a blueprint to guide the retirement and redevelopment of New York City's oldest fossil fuel facilities by 2030. The Climate Action Council Scoping Plan made recommendations for a circular economy approach to materials management and an increase in recycling capacity. One strategy in the Plan calls for the State to support domestic recycling facilities and markets for recovered resources and incentivize public-private partnerships for recycling facility development. NYSERDA's Blueprint for Advanced Nuclear Energy Technologies recommends that the State address challenges around waste management and storage to enable the adoption of advanced nuclear.

2.5.2. Potential Environmental Effects

Fossil Fuel Plant Retirement and Legacy Pollution

The decommissioning of fossil fuel power plants may necessitate environmental remediation, which involves the investigation and cleanup of hazardous materials to meet federal and state requirements. Coal ash has contributed to groundwater contamination and can spill into adjacent waterways, where it can also harm multiple physiological systems in exposed animals.[72] Remediation of natural gas and petroleum-fired plants involves the dismantling, cleaning, and disposal of fuel storage equipment such as tanks and transportation lines.[73] Leaking fuel storage tanks may require additional remediation to

[71] NYSERDA. 2015. Table of Permits and Approvals. New York State Offshore Wind Master Plan. NYSERDA Report 17-25x.

[72] Hernandez, Felipe, Ricki E. Oldenkamp, Sarah Webster, James C. Beasley, Lisa L. Farina, Samantha M. Wisely, "Raccoons (Procyon lotor) as Sentinels of Trace Element Contamination and Physiological Effects of Exposure to Coal Fly Ash," December 8, 2016, https://link.springer.com/content/pdf/10.1007/s00244-016-0340-2.pdf.

[73] NYSERDA, *Remediation*, accessed July 11, 2025, https://www.nyserda.ny.gov/All-Programs/Just-Transition-Site-Reuse-Planning-Program/Remediation

remove and properly dispose of contaminated soil. Some level of asbestos remediation may also be necessary.

Subsurface Energy Development

The State of New York has a rich history of oil and natural gas production, dating back to the nineteenth century. DEC currently maintains records for approximately 20,000 plugged wells and 23,000 unplugged wells; about 12,000 of the unplugged wells are actively producing, and new drilling continues. Most oil and gas wells in New York are located in the western part of the state, with the majority located in Allegany, Cattaraugus, Chautauqua, and Erie counties.[74]

It is estimated that a total of 75,000 wells may have been drilled in New York, with potentially tens of thousands of legacy orphaned and abandoned wells without proper well plugging prior to the existence of DEC or a regulatory framework in the state. If left unplugged, orphaned and abandoned wells can provide unimpeded conduits for oil, gas, and other fluids to migrate between different geologic formations, into aquifers, and potential to impact the land surface and waterways.[75] Unplugged orphaned and abandoned wells can also provide a potential route for subsurface methane and hydrogen sulfide to escape into the atmosphere, potentially contributing to increased levels of GHGs.

As the locations of many orphaned and abandoned wells are unknown, in 2020, DEC and NYSERDA collaborated to implement new tools and techniques for locating orphaned and abandoned wells drilled prior to existing regulation, including flying drones equipped with magnetometers.[76] With property owner cooperation, DEC has begun using this unmanned aerial systems technology across seven counties to successfully locate orphaned and abandoned wells which could not be located through routine DEC inspections. Once the wells are located, DEC has used State and federal funding to plug more than 500 orphaned and abandoned wells to mitigate the associated potential threats to the environment public health, and public safety.

Nuclear Waste

As discussed in the Pathways Analysis chapter of this Plan, planning scenarios project the continued operation of existing state nuclear plants through 2040. Nuclear power creates radioactive waste that remains in the environment for thousands of years and requires active stewardship to contain and mitigate risk for environmental exposure. By volume, the majority of radiological waste is made up of lightly contaminated items, primarily associated with electric power generation but also includes activities at hospitals, universities, research laboratories and others, and is classified as low-level radioactive waste. The New York State Low-Level Radioactive Waste Management Act requires low-level waste generators in the State to submit annual reports to NYSERDA that provide detailed information on how low-level radioactive waste is generated, stored, and disposed. Spent nuclear fuel from power generation is classified as high-level waste. Spent nuclear fuel generated by nuclear power plants is

[74] DEC, *Finding And Identifying Oil And Gas Wells*, accessed July 11, 2025, https://dec.ny.gov/environmental-protection/oil-gas/finding-identifying-oil-and-gas-wells.
[75] DEC, *Orphaned, Abandoned, and Marginal Well Plugging*, accessed July 11, 2025, https://dec.ny.gov/environmental-protection/oil-gas/orphaned-abandoned-well-plugging.
[76] DEC, *Drone Technology Helps Locate Orphaned Wells*, accessed July 11, 2025, https://dec.ny.gov/environmental-protection/oil-gas/orphaned-abandoned-well-plugging/drone-technology.

managed on-site in the form of solid spent fuel rods stored in deep pools of water for approximately 10 years after generation and then stored in steel-lined concrete casks, a practice known as dry cask storage. Dry cask storage has been successful at preventing leaks or exposure, but there is a risk of storage failure from materials degradation as dry casks age. Cask aging management is an important element of long-term storage, until such time as the federal government implements its responsibility to take possession of the high-level waste for permanent disposal options, which currently remain limited. Each of the nuclear power plant locations in New York manages an Independent Spent Fuel Storage Installation for high-level waste generated on the site.

Renewable Energy Waste

The transition to renewable energies and green transportation will produce waste that includes batteries, solar panels, and wind turbine blades. Waste from end-of-life renewable energy infrastructure is expected to increase significantly in the coming decades. More than 85% of a solar photovoltaic module is made of recyclable materials; however, recycling is not currently cost effective or widely adopted.[77] Some solar panels are considered hazardous waste due to high levels of metals present.[78] Despite this, most solar waste currently goes to landfills.[79] In the U.S., 90% of the mass of decommissioned wind turbines could be recycled.[80] However, the U.S. Department of Energy found that existing U.S. recycling facilities find it difficult to process the materials in wind turbine blades and generators.

Battery-based energy storage could cause environmental impacts during end-of life disposal. Improper disposal at the end of a battery's life may cause land and groundwater pollution.[81] Recycling batteries can limit the environmental impacts, but there are barriers to recycling utility-scale lithium-ion batteries, including the high cost of spent battery transportation.[82] Globally, only five percent of lithium-ion batteries were recycled as of 2019, though that number could be rising more recently as lithium-ion batteries become more popular, particularly with individual consumers.[83]

2.5.3. Policies and Programs

NYSERDA's Just Transition Site Reuse Planning Program supports communities with planning services to inform future decision making at the local level to mitigate negative impacts of pending or future fossil

[77] DOE, "Beyond Recycling: Reducing Waste from Solar Modules Before They're Even Made," March 5, 2024, https://www.energy.gov/eere/solar/articles/beyond-recycling-reducing-waste-solar-modules-theyre-even-made.
[78] EPA, *End-of-Life Solar Panels: Regulations and Management*, accessed July 11, 2025, https://www.epa.gov/hw/end-life-solar-panels-regulations-and-management.
[79] DEC, *Rulemaking - Adding Solar Panels To The Universal Waste Regulations*, accessed July 11, 2025, https://dec.ny.gov/regulatory/regulations/rulemaking-adding-solar-panels-to-the-universal-waste-regulations
[80] DOE. 2025. https://www.nrel.gov/docs/fy25osti/87970.pdf
[81] Gaustad, G. 2018. Lifecycles of Lithium-Ion Batteries: Understanding Impacts from Material Extraction to End of Life. March 14. Spring Bridge on International Frontiers of Engineering (2018) 48:1. https://www.nae.edu/Publications/Bridge/180760/181102.aspx.
[82] MIT Energy Initiative. 2022. The Future of Energy Storage https://energy.mit.edu/wp-content/uploads/2022/05/The-Future-of-Energy-Storage.pdf
[83] Huang, Y. and Li, J. 2022. Key Challenges for Grid-Scale Lithium-Ion Battery Storage. Accessed on July 13, 2023 at: https://onlinelibrary.wiley.com/doi/full/10.1002/aenm.202202197#aenm202202197-bib-0069

fuel power plant closures.[84] Funds may be used to evaluate a site's environmental conditions (Phase I Environmental Site Assessment) or conduct pre-development activities, such as evaluating the presence or environmental contamination.

DEC is considering adding solar panels to the Universal Waste (UW) rule. The UW rule was established by the EPA in 1995 and is a set of requirements for commonly generated hazardous waste. DEC believes that hazardous waste solar panels are often misidentified and diverted to non-hazardous waste management streams and require an improved set of regulations for end-of-life management.[85] Niagara County became the first local government in the nation to pass a local law requiring producers to finance solar panel recycling.[86] DEC also recommends the passage of extended producer responsibility requirements that should include waste from renewable and green technologies.[87]

3. Opportunities to Inform an Environmentally Responsible Energy Transition

Assessing environmental uncertainties associated with energy development and use is key to avoiding, minimizing, and mitigating potential impacts as well as identifying opportunities for co-utilization or ecosystem enhancements. The State currently undertakes research into new energy technologies, as well as conducts data and monitoring studies to address information gaps and optimize siting, which can in turn reduce project impacts, risks and costs.

3.1. Environmental Research and Pre-Development Data Collection

As the State's energy generation mix continues to evolve to meet its energy needs, it will be important to continuously evaluate the potential impacts and benefits of new energy technologies and seek ways to optimize energy siting and use. For example, the State conducted more than 20 studies to inform the **New York State Offshore Wind Master Plan** in 2018.[88] These included an assessment of wildlife, fisheries, and habitats, which were used to refine the BOEM's Wind Energy Areas and identify areas of research to further improve siting. New York continues to invest in research studies to improve understanding of environmental sensitivities and user conflicts associated with offshore wind.[89]

New York has also proactively undertaken pre-development data collection ahead of offshore wind development, such as collecting metocean data, including wind speed and direction and wave height; mapping seabed sediments and sub-seabed conditions; conducting digital aerial surveys to identify wildlife; and deploying acoustic sensors to detect birds, bats, and marine mammals.[90] Pre-development data collection can reduce project costs by providing critical information to developers, regulators, and

[84] NYSERDA https://www.nyserda.ny.gov/All-Programs/Just-Transition-Site-Reuse-Planning-Program
[85] DEC, *Rulemaking - Adding Solar Panels To The Universal Waste Regulations*, accessed July 11, 2025, https://dec.ny.gov/regulatory/regulations/rulemaking-adding-solar-panels-to-the-universal-waste-regulations.
[86] County of Niagra, *Niagara County Solar Panel Recycling Local Law*, accessed July 11, 2025, https://www.niagaracounty.gov/government/county_information/niagara_county_solar_panel_recycling_local_law.php.
[87] DEC. 2023. New York State Solid Waste Management Plan: Building the Circular Economy through Sustainable Materials Management. https://dec.ny.gov/sites/default/files/2024-05/finalsswmp20232.pdf
[88] NYSERDA, Offshore Wind Master Plan, accessed July 11, 2025, https://www.nyserda.ny.gov/All-Programs/Offshore-Wind/About-Offshore-Wind/Master-Plan.
[89] NYSERDA, Offshore Wind, accessed July 11, 2025, https://www.nyserda.ny.gov/All-Programs/Offshore-Wind/Focus-Areas/Regional-Collaboration/Siting-Offshore-Wind.
[90] Ibid.

stakeholders early to improve understanding of the marine environment, reducing project risk; help to inform construction windows and permits; and accelerate project timelines.

3.1.1. Co-Utilization or Dual-Use of Energy Facilities

New energy development is being deployed in dynamic environments with existing users. To characterize the potential for energy facilities to support multiple uses, the State is funding research in collaboration with agricultural and commercial fisheries users.

For example, the co-utilization of solar energy facilities with active agriculture—referred to as "agrivoltaics"—represents a possible pathway to help achieve New York's solar energy goals while preserving production in agricultural lands. Examples of agrivoltaics can include, but are not limited to, growing livestock grazers, such as sheep and cattle, to produce livestock products and maintain vegetation in solar panel arrays while panels provide shading and protection from the weather; and growing crops that can thrive under and around solar panels to help sustain soils and farming activity. New York State is funding research projects to produce data on crop and grazing potential, environmental and species use, enhancement and mitigation opportunities, and optimal siting design considerations for large solar PV projects.

To balance the growth of the offshore wind industry with existing marine industries, such as commercial fishing, the State has supported research to maintain and grow the region's sustainable fisheries. This has included collaboratively developing technical strategies and tools to minimize commercial fisheries disruption within offshore wind areas, gear modification to enhance access to fishing within wind areas, and projects that have improved fisheries stock enhancement.

3.2. Environmental Monitoring

The State conducts environmental monitoring to evaluate compliance and document long-term trends associated with the environmental impacts of energy use. The data collected assists policymakers in evaluating the effectiveness of energy-related environmental regulations and policies.

For example, air quality monitoring can identify how transitions in the electric generation and transportation sector are affecting air quality. DEC operates more than 50 air quality monitoring sites statewide that measure both criteria and non-criteria pollutants, including ozone, SO_2, NO_x, carbon monoxide (CO), $PM_{2.5}$ (fine particulate with diameter less than 2.5 microns), and meteorological data. Air quality monitoring networks such as this not only provides real-time data on dangerous conditions to help people decide when to curtail outdoor activity but can be instrumental to observing trends and measuring the projected air quality benefits associated with this Plan.

Another environmental monitoring network that has proven instrumental to informing energy-related air quality regulations has been the Adirondack Long Term Monitoring (ALTM) program. The ALTM was initiated in 1982 with the goal of evaluating the chemistry of Adirondack lakes and measuring the impacts that electricity generation sources—mainly those in the midwestern states—were having on otherwise pristine Adirondack waterbodies. ALTM data on the effects of acid rain proved instrumental in the passage of federal Clean Air Act Amendments and has continued to measure their effectiveness. As

the watersheds in the Adirondacks have been recovering from acid rain and its effects, impacts from climate change and interacting stressors are emerging.

3.3. Stakeholder Collaboration to Inform Responsible Energy Development

New York State convenes multiple stakeholder groups to inform and advise on issues associated with renewable energy development. These stakeholder groups have proven successful in identifying areas to advance research to inform responsible energy development policies.

For example, following a series of fires at three BESS locations across New York State in the summer of 2023, Governor Hochul convened an Inter-Agency Fire Safety Working Group to address safety concerns around lithium-ion BESS. The Working Group includes State agency officials from the New York State Division of Homeland Security and Emergency Services, New York State Office of Fire Prevention and Control, NYSERDA, DEC, the New York State Department of Public Service and the New York State Department of State, as well as nation-leading BESS safety industry experts. In February 2024, the working group released initial recommendations for enhanced safety standards.

The State Agricultural Technical Working Group (A-TWG) has brought together State agencies; agricultural land and farmer advocates; nongovernmental organizations that focus on clean energy, climate, and environmental protection; local government officials; solar developers and operators; and academic experts to steer efforts in advancing renewable energy development across scales in a responsible way that supports the State's agricultural operations, lands, farmers, and communities. Committees of this group have advised on state solar energy procurement strategies to avoid and minimize agricultural impacts, opportunities to advance agrivoltaics policy, and characterizing agronomic impacts and opportunities of solar energy.

New York State also established Offshore Wind Technical Working Groups (TWGs) concerning the key subjects of fishing, maritime commerce, the environment, jobs, the supply chain, and environmental justice. The offshore wind TWGs are designed to foster ongoing collaboration with individuals and entities who have "technical knowledge, practical experience, and professional interest" in topics related to the OSW industry. The Environmental and Fisheries TWGs have supported information sharing, developed guidance on best practices, and informed research investments.[91] NYSERDA is also an active member of the Responsible Offshore Science Alliance and the Regional Wildlife Science Collaborative, which support regional research on fisheries and wildlife potentially impacted by offshore wind development.

[91] Brunbauer et al. 2023. Effective stakeholder engagement for offshore wind energy development: the State of New York's Fisheries and Environmental Technical Working Groups. Marine and Coastal Fisheries, 15(2) https://doi.org/10.1002/mcf2.10236