# Draft Supplemental Environmental Impact Statement In

**CASE 15-E-0302 - Proceeding on Motion of the Commission to Implement a Large-Scale Renewable Program and a Clean Energy Standard.**

**CASE 14-M-0101 – Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision.**

**CASE 14-M-0094 – Proceeding on Motion of the Commission to Consider a Clean Energy Fund.**

**CASE 13-M-0412-- Petition of New York State Energy Research and Development Authority to Provide Initial Capitalization for the New York Green Bank.**

**CASE 10-M-0457 - In the Matter of the System Benefits Charge IV.**

**CASE 07-M-0548 - Proceeding on Motion of the Commission Regarding an Energy Efficiency Portfolio Standard.**

**CASE 03-E-0188 - Proceeding on Motion of the Commission Regarding Retail Renewable Portfolio Standard.**

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| | |
|---|---|
| ACS | American Community Survey |
| ADR | Acid Deposition Reduction |
| AMI | Advanced Metering Infrastructure |
| BEC | Bureau Electric Control |
| BEVs | Battery electrical vehicles |
| bgd | billion gallons per day |
| BMPs | Best Management Practices |
| C&D | Construction and Demolition |
| CAA | Clean Air Act |
| CAES | Compressed Air Energy Storage |
| CAFO | Combined Animal Feeding Operation |
| CARIS | Congestion Assessment and Resource Integration Studies |
| CCA | Community Choice Aggregation |
| CEA | Critical environmental areas |
| CEF | Clean Energy Fund |
| CEQR | City Environmental Quality Review |
| CHG&E | Central Hudson Gas & Electric Company |
| CHP | Combined Heat and Power |
| CMA | Calcium Magnesium Acetate |
| CO | Carbon monoxide |
| $CO_2$ | Carbon dioxide |
| COB | Competitive Opportunities/Bypass Case |
| Commission | New York State Public Service Commission |
| Con Edison | Consolidated Energy Company of New York |
| CPP | Clean Power Plan |
| CRRA | Community Risk and Resiliency Act |
| CSA | Combined statistical areas |
| CSP | Concentrating Solar Power |
| CSRE | Customer-Sited Renewable Energy |
| CST | Customer-sited Tier |
| CWA | Clean Water Act |
| DAM | Department of Agriculture & Markets |
| DER | distributed energy resources |
| DG | distributed generation |
| DM | Demand Management |
| DMM | Document and Matter Management |
| DO | Dissolved Oxygen |
| DOE | U.S. Department of Energy |
| DOS | Department of State |
| DOT | Department of Transportation |
| DPS | New York State Department of Public Service |
| DR | Demand Response |

| | |
|---|---|
| DSP | Distributed System Platform |
| DSPP | Distributed System Platform Provider |
| EAF | Environmental Assessment Form |
| ECL | Environmental Conservation Law |
| EDTA | Electric Drive Transportation Association |
| EE | Energy Efficiency |
| EEPS | Energy Efficiency Portfolio Standard |
| EIA | U.S. Energy Information Administration |
| EIS | Environmental Impact Statement |
| EJ | Environmental Justice |
| ELF | extremely low frequency |
| EMFs | electric and magnetic fields |
| EMS | Energy Management System |
| EO | Executive Order |
| EPA | U.S. Environmental Protection Agency |
| EPAct | Energy Policy Act of 2005 |
| ESCOs | Energy Service Companies |
| EVs | electrical vehicles |
| EVSE | Electric Vehicle Supply Equipment |
| FACTS | flexible AC transmission systems |
| FAQs | Frequently Asked Questions |
| FCVs | Fuel Cell Vehicles |
| FCZMA | Federal Coastal Zone Management Act |
| FERC | Federal Energy Regulatory Commission |
| FHWA | Federal Highway Administration |
| FMP | Forest Management Plan |
| GEIS | Generic Environmental Impact Statement |
| GHG | Greenhouse Gases |
| GHP | Geothermal heat pump |
| GIV | Grid Integrated Electric Vehicles |
| GWh | Gigawatt hours |
| HCL | Hydrogen Chloride |
| HEFPA | Home Energy Fair Practices Act |
| HF | Hydrogen Fluoride |
| HLRW | high-level radioactive wastes |
| HOV | High-occupancy vehicle |
| ICEs | Internal Combustion Engines |
| IOUs | Investor-Owned Utilities |
| IPCC | Intergovernmental Panel on Climate Change |
| IPP | independent power producers |
| ISO | Independent System Operator |
| JFK | John F. Kennedy International Airport |
| kV | kilovolts |
| kVA | kilovolt-ampere |
| kWh | kilowatt-hour |
| LEV | Low emission vehicle |
| LFG | Landfill Gas |
| LILCO | Long Island Lighting Company |
| LIPA | Long Island Power Authority |
| LISF | Long Island Solar Farm |
| LLRW | low-level radioactive wastes |

| | |
|---|---|
| LMI | Low and Moderate Income |
| LNG | liquefied natural gas |
| MACT | Maximum Achievable Control Technology |
| mG | Milligauss |
| MMCR | Market-to-Market Congestion Relief Coordination |
| MSA | metropolitan statistical area |
| MSW | Municipal Solid Waste |
| MTA | Metropolitan Transportation Authority |
| MW | Megawatt(s) |
| MWh | megawatt-hour |
| NAAQS | National Ambient Air Quality Standard |
| NADP | National Acid Deposition Program |
| NEPA | National Environmental Policy Act |
| NIMO | Niagara Mohawk Power Corporation |
| $NO_2$ | nitrogen dioxide |
| $NO_X$ | nitrous oxides |
| NPCC | Northeast Power Coordinating Council |
| NPS | National Park Service |
| NPV | Net Present Value |
| NREL | National Renewable Energy Laboratory |
| NRHP/SRHP | National and State Registers of Historic Places |
| NSPS | New Source Performance Standards |
| NWCC | National Wind Coordinating Committee |
| NYCA | New York Control Area |
| NYCHA | New York City Housing Authority |
| NYCRR | New York Codes, Rules and Regulations |
| NYGB | New York Green Bank |
| NYISO | New York Independent System Operator |
| NYNHP | New York Natural Heritage Program |
| NYPA | New York Power Authority |
| NYSDEC | New York State Department of Environmental Conservation |
| NYSDPS | New York State Department of Public Service |
| NYSEG | New York State Electric & Gas Company |
| NYSERDA | New York State Energy Research and Development Authority |
| NYSOPRHP | New York State Office of Parks, Recreation and Historic Preservation |
| NYSRC | New York State Reliability Council |
| O&R | Orange & Rockland Company |
| $O_3$ | Ozone |
| OGS | Office of General Services |
| OSHA | Occupational Health and Safety Administration |
| OTEC | Ocean Thermal Energy Conversion |
| OTR | Ozone Transport Region |
| PB | Lead |
| PEJAs | Potential Environmental Justice Areas |
| PEM | polymer electrolyte membrane |
| PEVs | Plug-In Electric Vehicles |
| PHEVs | Plug-In Hybrid Electric Vehicles |
| PHS | Pumped Hydro Storage |
| PJM | PJM Interconnection LLC |
| PM | particulate matter |
| PMUs | phasor measurement units |

| | |
|---|---|
| Port Authority | New York and New Jersey Port Authority |
| ppm | parts per million |
| PSC | New York State Public Service Commission |
| PSD | Prevention of Significant Deterioration |
| PSL | Public Service Law |
| PV | Photovoltaic |
| R&D | research and development |
| RCRA | Resource Conservation and Recovery |
| REV | Reforming the Energy Vision |
| RG&E | Rochester Gas & Electric Company |
| RGGI | Regional Greenhouse Gas Initiative |
| ROW | right-of-way |
| RPS | Renewable Portfolio Standard |
| RPT | Real estate property taxes |
| RTO | Regional Transmission Operators |
| SADCA | State Acid Deposition Control Act |
| SASS | Scenic Areas of Statewide Significance |
| SBC | System Benefits Charge |
| SCFWH | Significant Coastal Fish and Wildlife Habitats |
| SDWA | 1974 Safe Drinking Water Act |
| SEQRA | New York's State Environmental Quality Review Act |
| SGIG | Smart Grid Investment Grant |
| SHPO | Historic Preservation Office |
| SIP | State Implementation Plan |
| SIR | Standardized Interconnection Requirements |
| SOx | sulfur dioxide |
| SPDES | New York State Pollutant Discharge Elimination System |
| T&D | transmission and distribution |
| T&MD | Technology and Market Development |
| The Board | State Energy Planning Board |
| TOs | transmission owners |
| TOTS | Transmission Owner Transmission Solutions |
| TOU | Time of Use |
| U.C. | University of California at Irvine |
| U.S. | United States |
| USACE | U.S. Army Corps of Engineers |
| USEPA | U.S. Environmental Protection Agency |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | U.S. Geological Survey |
| V2G | Vehicle-to-grid |
| VOCs | Volatile Organic Chemicals |
| WHO | World Health Organization |
| WTE | Waste-to-Energy |
| ZEV | Zero-emission vehicle |

# EXECUTIVE SUMMARY

In February 2015, the New York State Public Service Commission finalized and published a Generic Environmental Impact Statement (GEIS) that explored the potential environmental impacts associated with the Commission's pursuit of two major policy reviews. The initiatives underlying the GEIS include the Commission's "Reforming the Energy Vision" (REV) proceedings and the Commission's then-pending proposal to consolidate existing clean energy programs in a comprehensive "Clean Energy Fund" (CEF).[1] The GEIS describes the objectives and possible outcomes and impacts of the REV and CEF proceedings.[2]

Since the publication of the GEIS, Governor Andrew M. Cuomo tasked the Commission with two additional policy directives:

1. Design and implement a new Clean Energy Standard (CES) mandating that 50 percent of all electricity consumed in New York by 2030 be supplied by renewable resources (the "50 by 30" goal); and
2. Establish a support mechanism under the CES to sustain the operations of eligible nuclear facilities, as major sources of emissions-free power, separate from the renewable energy goal.

On January 21, 2016, the Commission issued an order expanding the scope of its ongoing review of the options for large scale renewable (LSR) energy development to include consideration of a CES.[3] The January 21 order envisions the CES as a mechanism to ensure that both the 50 by 30 goal and the maintenance of qualifying upstate nuclear resources are achieved. On January 25, Commission staff issued a white paper (Staff White Paper) describing potential approaches to the design and implementation of the proposed CES.[4] The Staff White paper relied, in part, on the analysis developed in the LSR options report that evaluated a range of LSR procurement structures, including a cost analysis of development and financing options.[5]

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[1] The Commission's proceedings covering REV and CEF include Case 14-M-0101 and Case 14-M-0094.The Commission issued an order moving forward on the CEF on January 21, 2016.

[2] NYS Department of Public Service. Final Generic Environmental Impact Statement In CASE 14-M-0101- Reforming the Energy Vision and CASE 14-M-0094- Clean Energy Fund. Prepared by Industrial Economics, Incorporated and Optimal Energy, Incorporated. 6 February 2015. Accessed 14 January 2016: file:///G:/Share/NYSERDA%20Flexible%20Energy%20Contract/06%20TWO%204%20-%20Clean%20Energy%20EIS/Supplemental%20EIS/%7B9E35CB6F-9B7D-4220-9CD4-B254C0FB4551%7D.pdf.

[3] Case 15-E-0302, Order Expanding Scope of Proceeding and Seeking Comments (January 21, 2016) at 5-6.

[4] NYS DPS. 2016. Staff White Paper on Clean Energy Standard. CASE 15-E-0302. January 25.

[5] Case 15-E-0302 – Large-Scale Renewable Energy Development in New York: Options and Assessment (June 2015) (LSR Options Report)

The possible impacts of the decision to enforce the 50 by 30 goal and to provide financial support to qualifying nuclear facilities through a CES were not identified and assessed in the 2015 GEIS. As required by the New York State Environmental Quality Review Act (SEQRA), this Supplemental Environmental Impact Statement (SEIS) builds upon and expands the analyses presented in that document. The SEIS identifies the potential environmental impacts of the CES and examines the interplay between the goals and impacts of the CES and the anticipated outcomes of the REV and CEF proceedings that were previously evaluated in the GEIS.[6]

## ES.1 SEQRA AND PROPOSED ACTION

As discussed in **Chapter 1**, the basic purpose of SEQRA is to incorporate the consideration of environmental factors into the planning and decision-making processes of state, regional, and local government agencies at the earliest possible time. SEQRA requires agencies to identify the adverse impacts that could result from their actions and to consider how those impacts might be avoided or minimized. If an agency determines that an action may have a significant adverse impact, then the agency must prepare an Environmental Impact Statement (EIS).

As described in the Staff White Paper, as proposed the CES would establish several renewable resource tiers eligible for renewable energy credits to meet the Governor's mandate:

- Tier 1 New Renewable Resources;
- Tier 2 Existing Renewable Resources;
    - Tier 2A Competitive Sub-Tier; and
    - Tier 2B Non-competitive Sub-Tier.[7]

Tier 1 would be dedicated to new renewable energy facilities with no limitations on facility size. Therefore, both smaller customer-sited (behind-the- meter) resources and LSR resources are eligible for Tier 1. Tier 2 aims to support continued contribution of currently operating renewable resources. Tier 2A aims to provide sufficient revenue to attract supply for which New York competes in neighboring markets. Tier 2B would provide sufficient revenue to maintain the renewable baseline electricity generation from facilities that do not compete with markets outside of the New York control area.[8]

The Staff White Paper also proposes a separate nuclear tier (Tier 3) to ensure that emissions-free power from qualifying nuclear generating plants is adequately valued. The nuclear tier under the CES would provide financial support to eligible licensed nuclear facilities to continue operations "as a short-term bridge while the State's energy economy transitions to the scale of renewable energy promised by the 50 by 30 goal."[9]

[6] To identify and analyze the impacts of the proposed CES in the context of REV and the CEF, this Supplemental EIS incorporates by reference the 2015 GEIS.

[7] NYS DPS. 2016. Staff White Paper on Clean Energy Standard. CASE 15-E-0302. January 25.

[8] NYS DPS. 2016. Staff White Paper on Clean Energy Standard. CASE 15-E-0302. January 25.

[9] Case 15-E-0302, Order Expanding Scope of Proceeding and Seeking Comments (January 21, 2016) at 3.

## ES.2 ANALYTIC APPROACH

In order to identify the potential environmental impacts related to implementation of the proposed CES, this SEIS relies on a number of assumptions. First, the SEIS must define the amounts and types of new renewable generation that may be needed to meet the CES goal. The analysis presented here considers a portfolio of large-scale renewables that was developed using a supply curve model. The model develops a least-cost plan of annual incremental renewable capacity additions needed to meet the target, based on a projection of demand growth, market data, cost estimates, and other factors. The model considers several types of renewable resources individually, including multiple size categories of land-based wind, utility-scale solar, upgraded hydroelectric facilities, retrofitting non-powered dams, off-shore wind, anaerobic digestion, and additional biomass-source generation.[10] The results of the modeling suggest a base case in which a total LSR increment of approximately 29,000 GWh would be needed to meet the 50 by 30 goal. As an alternative, high-end case, this SEIS also considers the potential impacts if demand is higher than projected in the base case and a total of approximately 40,000 GWh of LSR would be necessary to meet the goal.

The analysis focuses primarily on the impacts that are associated with LSR because (1) the 2015 GEIS addresses the potential impacts of distributed renewable resources, and (2) the impacts of LSR projects are more likely to be significant. The specific mix of LSR and behind the meter sources that is ultimately installed may be different from what is assumed in the model. If the actual proportion of LSR to distributed renewable resources turns out to be smaller than this SEIS estimates, the consequence is likely to be a reduction in overall impacts.

Second, while it is not possible to predict economic conditions through the whole period contemplated by the CES proposal, this SEIS assumes that the qualifying nuclear facilities receive support and continue operating through the expiration of their respective license terms.

## ES.3 ENVIRONMENTAL IMPACTS

Based on these key assumptions, this SEIS identifies the range of impacts that could result from the approval and implementation of the CES. The full details are discussed in **Chapters 4, 5, and 9**. As in the 2015 GEIS, the evaluation of environmental impacts in this SEIS is largely qualitative. That is, a quantitative assessment of the potential environmental impacts would require information that is not available at this stage, such as information on the location of specific projects or developments.

### The Renewable Supply Portfolio

The deployment of large amounts of LSR under the CES may have adverse environmental impacts. This SEIS contemplates two broad categories of renewable energy sources developing under the CES: (1) new LSR generation; and (2) upgrades or enhancements to existing infrastructure to generate renewable energy, for example, upgrading existing hydropower facilities, retrofitting non-powered dams, and repowering retired or operating biomass units.

The environmental impacts will vary across these two broad categories of renewable energy generation. Most notably, development of new utility-scale generation entails both temporary

[10] This is not an exhaustive list of the technologies that may be eligible under the CES. See Staff White Paper, Appendix C.

and permanent changes in the environment. Temporary impacts include impacts associated with construction, which are less significant for projects that leverage existing infrastructure. In addition, these short-term disturbances can be mitigated through use of appropriate construction practices and safeguards. Large scale solar and wind installations may have significant land requirements and may permanently affect existing land uses, wildlife, and other resources in a given project area. Development of new utility-scale solar and wind generation may alter the visual and cultural landscape of rural areas in upstate New York, where large scale solar and wind is likely to be developed. When such operations are sited in traditionally rural communities, the industrial nature of solar and wind facilities can offer strong contrasts to the surrounding landscape. To the extent that a specific community becomes host to multiple large scale renewable projects, adverse impacts on the community's aesthetic, visual, and cultural resources are possible.

#### Clean Energy Standard: Nuclear Tier

In contrast to the renewable supply mandate, which will introduce changes to the environment, the proposal to support qualifying nuclear facilities will not have significant adverse impacts. The impacts as are likely to occur are those associated with normal operations of the facilities and would simply continue through the expiration of their U.S. Nuclear Regulatory Commission (NRC) licenses. The environmental and other impacts have been most recently described and evaluated by the NRC in the course of its recent relicensing proceedings, discussed in **Chapter 5**.

Sustaining operations of economically distressed nuclear facilities would require the facilities to continue using uranium fuel. The NRC has also evaluated this issue and identified the maximum environmental effects per annual fuel requirement. These include impacts to land, water, fossil fuel use, and gas, liquid, and solid effluents, radiological effluents, thermal effluents, and exposure of workers and the public to radiation sources. The NRC concluded that the impacts from the uranium fuel cycle including impacts of transporting materials would be small. Additional mitigation measures are not anticipated beyond the already established measures in place, under the NRC's regulatory authority.

#### Socioeconomic Categories

One of the primary beneficial changes expected from implementation of the CES is a reduction in total emissions of air pollutants resulting from fuel combustion. According to the supply curve model used for this analysis, increasing the contribution of renewable generation to meet the "50 by 30" mandate could reduce nitrogen oxides ($NO_x$), sulfur dioxide ($SO_2$), and carbon dioxide ($CO_2$) emissions by thousands of tons per year. Net program costs were developed for all three tiers, which are defined as the gross program costs reduced by the societal value of the avoided $CO_2$ emissions. For the total of Tier 1, 2 and 3 resources, the near-term Net Present Value (NPV) results a net benefit that ranges from $83 million to $622 million in the 2020 time frame. Looking at the 2030 horizon, the NPV results in a net benefit of $1.07 billion to $3.05 billion.

Implementation of the CES may also bring regional economic impacts and other public benefits. The continued operation of nuclear facilities made possible by the CES Tier 3 will preserve jobs and tax revenues, resulting in regional economic benefits. New development of utility scale renewable energy such as wind and solar is also expected to provide economic benefits including increased jobs and economic output due to construction and operations, and increased tax

revenues. These direct jobs and spending in the local economy will also produce secondary impacts, as spending by employees and affected industries flows through the regional economy. Rural landowners may also benefit directly from lease payments for development of renewable resources on their property. However, the actual net impact of the proposed action on regional economies will depend upon many dynamic, unknown factors as technology continues to change and the economy grows and shifts over time. These costs and benefits are addressed in **Chapter 9.**

## ES.4 MITIGATION OF POTENTIAL ADVERSE IMPACTS

A variety of measures are available to mitigate (i.e., minimize or avoid) the potentially adverse environmental impacts that may result from implementation of the CES. One key mitigation measure is compliance with existing Federal and state regulations, which are specifically designed to protect human health and the environment from significant and/or adverse impacts. For continued operations of eligible upstate nuclear facilities, the NRC maintains regulatory oversight of commercial nuclear power plants. Through its licensing, inspection, and enforcement authorities, the NRC ensures that civilian use of radioactive materials is protective of public health and safety, promotes the common defense and security, and protects the environment. In addition to the NRC, the Occupational Safety and Health Administration (OSHA) and numerous New York State agencies (e.g., New York Department of Labor, New York State Department of Health, New York State Department of Environmental Conservation, and New York City Department of Health and Mental Hygiene Regulations) play additional roles in ensuring the safe use of radioactive materials.

Site-specific permitting regimes, such as the State Environmental Quality Review (SEQR) process, and Article 10 and Article VII of the New York Public Service Law, require agencies and project developers to identify and mitigate potentially adverse environmental impacts that may result from the construction and operation of specific projects. State agencies and many localities have acquired significant experience with the siting of renewable energy facilities since the adoption of the State's Renewable Portfolio Standard in 2004. As interest in, and development of renewable sources of energy have increased, local and State permitting processes and capabilities have also developed. For example, a number of new studies and guidance were recently released to provide greater guidance on the impacts of renewable energy facilities and options for mitigation of such impacts. Examples of such policies and guidance potentially applicable to types of impacts that are described in this SEIS are further discussed in **Chapter 6**. As a result of this experience and the availability of these regulatory tools, the adverse impacts identified in this SEIS can be avoided or minimized in future project reviews.

# CHAPTER 1 | SEQRA AND DESCRIPTION OF THE PROPOSED ACTION

In February 2015, the Commission finalized and published a Generic Environmental Impact Statement (GEIS) that explored the potential environmental impacts associated with the Commission's pursuit of two major policy reviews. The initiatives underlying the GEIS include the Commission's "Reforming the Energy Vision" (REV) proceedings and the Commission's proposal to consolidate existing clean energy programs in a comprehensive "Clean Energy Fund" (CEF).[11] The GEIS describes the objectives and possible outcomes and impacts of the REV and CEF proceedings.[12]

Since the publication of the GEIS, Governor Andrew M. Cuomo tasked the Commission with two additional policy directives:

1. Design and implement a new Clean Energy Standard (CES) mandating that 50 percent of all electricity consumed in New York by 2030 be supplied by renewable resources (the "50 by 30" goal); and
2. Establish a support mechanism under the CES to sustain the operations of eligible nuclear facilities, as major sources of emissions-free power, separate from the renewable energy goal.

On January 21, 2016 the Commission issued an order expanding the scope of its ongoing review of the options for large scale renewable energy (LSR) development to include consideration of a CES.[13] The Commission directed the Department of Public Service staff to prepare and issue a white paper (Staff White Paper) addressing proposals for the design of the CES consistent with the aforementioned policy directives. The Commission required the Staff White Paper to include:

- How the CES aligns with and contributes to the achievement of REV objective and principles;
- Best practices in the region and nationally;
- Methods to determine the nature of the obligation of the mandate;
- Methods to achieve and enforce compliance with the mandate;

[11] The Commission's proceedings covering REV and CEF include Case 14-M-0101 and Case 14-M-0094.

[12] NYS Department of Public Service. Final Generic Environmental Impact Statement In CASE 14-M-0101- Reforming the Energy Vision and CASE 14-M-0094- Clean Energy Fund. Prepared by Industrial Economics, Incorporated and Optimal Energy, Incorporated. 6 February 2015. Accessed 14 January 2016: file:///G:/Share/NYSERDA%20Flexible%20Energy%20Contract/06%20TWO%204%20-%20Clean%20Energy%20EIS/Supplemental%20EIS/%7B9E35CB6F-9B7D-4220-9CD4-B254C0FB4551%7D.pdf.

[13] Case 15-E-0302, Order Expanding Scope of Proceeding and Seeking Comments (January 21, 2016) at 5-6.

- The role of energy efficiency;
- Assuring adequacy of supply of clean energy including methods to incent the development of in-state resources;
- The cost to consumers and the role of complementary state programs to drive down the cost of compliance that is ultimately bore by consumers;
- Equitable allocation of the obligations and costs of the CES mandate on all classes of consumers, particularly low income customers; and
- Structure and operation of the retail energy market.

The January 21 order envisions the CES as a mechanism to ensure that both the 50 by 30 goal and the maintenance of qualifying upstate nuclear resources are achieved. The Commission describes the CES as a program that will complement the Commission's other clean energy efforts.[14]

On January 25, the Staff White Paper was issued describing potential approaches to the design and implementation of the proposed CES for Commission consideration. An overview of the proposed framework is captured in **Exhibit 1-1**.

The possible impacts of the decision to enforce the 50 by 30 goal and to provide financial support to qualifying nuclear facilities through a CES were not identified and assessed in the 2015 GEIS. As required by the New York State Environmental Quality Act (SEQRA), this supplemental EIS builds on and expands the analyses presented in the 2015 GEIS. It identifies the potential environmental impacts of the proposed CES and examines the interplay between the goals and impacts of the CES and the anticipated outcomes of the REV and CEF proceedings previously described in the 2015 GEIS.

While the REV and CEF initiatives have many components and objectives, their primary goal is the transformation of the State's energy demand profile through the introduction of innovative technologies, distribution-level markets and resources, energy efficiency, and the expansion of clean energy resources on both the distribution and the bulk electric systems. In contrast, the proposed CES seeks to modify the supply that will be available to meet that demand. The proposed CES will also ensure that existing emissions-free supply sources are maintained even as the renewable supply portfolio evolves to meet the 50 by 30 goal. Thus, the objectives of the proposed CES will complement the outcomes anticipated for both the REV and CEF proceedings.

To identify and analyze the impacts of the proposed CES in the context of REV and the CEF, this supplemental EIS incorporates the 2015 GEIS. The following chapters reference the 2015 GEIS where applicable and focus on the differential impacts that may result from the Commission's development and implementation of the CES. This chapter is organized into six parts.

- Section 1.1 describes the purpose of New York's SEQRA and the requirement to prepare a Supplemental Environmental Impact Statement (EIS) for an action or plan which changes the scope of the previously assessed action.

[14] *Ibid* at 6.

- Sections 1.2 and 1.3 provide an overview of the public need, purpose, and actions proposed by the Staff White Paper that recommends specific CES Renewable Energy Tiers, and CES Nuclear Tier, respectively.
- Section 1.4 provides a summary of the public benefits anticipated from the successful implementation of the CES.
- Section 1.5 discusses the location of the proposed action.
- Section 1.6 concludes the chapter with a brief overview of the other energy programs that are intertwined with the CES.

## 1.1 COMPLIANCE WITH THE NEW YORK STATE ENVIRONMENTAL QUALITY REVIEW ACT

New York's SEQRA, which is contained in Article 8 of the Environmental Conservation Law, declares that it is the State's policy to:

> "… encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and enhance human and community resources; and to enrich the understanding of ecological systems, natural, human and community resources important to the people of the state."

The basic purpose of SEQRA is to incorporate the consideration of environmental factors into the existing planning, review, and decision-making processes of State, regional, and local government agencies at the earliest possible time. Consistent with this intent, SEQRA requires agencies to identify the adverse impacts that could result from their actions and to consider how those impacts might be avoided or minimized. If the regulatory agency determines that an action may have a significant adverse impact, then the agency must prepare an EIS.

### Preparation of a Supplemental Environmental Impact Statement

The 2015 GEIS was prepared in compliance with SEQRA to address the environmental impacts of the REV and CEF initiatives. For proposed actions such as the decision to develop a CES, which was not evaluated in the earlier study, 6 NYCRR §617.9(a)(7) indicates that a supplemental EIS is the appropriate mechanism for assessing environmental impacts.

## 1.2 CLEAN ENERGY STANDARD: RENEWABLE ENERGY TIERS

Consistent with 6 NYCRR §617.9(b)(5)(1), this section provides a concise description of: (1) the need and purpose of the proposed CES for renewable energy supply, and (2) the actions proposed to implement it.

### The CES Framework

The Staff White Paper addresses four principal policy objectives of the CES: (1) increase renewable electricity supply to achieve the 50 by 30 goal, (2) support construction of new renewable generation in New York State, (3) prevent premature closure of upstate nuclear facilities, and (4) promote the progress of REV market objectives.

**Exhibit 1-1** provides the elements of a CES design framework in consideration of the above objectives.

**EXHIBIT 1-1. PROPOSED CES FRAMEWORK[15]**

(i) All electric retail load serving entities (LSEs) share the obligation of the CES mandate in proportion to their annual retail electricity sales. This includes 'jurisdictional' LSEs, subject to the Commission's authority and all 'non-jurisdictional' LSEs (the New York Power Authority, or NYPA, and the Long Island Power Authority, or LIPA);

(ii) Establishment of CES tiers to support a growing quantity of new renewable generation, as well as continued contribution of existing renewables and zero emission resources;

(iii) Specification of eligibility requirements for resources within each tier (Resource type, Vintage, Geographic, Other);

(iv) For each tier, a firm set of requirements through 2020, with targets through 2030 to be developed in an implementation plan;

(v) Demonstration of compliance through the use of tradable renewable energy credits (RECs) for renewable energy purchases, and zero emission credits (ZECs) for qualified nuclear generation purchases, both as created and tracked within a newly designed New York Generation Attribute Tracking System (NYGATS);

(vi) Use of an alternative compliance payment mechanism for each CES tier to cap REC and ZEC prices and provide for a flexible alternative means of compliance;

(vii) Competitive long-term procurements by NYSERDA and utilities, as needed, for specific tiers to support project financing, reduce compliance costs, and provide both generators and customers with price stability;

(viii) A method for disposition of procured RECs and ZECs;

(ix) Triennial program assessments by the Commission; and

(x) Development of an Implementation Plan.

### CES: Renewable Supply

To provide a basis for discussion of the potential impacts of the CES, the SEIS must define the amounts and types of new renewable generation that may be needed to meet the CES goal. The analysis presented here evaluates a portfolio of large-scale renewables needed to meet the 50 by 30 target that was developed using a large-scale renewable supply curve model. The model addresses several types of renewable resources individually, including multiple size categories of land-based wind, utility-scale solar, upgraded hydroelectric facilities, retrofitting non-powered dams, off-shore wind, anaerobic digestion, and additional biomass-source generation.[16] The results of the modeling, as a base case, suggest that a total LSR increment of 28,700 GWh will be

[15] NYS DPS. 2016. Staff White Paper on Clean Energy Standard. CASE 15-E-0302. January 25.

[16] See Appendix C of this SEIS for a detailed discussion from the white paper concerning the renewable energy resources that will be eligible to meet the program requirements.

needed to meet the 50 by 30 goal. As an alternative, high-end case, this SEIS also considers the potential impacts if 39,900 GWH of LSR are necessary to meet the goal.

Considering these implementation targets, the January 25 white paper proposes the development of multiple renewable resource tiers for renewable energy credits:

- Tier 1 New Renewable Resources;
- Tier 2 Existing Renewable Resources;
    - Tier 2A Competitive Sub-Tier; and
    - Tier 2B Non-competitive Sub-Tier.[17]

Tier 1 would be dedicated to new eligible energy facilities with no limitations on facility size. Tier 2 aims to support continued contribution of currently operating resources. Tier 2A aims to provide sufficient revenue to attract supply for which New York competes in neighboring markets. Tier 2B would provide sufficient revenue to maintain the renewable baseline electricity generation from facilities that do not compete with markets outside of the New York control area.[18]

#### Renewable Energy Tiers: Need and Purpose

The 2015 New York State Energy Plan (NYSEP) sets forth the State's long-term goal to provide 50 percent of its electricity from renewable resources by 2030. The plan also proposes that the State achieve, by 2030, a 40 percent reduction in GHG emissions from 1990 levels, and a 24 percent decrease in energy consumption in buildings. These SEP goals respond to the need to lower greenhouse gas emission.

#### Proposed Actions: Renewable Energy Tiers

Initiatives contemplated under the renewable energy portion of the 2015 NYSEP include:

- Large-scale renewables (LSR) strategy pairs LSR with dynamic distributed energy resources (DER) such as demand response, and energy storage.
- NY-Sun Initiative provides long-term support to the state solar industry;
- K-Solar (closely tied to Community Solar NY) provides tools, technical expertise, and access to K-12 schools to install solar;
- Shared Renewables develops community net metering policies to provide customers with opportunity to share local, renewable projects;
- Offshore Wind (OSW) Initiative promotes programmatic and regulatory efforts to create an ecosystem conducive for at-scale OSW projects;
- Renewable Heat NY/Other Renewable Thermal Technologies provides support to residential and commercial customers for advanced wood/pellet equipment development and wood/pellet production, storage, and use;

[17] NYS DPS. 2016. Staff White Paper on Clean Energy Standard. CASE 15-E-0302. January 25.

[18] NYS DPS. 2016. Staff White Paper on Clean Energy Standard. CASE 15-E-0302. January 25.

- Clean Organic Waste Management supports development of water resource recovery facilities that deliver operational and energy productivity gains, and additional revenue streams; and
- Sustainable Fuel Production aims to develop, comprehensive, sustainable, low-carbon fuel production using in-state agricultural and organic waste feedstock.

The CES will establish a mandate that the 50 by 30 goal be met using these and other renewable technologies, thereby providing additional incentives to develop both distributed energy renewable resources and grid-connected renewable energy supply.

## 1.3 CLEAN ENERGY STANDARD: NUCLEAR TIER

Consistent with 6 NYCRR §617.9(b)(5)(1), this section provides a concise description of: (1) the need and purpose of the proposed CES nuclear tier (i.e., Tier 3), and (2) the actions proposed to achieve this CES objective.

### Nuclear Tier Need and Purpose

Historically, northeast energy markets have relied on nuclear electricity generation to meet the region's minimum electricity needs. However, the growth in natural gas availability has increased competition in the wholesale electricity market, pricing out some nuclear operators that face increasing costs. This problem is especially relevant to upstate nuclear plants which rely on energy revenue margins to maintain their financial viability. These current market conditions have resulted in the closure, or announced closure of upstate New York and New England nuclear facilities. The Vermont Yankee Nuclear Power Station closed in 2014 and two upstate NY facilities have announced their intent to retire. The R.E. Ginna and James A. FitzPatrick nuclear plants announced plans to close in 2017 based, in part, on the inability of the wholesale electric market to value zero emission energy generation.[19,20] The Nine Mile Point nuclear facility also faces these same economic pressures. Combined, these three upstate nuclear facilities provide approximately 16 percent of the State's energy.[21] If the upstate power plants follow-through with their intent to close in the near term, New York would need to procure more of its electricity from fossil fuel generating plants, likely natural gas plants, which would result in increases in carbon dioxide, nitrogen oxide, and other pollutants.[22]

Overall, the loss of upstate nuclear facilities would threaten emissions reductions achieved through the State's renewable energy programs, diminish fuel diversity, increase price volatility,

[19] ISO New England. 2015 Regional Electricity Outlook. 15 January 2015. Accessed January 15, 2016: http://www.iso-ne.com/static-assets/documents/2015/02/2015_reo.pdf.

[20] Case 14-E-0270, Petition Requesting Initiation of a Proceeding to Examine a Proposal for Continued Operation of the R.E. Ginna Nuclear Power Plant, LLC., Petition Requesting Initiation of a Proceeding to Examine a Proposal for Continued Operation (filed July 11, 2014). On November 2, 2015, Entergy announced plans to close the FitzPatrick Nuclear Power Plant. http://www.prnewswire.com/news-releases/entergy-to-closejames-a-fitzpatrick-nuclear-power-plant-in-central-new-york-300170100.html

[21] NYS DPS. 2016. Staff White Paper on Clean Energy Standard. CASE 15-E-0302. January 25.

[22] NYS DPS. 2016. Staff White Paper on Clean Energy Standard. CASE 15-E-0302. January 25.

and harm host communities. Support for these facilities 3 through a CES mechanism reduces these threats.

#### Nuclear Tier Proposed Actions

The Staff White Paper proposes a separate nuclear tier (Tier 3) to ensure that emissions-free power from currently operating nuclear generating plants remains available in New York to meet its environmental and energy policy goals. The nuclear tier under the CES would provide financial support to eligible licensed nuclear facilities to continue operations "as a short-term bridge while the State's energy economy transitions to the scale of renewable energy promised by the 50 by 30 goal."[23] The Staff White Paper proposes the use of nuclear zero emission credits (ZECs) which would provide support for licensed nuclear power plants that face financial difficulties. Under the proposal, qualifying nuclear facilities must:

- Have an in-service date of January 1, 2015 or earlier;
- Be facing financial difficulty (as determined by DPS examination of facility records);
- Operating with a fully renewed license by the NRC until 2029 or beyond;[24] and
- Operating consistent with any other required federal and state authorizations.

All load serving entities (LSEs) will be required to procure ZECs from qualifying resources such as through direct purchases, purchases through a ZEC marketplace, or bilateral transactions (e.g., bundled energy and ZEC arrangements).

### 1.4 PUBLIC BENEFITS OF THE CES

Consistent with 6 NYCRR §617.9(b)(5)(1), this section provides a concise description of the public benefits anticipated from the proposed actions described in Sections 1.2 and 1.3 for the CES.

The public benefits of pursuing the CES should be considered in comparison to the cost of the "business as usual" scenario in which current programs (see **Section 1.6**) are maintained and the electricity system develops in reasonably anticipated ways. **Section 1.4** of the 2015 GEIS discusses the anticipated public benefits of the REV and CEF. The CES would be expected to strengthen the benefits of the REV and CEF as there will be a mandate to incorporate additional renewable sources, making achievement of the REV and CEF benefits more likely. However, to the extent that the CES shifts new renewable development from distributed resources to large-scale resources, some of the anticipated public benefits of the REV and CEF, such as reduced line losses, or avoided transmission and distribution investment, may be reduced.

Depending on the mechanisms employed, increasing the supply of renewable resources to meet 50 percent of New York State demand by 2030 under the CES is expected to result in the following types of public benefits:

- ***Public health benefits*** due to avoided emissions of GHG and criteria air pollutants. As increased use of renewable energy sources leads to improved air quality, society benefits

[23] Case 15-E-0302, Order Expanding Scope of Proceeding and Seeking Comments (January 21, 2016) at 3.

[24] Eligibility for facilities will expire upon expiration of its current license term.

from reduced health impacts and increased employee productivity. For example, as air quality improves, state health care expenditures for treatment of asthma, acute bronchitis, and respiratory conditions may be reduced.

- ***Climate change benefits*** related to the reduction in the State's reliance on fossil fuel energy. As discussed in **Chapter 3** of the 2015 GEIS, climate change is expected to increase air temperatures which will in turn intensify water cycles through increased evaporation and precipitation. In New York, more intense water cycles are expected to lead to increases in local flash and coastal flooding, increases in the frequency and intensity of extreme precipitation and extreme heat events, longer summer dry periods, lower summer flows in large rivers, lower groundwater tables, and higher river and in-stream water temperatures.[25]
- ***Ecosystem services benefits*** due to reduced impacts on land and water uses, as renewable sources are incorporated into New York's energy supply portfolio in lieu of investment in fossil fuel sources. For example, "wind and solar energy require essentially no water to operate, and thus do not pollute water resources or strain supply by competing with agriculture, drinking water systems, or other important water needs." [26]
- ***Fuel diversity benefits***. Measures proposed under the CES 50 by 30 goal and CES nuclear maintenance program will likely serve to maintain fuel diversity. The addition of new renewable electricity supplies will also limit the State's reliance on natural gas, thereby contributing to this objective.
- ***Economic development benefits.*** CES is expected to create regional economic benefits through New York State. These benefits can take the form of increased manufacturing of renewable energy equipment; jobs and revenue creation, and the effects of spending throughout local economies. Construction of additional LSR energy resources to meet the CES 50 by 30 goal may provide such regional economic benefits. A recent analysis found that for every incentive dollar spent by New York to support the construction of new LSR facilities, the state realizes approximately $3 of direct investment associated with project spending over the project's lifetime. [27] To the extent the CES nuclear maintenance program enables continued operation of facilities that would otherwise retire, the action would result in benefits to the regional economy in the form of stable wages, jobs, and tax revenues.

[25] Rosenzweig, C., W. Solecki, A. DeGaetano, M. O'Grady, S. Hassol, P. Grahborn (Eds). 2011. Responding to Climate Change in New York State. Synthesis Report prepared for NYSERDA. Accessed on September 10, 2014 at: http://www.nyserda.ny.gov/-/media/Files/Publications/Research/Environmental/EMEP/climaid/ClimAID-synthesisreport.pdf.

[26] Union of Concerned Scientists. Benefits of Renewable Energy Use. Accessed on January 26, 2015 at: http://www.ucsusa.org/clean_energy/our-energy-choices/renewable-energy/public-benefits-of-renewable.html#.VqfE4fkrL0M.

[27] NYSERDA. 2013. "NYSERDA Renewable Portfolio Standard Main Tier 2013 Program Review, Final Report," September 5. http://www.nyserda.ny.gov/-/ media/Files/EDPPP/Energy-and-Environmental-Markets/RPS/RPS-Documents/2013/2013-RPS-investments-NYS.pdf

## 1.5 LOCATION OF ACTION

The CES in conjunction with the REV and CEF is intended to transform the ways in which energy is valued, generated, distributed, managed, and used in meeting New York's energy demand. As such, the location of the action is the entire State of New York. Subsequent chapters use the State of New York as the analytic study area.

## 1.6 RELATIONSHIPS TO OTHER PLANS AND PROGRAMS

The CES, which will be the successor program to the Renewable Portfolio Standard Program (RPS), will interact with a number of additional energy-related programs and plans. Many of these programs are described in the 2015 State Energy Plan and include, for example, the many initiatives contemplated under the REV regulatory docket and NYSERDA's CEF, such as the New York Green Bank and New York Sun.

# CHAPTER 2 | THE ELECTRIC INDUSTRY IN NEW YORK STATE

Consistent with 6 NYCRR §617.9(b)(5)(ii) of the SEQRA, this chapter provides baseline information on the State's current energy industry, which the CES, in conjunction with the activities contemplated under the REV and CEF proceedings, is intended to transform. The background information presented in this chapter is provided to assist with understanding the impacts of the proposed CES actions and, together with **Chapter 3,** describes the baseline against which **Chapters 5 through 10** evaluate and compare the impacts of the proposed CES on the energy industry in New York.

This chapter incorporates by reference the information presented in Chapter 2 of the 2015 GEIS. Specifically, this chapter is organized into two parts, reflecting select updates on the information provided on New York's electric industry since the 2015 GEIS was published:

- Section 2.1: Trends in Electricity Demand;
- Section 2.2: The Present Electric System.

Updates presented in the aforementioned sections are limited to and focused on relevant factors that may assist in understanding the likely impacts of the Commission's development and implementation of the CES.

## 2.1 TRENDS IN ELECTRICITY DEMAND

In looking at national trends in energy consumption, overall U.S. electricity remained relatively flat from 2013 to 2014, as compared to consecutive decreases in electricity demand during the prior three years.[28] In New York annual electric use dropped 2.1 percent between 2013 and 2014.[29] **Exhibit 2-1** below presents historical trends in electric energy demand in New York State. Over the past fifteen years, New York's electric energy demand grew by an average annual rate of 0.21 percent.[30] As noted in the 2015 GEIS, while average demand has been growing over the past ten years, total energy use across all sectors fell by an average of 0.8 percent per year between 2000 and 2012 in New York.[31]

[28] When looking at national trends in energy consumption, the 2015 GEIS noted that U.S. electricity demand fell for the third consecutive year, dropping by 0.1 percent between 2012 and 2013.

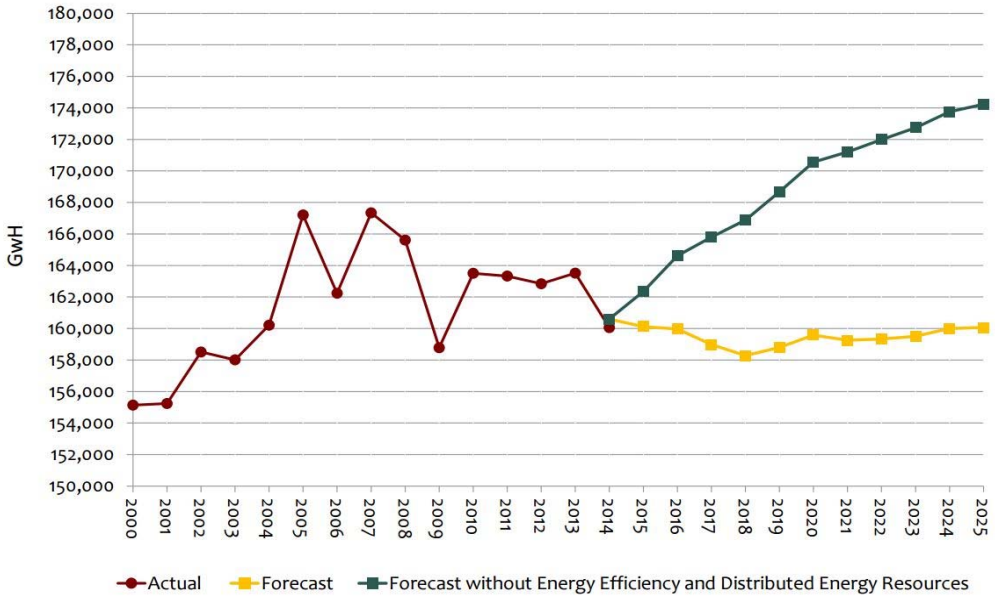
[29] NYISO. 2015. Power Trends 2015: Rightsizing the Grid. Accessed January 14, 2016 at: http://www.nyiso.com/public/webdocs/media_room/press_releases/2015/Child_PowerTrends_2015/ptrends2015_FINAL.pdf.

[30] *Ibid*.

[31] New York State Energy Planning Board. 2014. New York State Energy Plan. Volume 2: End-Use Energy. Accessed September 14, 2014 at: http://energyplan.ny.gov/-/media/nysenergyplan/2014stateenergyplan-documents/2014-draft-nysep-vol2-enduse.pdf.

In 2013, New York State continues to rank eighth in terms of total energy consumption.[32] The State also continues to remain among the lowest in the nation in terms of energy consumption per capita; in 2013, New York Stated was tied with Rhode Island in terms of energy consumption per capita.[33] The state's low per capita energy consumption is due in part to its widely-used mass transportation systems in the New York metropolitan area; according to the EIA, more than half of New York residents (and more than half of New York City workers) use public transit, a rate five times the U.S. average.[34]

### EXHIBIT 2-1. NEW YORK STATE ELECTRIC ENERGY USAGE TRENDS, ACTUAL AND FORECAST




Source: NYISO. 2015. Power Trends 2015: Rightsizing the Grid. Page 11.

In addition to annual electric energy demand, which provides a measure of overall electricity consumption, it is important to consider annual peak demand, which measures the maximum amount of electricity a system is required to deliver, as discussed above. While peak demand represents only a small fraction of a year's overall power consumption, it is a significant system factor because reliability standards are based on projected peak demand. The 2014 Peak Demand was 12 percent below the 2013 peak demand due to a milder than typical summer. Despite the lower than expected 2014 peak demand, peak demand is expected to continue to grow over time; the most recent forecast estimates an annual 0.48 percent each year between 2015 and 2025.[35] As

[32] EIA. Rankings: Total Energy Consumed per Capita, 2013 (million Btu). Accessed January 18, 2016 at: https://www.eia.gov/state/seds/data.cfm?incfile=/state/seds/sep_sum/html/rank_use_gdp.html.

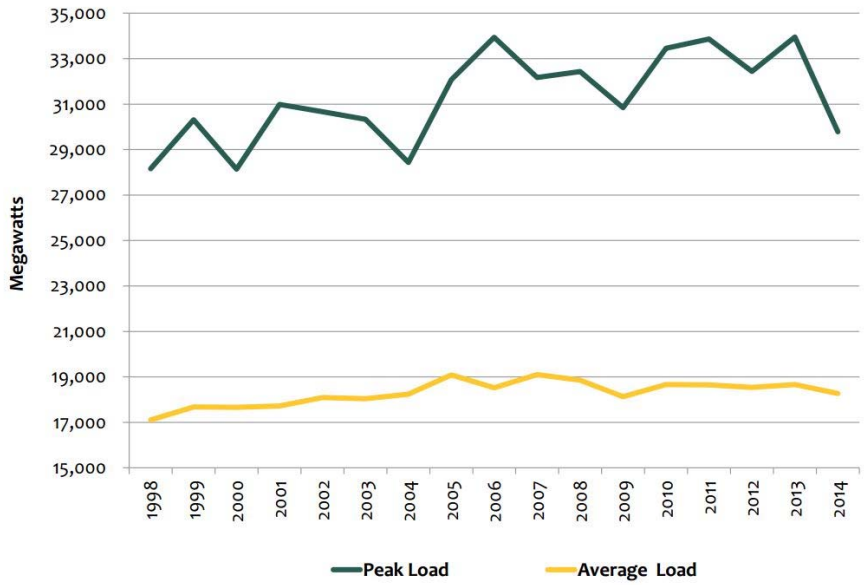
[33] EIA. Rankings: Total Energy Consumed per Capita, 2013 (million Btu). Accessed January 18, 2016 at: https://www.eia.gov/state/rankings/.

[34] EIA. State Energy Data System. Last Updated: July 167, 2015. Accessed January 18, 2016 at: http://www.eia.gov/state/print.cfm?sid=NY.

[35] *Ibid*.

illustrated in **Exhibit 2-2**, peak demand is increasing as average demand remains relatively constant.

**EXHIBIT 2-2. PEAK VERSUS AVERAGE DEMAND IN NEW YORK STATE: 1998-2014**




Source: NYISO. 2015. Power Trends 2015: Rightsizing the Grid. p. 13.

### Geographical Distribution of Electricity Demand

As discussed in the 2015 GEIS and shown in **Exhibit 2-3**, electricity consumption and demand in New York State varies significantly between upstate and downstate areas. In 2014, downstate areas, including New York Control Area (NYCA) load zones H-K, continue to represent more than half of the State's electricity usage. Trends in peak summer demand in New York City and Long Island remain the same in 2014 as 2013, with 2014 peak summer demand exceeding that of the rest of the State.

## 2.2 THE PRESENT ELECTRIC SYSTEM

New York State's electric system consists of three components: generation, transmission and distribution. In this section, we present limited updates on the State's electric generation since the 2015 GEIS. The information presented in the 2015 GEIS on the State's transmission and distribution systems remain largely unchanged and are therefore incorporated by reference in its entirety.

### EXHIBIT 2-3. 2014 ELECTRICITY DEMAND, BY NEW YORK CONTROL AREA LOAD ZONE

| STATE SUB-AREA | NYCA LOAD ZONE | 2014 ANNUAL ENERGY USAGE (GWh) | PEAK DEMAND (MW) | |
|---|---|---|---|---|
| | | | SUMMER | WINTER |
| Upstate | A (West) | 15,890 | 2,227 | 2,419 |
| | B (Genesee) | 9,902 | 1,617 | 1,617 |
| | C (Central) | 16,347 | 2,574 | 2,689 |
| | D (North) | 4,835 | 527 | 725 |
| | E (Mohawk Valley) | 8,158 | 1,267 | 1,339 |
| | F (Capital) | 12,010 | 2,033 | 1,925 |
| | G (Hudson Valley) | 9,834 | 2,036 | 1,556 |
| Downstate | H (Millwood) | 2,886 | 584 | 537 |
| | I (Dunwoodie) | 6,088 | 1,333 | 954 |
| | J (New York City) | 52,541 | 10,567 | 7,481 |
| | K (Long Island) | 21,568 | 5,017 | 3,406 |
| **Upstate Subtotal** | | **67,142** | **12,281** | **12,270** |
| **Downstate Subtotal** | | **83,083** | **17,501** | **12,378** |
| **TOTAL** | | **160,059** | **29,782** | **24,648** |

Source: NYISO, 2015 Load & Capacity Data "Gold Book." Page 22.

#### Existing Power Plants and Capacity

According to NYISO, for the summer of 2015, power resources available to serve New York State totaled 41,610 MW.[36, 37] While the 2015 total is 312 MW higher than the previous year (41,298 MW), the summer 2015 total resource capability remained above the projected peak demand of 33,567 MW.[38] As of September 2015, New York State ranked seventh in the country for total net electricity generation with a total of 12,005 MWh, up from one year prior when New York State ranked ninth in the nation with a total net electricity generation of 9,685 MWh.[39]

**Exhibit 2-4** details New York State's power generation and capacity by fuel type. The mix of fuel types remains relatively steady since 2013, with the majority of the state's total capacity (based on 2015 summer capability) and electric generation coming from three fuel types: dual-fuel (gas and oil) facilities, nuclear (producing just under 1/3), and hydropower.[40]

[36] NYISO. 2015 Load & Capacity Data "Gold Book." April 2015.

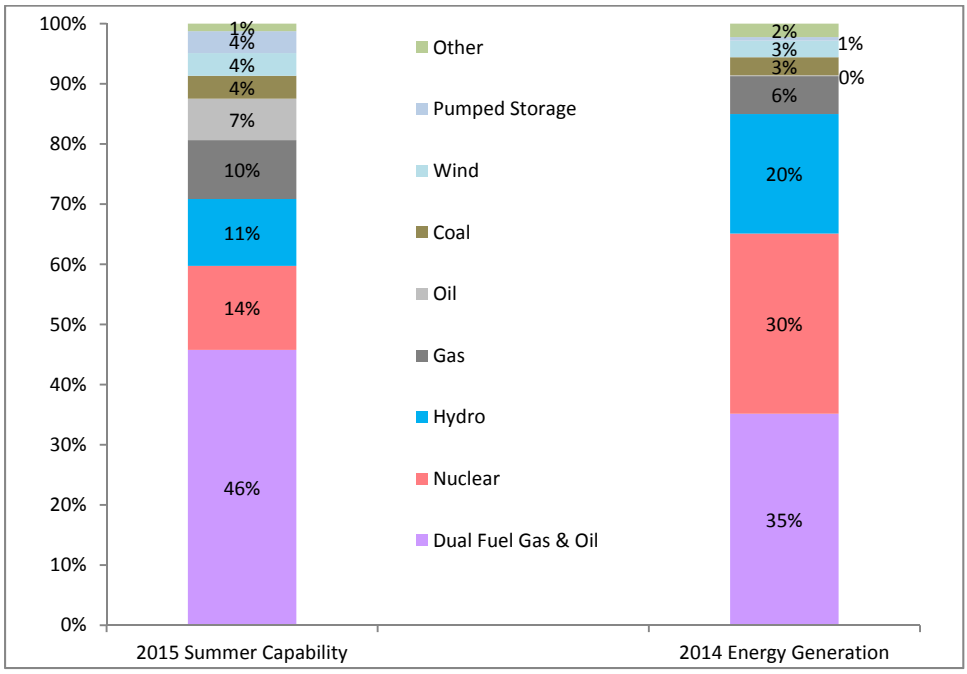
[37] NYISO. 2015. Power Trends 2015: Rightsizing the Grid. Accessed January 14, 2016 at: http://www.nyiso.com/public/webdocs/media_room/press_releases/2015/Child_PowerTrends_2015/ptrends2015_FINAL.pdf. Includes installed generating capacity of 39,039 MW from in-state power projects, projected levels of demand response participation totaling 1,124 MW, and power available for imports from neighboring electric systems of 1,446 MW.

[38] Ibid.

[39] EIA. New York State Profile and Energy Estimates: Rankings: Total Net Electricity Generation September 2015. Accessed January 15, 2016 at: http://www.eia.gov/state/rankings/?sid=NY#series/51.

[40] NYISO. 2015. Power Trends 2015: Rightsizing the Grid. Accessed January 14, 2016 at: http://www.nyiso.com/public/webdocs/media_room/press_releases/2015/Child_PowerTrends_2015/ptrends2015_FINAL.pdf.

### EXHIBIT 2-4. NEW YORK CAPABILITY AND GENERATION BY FUEL TYPE




Source: NYISO. 2015 Load & Capacity Data 'Gold Book.' April 2015. Pages 60-61.

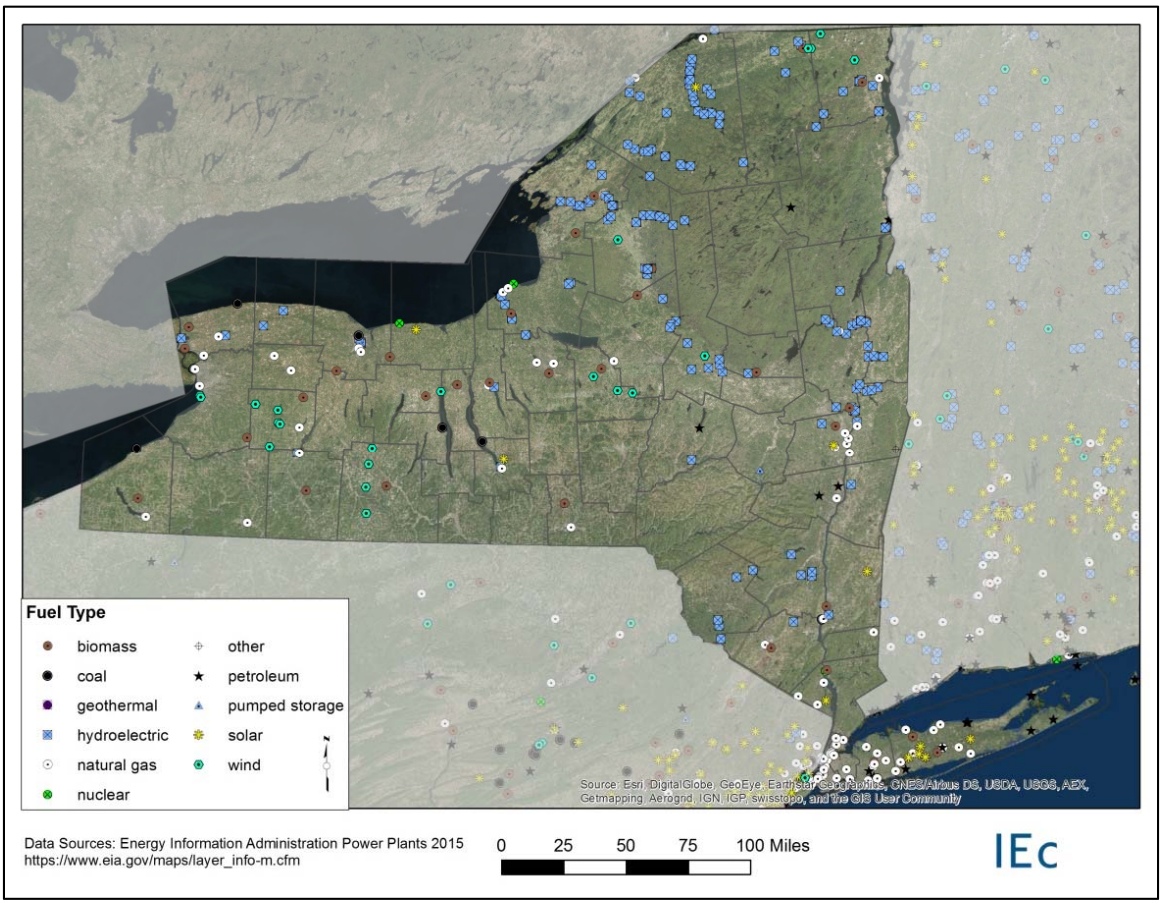
Note: Percentages represent 2015 NYCA summer capability and 2014 NYCA generation.

As discussed in the 2015 GEIS, the mix of generation resources is less diverse when viewed at the regional level. As illustrated in **Exhibits 2-5, 2-6 and 2-7**, an ongoing challenge of the State's supply is a geographical misalignment between the location of the majority of the State's electric demand in downstate areas, as compared to the upstate location of most of the State's power supplies (and particularly the sources with historically lower operating costs, such as hydroelectricity and nuclear power).

Consistent with the geographic distribution of the State's electricity demand, the majority of new generation in 2014 was primarily located in New York City and the Hudson Valley. In 2014, 1,242 MW of name plate capacity was added, of which 95 percent occurred in Zone G (Hudson Valley) and Zone J (New York City), where 912 MW and 266 MW were added, respectively. An additional 64 MW as also added in Central New York (Zone C) in 2014.[41]

[41] NYISO. 2015. Power Trends 2015: Rightsizing the Grid. Accessed January 14, 2016 at: http://www.nyiso.com/public/webdocs/media_room/press_releases/2015/Child_PowerTrends_2015/ptrends2015_FINAL.pdf.

## EXHIBIT 2-5. LOCATION OF GENERATION BY FUEL TYPE, 2012-2013

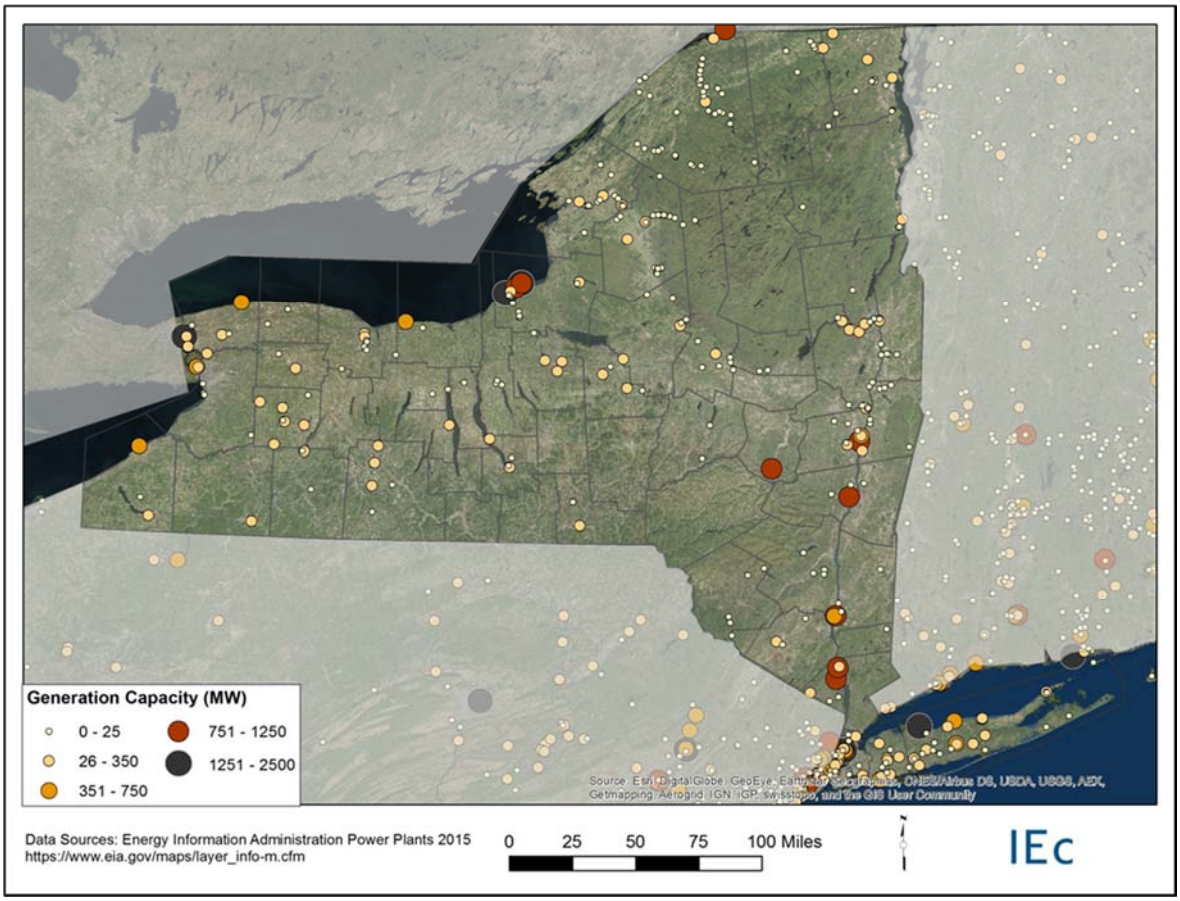


## EXHIBIT 2-6. 2015 INSTALLED GENERATION CAPACITY BY NYCA LOAD ZONE

| STATE SUB-AREA | NYCA LOAD ZONE | INSTALLED CAPACITY (MW) | |
|---|---|---|---|
| | | SUMMER | WINTER |
| Upstate | A (West) | 4,493 | 4,530 |
| | B (Genesee) | 767 | 782 |
| | C (Central) | 6,651 | 6,933 |
| | D (North) | 1,620 | 1,636 |
| | E (Mohawk Valley) | 1,087 | 1,118 |
| | F (Capital) | 4,413 | 4,972 |
| | G (Hudson Valley) | 2,649 | 2,618 |
| Downstate | H (Millwood) | 2,107 | 2,132 |
| | I (Dunwoodie) | - | - |
| | J (New York City) | 9,597 | 10,560 |
| | K (Long Island) | 5,281 | 5,732 |
| **Upstate Subtotal** | | **21,680** | **22,648** |
| **Downstate Subtotal** | | **16,985** | **18,114** |
| **TOTAL** | | **38,665** | **41,013** |

Source: NYISO. 2015 Load & Capacity Data "Gold Book." April. p. 58, 59. Accessed January 18, 2016 at: http://www.nyiso.com/public/webdocs/markets_operations/services/planning/Documents_and_Resources/Planning_Data_and_Reference_Docs/Data_and_Reference_Docs/2015%20Load%20and%20Capacity%20Data%20Report.pdf

### EXHIBIT 2-7. LOCATIONS OF GENERATING CAPACITY IN NEW YORK STATE

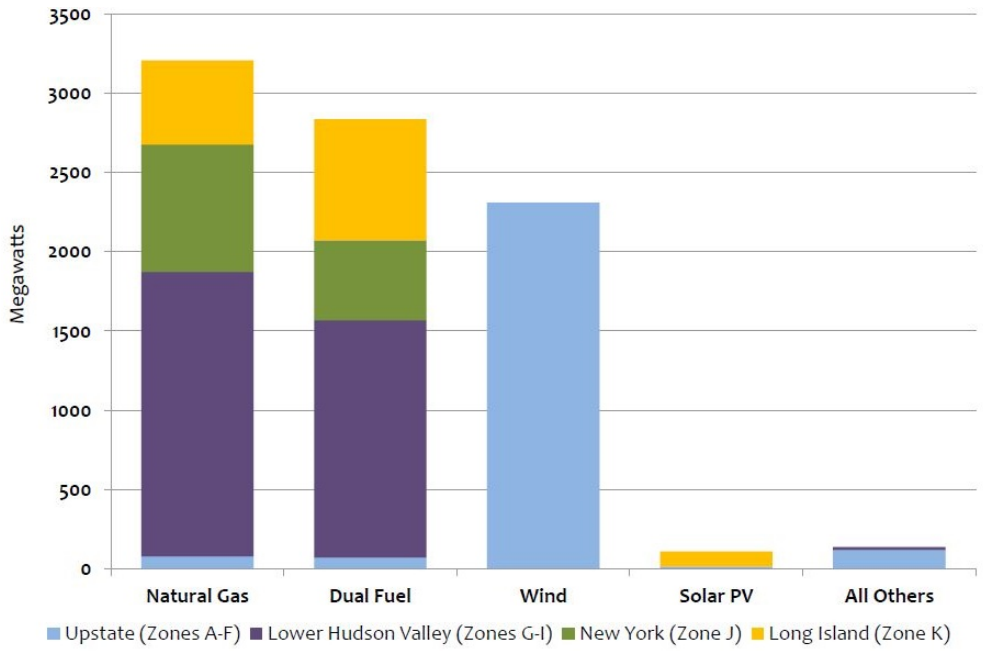



Natural gas continues to be the predominant fuel for new generation. In New York State, electricity generated by natural gas grew from about 53,000 GWh in 2012, to over 59,000 GWh in 2014.[42] This represents approximately 41% of annual demand. It is likely that natural gas will continue to dominate the State's fuel mix for the foreseeable future. As illustrated in **Exhibit 2-8**, as of March 2015, projects using natural gas (including dual-fuel) account for nearly three-quarters of all proposed generating capacity listed in the NYISO's interconnection queue. Wind power projects continue to make up another large segment, accounting for nearly one-quarter of all proposed generating capacity; a trend likely driven in part by the falling cost of wind energy as compared to other possible resources.[43]

[42] NYISO. 2015 Load & Capacity Data "Gold Book." April . p. 58, 59. Accessed January 18, 2016 at: http://www.nyiso.com/public/webdocs/markets_operations/services/planning/Documents_and_Resources/Planning_Data_and_Reference_Docs/Data_and_Reference_Docs/2015%20Load%20and%20Capacity%20Data%20Report.pdf. This includes dual fuel facilities and natural gas-only facilities.

[43] NYISO. 2015. Power Trends 2015: Rightsizing the Grid. Accessed January 14, 2016 at: http://www.nyiso.com/public/webdocs/media_room/press_releases/2015/Child_PowerTrends_2015/ptrends2015_FINAL.pdf..

### EXHIBIT 2-8. PROPOSED GENERATION BY FUEL TYPE (2015)




Source: NYISO. 2015. Power Trends 2015: Rightsizing the Grid.

#### Imports and Exports

To meet its electricity load demand, New York State imports a portion of its electricity from neighboring control areas. In 2013, New York imported an average 3,000 MW during peak hours, in 2014 State imports fell to just under 2,500 MW.[44]

New York State's main sources of imports are: Hydro-Québec, Ontario Hydro, New England, and the PJM system. In addition to these four primary interfaces, Long Island and New York City connect directly to PJM and New England across five controllable lines: the Cross Sound Cable, the 1385 Line, the Linden VFT Line, the HTP Line, and the Neptune Cable. **Exhibit 2-9** summarizes the average net scheduled imports from neighboring domestic and international control areas during peak hours (i.e., Monday through Friday, 6am to 10pm) in 2013 and 2014.[45] The vast majority of the State's imports continue to come from Canada, with almost 50 percent (as compared to 60 percent in 2013) of New York's net imports during peak hours provided solely by Hydro-Québec.

[44] Potomac Economics. 2014 State of the Market Report for the New York ISO Markets. May 2015. Developed by Accessed: January 17, 2016. http://www.nyiso.com/public/webdocs/markets_operations/documents/Studies_and_Reports/Reports/Market_Monitoring_Unit_Reports/2014/NYISO2014SOMReport__5-13-2015_Final.pdf

[45] Potomac Economics. 2014 State of the Market Report for the New York ISO Markets. May 2015. Developed by Accessed: January 17, 2016. http://www.nyiso.com/public/webdocs/markets_operations/documents/Studies_and_Reports/Reports/Market_Monitoring_Unit_Reports/2014/NYISO2014SOMReport__5-13-2015_Final.pdf

## EXHIBIT 2-9. AVERAGE NET IMPORTS (MW) FROM NEIGHBORING AREAS DURING PEAK HOURS

| YEAR | HYDRO QUEBEC | ONTARIO | PJM | NEW ENGLAND | CSC | NEPTUNE | 1385 | VFT | HTP | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| 2013 | 1,296 | 808 | 489 | -463 | 245 | 371 | 99 | 124 | 46 | 3,016 |
| 2014 | 1,152 | 768 | 352 | -702 | 173 | 528 | 56 | 43 | 68 | 2,438 |

Source: Potomac Economics. 2014 State of the Market Report for the New York ISO Markets. May 2015. Developed by Accessed: January 17, 2016. http://www.nyiso.com/public/webdocs/markets_operations/documents/Studies_and_Reports/Reports/Market_Monitoring_Unit_Reports/2014/NYISO2014SOMReport__5-13-2015_Final.pdf

# CHAPTER 3 | ENVIRONMENTAL SETTING

Consistent with 6 NYCRR §617.9(b)(5)(ii) of SEQRA, this chapter provides an overview of New York State's current environmental setting, defined under 6 NYCRR §617.2(l) as "the physical conditions that will be affected by [the] proposed action, including land, air, water, minerals, flora, fauna, noise, resources of agricultural, archeological, historic or aesthetic significance, existing patterns of population concentration, distribution or growth, existing community or neighborhood character, and human health." The environmental setting described in this chapter serves as a baseline for the existing environmental conditions against which Chapters 5 through 10 evaluate and compare the potential impacts of the CES.

This chapter incorporates by reference the information presented in Chapter 3 of the 2015 2015 GEIS. Specifically this chapter is organized into six parts, reflecting select updates on the information provided on New York's environmental setting since the 2015 GEIS was published:

- Section 3.1: Population;
- Section 3.2: Land Use;
- Section 3.3 Species Biodiversity;
- Section 3.4 Open Space;
- Section 3.5 Socioeconomics; and
- Section 3.6 Community Character.

Updates presented here are limited to and focused on relevant factors that may assist in understanding the likely impacts of the Commission's development and implementation of the CES.[46]

## 3.1 POPULATION[47]

New York remains the third most populous state, behind California and Texas.[48] In 2014, the U.S. Census estimated the population of New York at 19,746,227, an increase of approximately

[46] The full list of environmental resource areas addressed in 2015 2015 GEIS includes: physical geography, land use, water resources, climate and air quality, forest resources, critical environmental areas, species biodiversity, scenic and visual resources, open space, cultural and historic resources, waste management, noise and odor pollution, public health, growth and community character, transportation, socioeconomics and environmental justice.

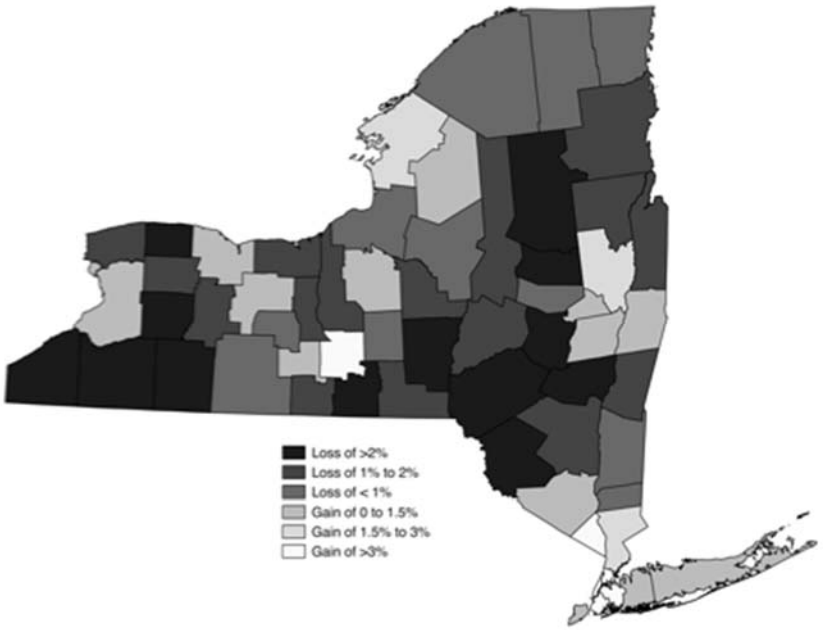
[47] U.S. Census Bureau. State & County Quick Facts – New York. Accessed August 14, 2014 at: http://quickfacts.census.gov/qfd/states/36000.html.

[48] U.S. Census Bureau. 2013. American Fact Finder. Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2013. 2013 Population Estimates. Accessed August 20, 2014 at: http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.

two percent as compared to 2010 population levels. Population levels and density vary substantially across the State. The five counties within New York City – Bronx, Kings, New York, Queens, and Richmond – are home to approximately 8.4 million residents and feature a population density of 27,546 per square mile. By comparison, the remainder of the State contains 11.2 million residents at a density of 240 persons per square mile.[49]

Population growth follows similar patterns as population levels and density. While the State saw an overall increase in population, much of that population growth is occurring in New York's downstate counties. Of the State's 62 counties, 22 counties experienced population growth between 2010 and 2014 (**Exhibit 3-1**). Population in all ten counties in the downstate area increased in 2014 compared to 2010, whereas only 12 counties in the remaining upstate areas experienced growth. The largest population losses (measured as a percentage of total population) occurred in three counties: Schoharie, Delaware, and Allegany.

**EXHIBIT 3-1. CHANGE IN ESTIMATED POPULATION BY NEW YORK COUNTY (2010-2014)**

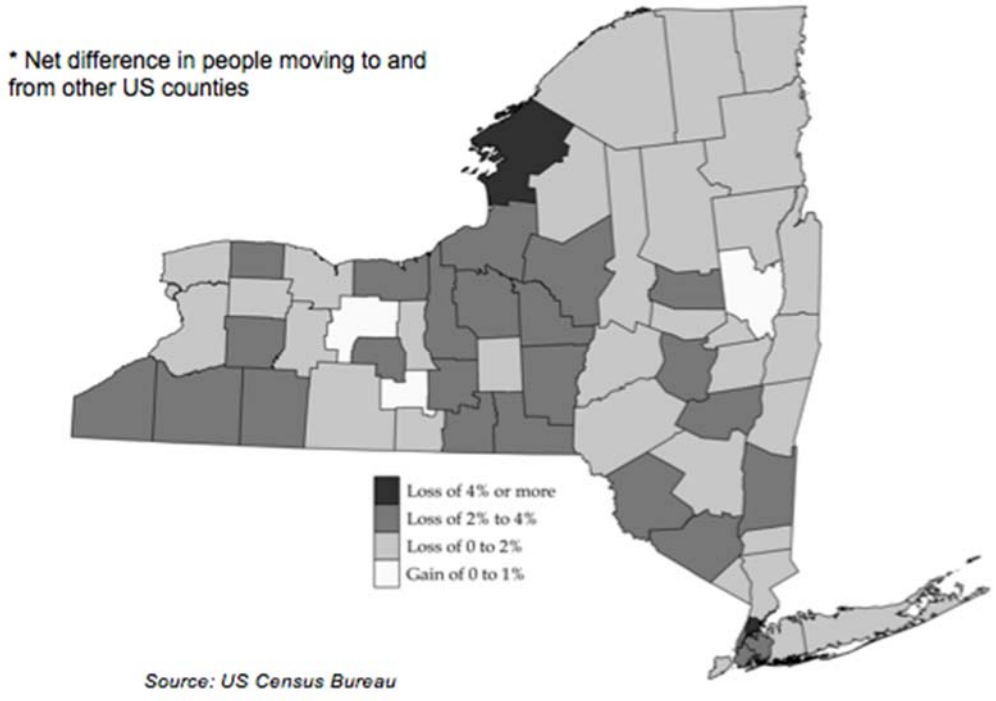



*Source: U.S. Census Bureau*

Changes in county level populations are largely driven by differences in domestic and foreign migration rates, where the former is a measure of the movement of residents outside of a county and the latter a measure of the movement of foreign immigrants into a county. Notably, all counties in New York State lost population due to domestic migration but such losses in downstate areas were offset by increases in foreign migration rates. **Exhibit 3-2** below illustrates changes in the domestic migration rate from 2010 to 2014.

[49] New York State Department of Health. 2013. Vital Statistics of New York State 2013: Table 2: Population, Land Area, and Population Density by County, New York State - 2013. Accessed January 20, 2014 at: http://www.health.ny.gov/statistics/vital_statistics/2013/table02.htm

### EXHIBIT 3-2. DOMESTIC MIGRATION RATES FOR NY COUNTIES (2010-2014)




## 3.2 LAND USE

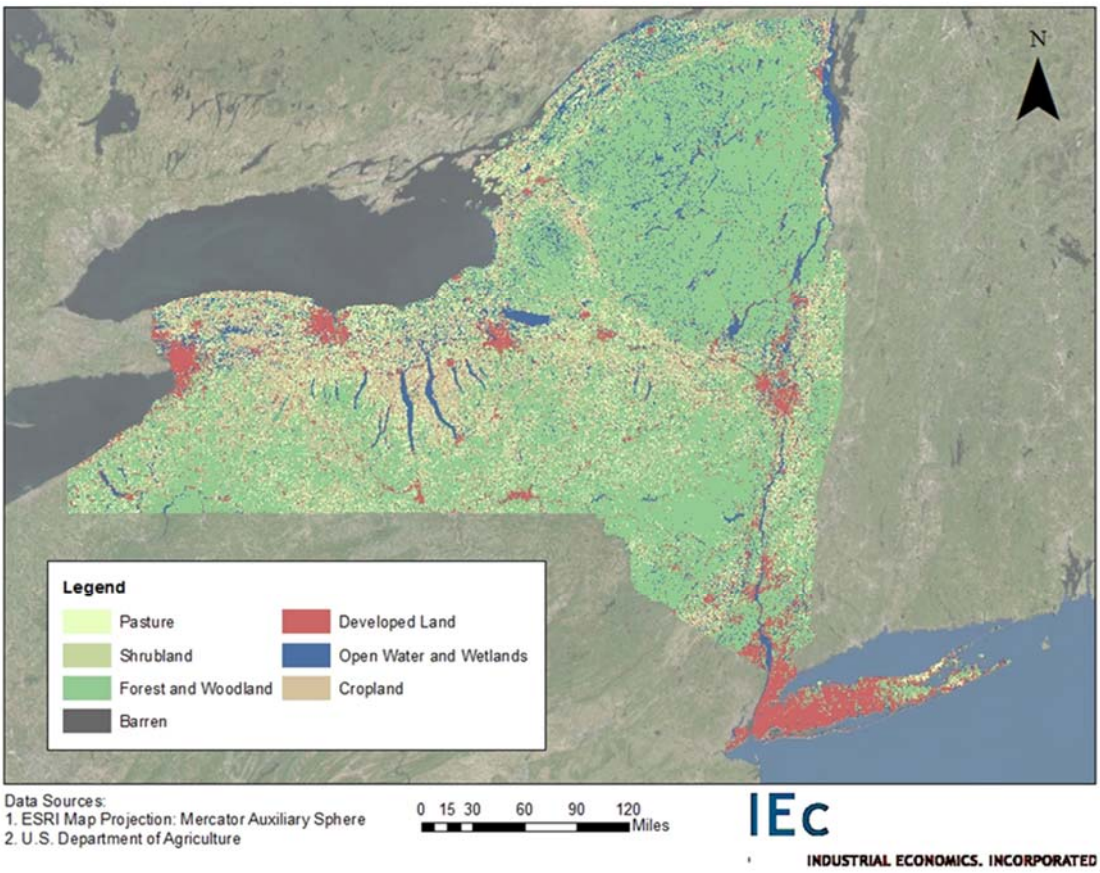
Land use is generally defined as the management and/or modification of the natural environment (or land) to support human uses. Existing land uses are largely a function of local topography but are also influenced by such factors as proximity to developed areas and transportation networks, past uses of the land, and general societal and economic trends. **Exhibits 3-3** and **3-4** provide an overview of major land uses across the State. As shown, more than half of New York State is forest and woodland (56 percent), while approximately 13 percent is active farmland and another 11 percent pasture. Developed areas, which consist primarily of residential, commercial, and industrial land uses, comprise approximately nine percent of the State.

### EXHIBIT 3-3. NEW YORK STATE LAND USE SUMMARY (2014)

| LAND TYPE | ACRES | PERCENT OF TOTAL |
|---|---|---|
| Cropland | 3,912,575 | 13% |
| Pasture | 3,276,078 | 11% |
| Forest & Woodland | 17,785,685 | 57% |
| Developed Land | 2,916,265 | 9% |
| Open Water | 1,061,497 | 3% |
| Wetlands | 1,602,363 | 5% |
| Barren | 51,398 | 0% |
| Shrubland | 508,760 | 2% |
| **TOTAL** | **31,114,621** | **100%** |

Source: USDA. 2015. 2014 Cropland Data Layer. National Agricultural Statistics Service. Accessed January 21, 2016 at https://nassgeodata.gmu.edu/CropScape/. USDA-NASS, Washington, DC.

**EXHIBIT 3-4. LAND USE ACROSS NEW YORK STATE (2014)**




### Agriculture[50]

Agriculture remains an important industry to the state's overall economy. While the state ranks 26 in the nation for total value of agricultural sales, New York is one of the top five producers for a number of agricultural commodities, including milk, horses, ponies, mules and donkeys. The State also ranks one of the top ten producers nationwide for a number of fruits, tree nuts, certain berries and floriculture and nursery products. Agricultural sales in recent years have outpaced the national average. In 2014, New York set a new record for sales with $6.36 billion in cash receipts, up from $4.7 billion in 2010. Commodities experiencing the greatest growth since 2010 include poultry and eggs, peaches, honey, cattle and hay.[51]

The characteristics of the State's farms remain as described in the 2015 GEIS. Farmland accounts for nearly one-quarter of the State's total land area (approximately 7.2 million acres), of which 59 percent is dedicated to crops, 22 percent is woodland, ten percent is pastureland and the remaining nine percent committed to conservation and other uses. Each year, the U.S.

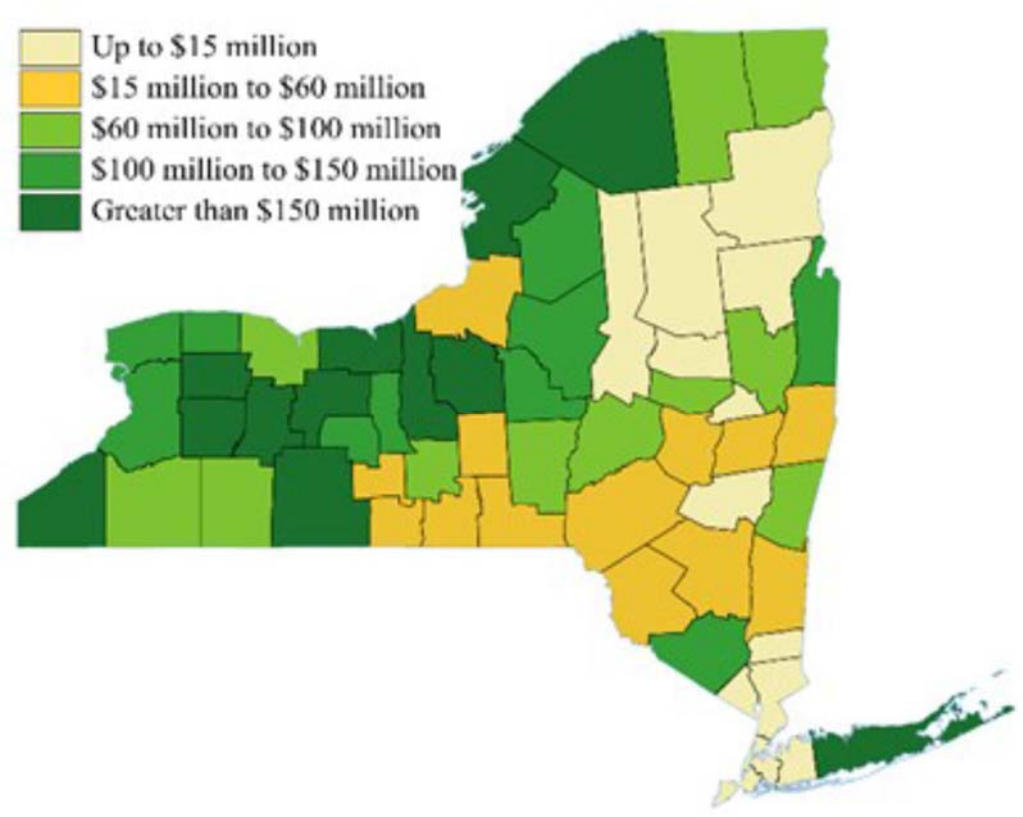
[50] New York State Comptroller. 2015. The Importance of Agriculture to the New York State Economy. March. Accessed January 20, 2016 at: http://www.osc.state.ny.us/reports/importance_agriculture_ny.pdf.

[51] *Governor Cuomo Announces Growth of New York Agricultural Sales Outpaces National Average*. December 14, 2015. [Press Release]. Accessed August 14, 2014 at: http://www.governor.ny.gov/news/governor-cuomo-announces-growth-new-york-agricultural-sales-outpaces-national-average.

Department of Agriculture issues an annual bulletin for each state. According to the New York Annual Bulletin for 2014-2015, the total number of farms has remained steady at 35,500 farms since 2012. The average farm size is 202 acres, as compared to a national average of 438 acres; more than half of New York's farms are smaller than 100 acres. The majority (80 percent) of the State's farms report sales less than $100,000 per year based on data from 2010 to 2014. The average age of farmers in the State is approximately 55 years old, with more than three-quarters of farmers over the age of 45.

While agricultural activity occurs all across the State, the Southern Tier has the largest number of farms with more than 6,600 farms, while the Finger Lakes region supports the largest amount of farmland with over 1.47 million acres. As shown in **Exhibits 3-5 and 3-6**, the top five counties for sales in 2012 were Wyoming, Cayuga, Suffolk, Genesee and St. Lawrence.

### EXHIBIT 3-5. AGRICULTURAL SALES BY COUNTY (2012)




Source: New York State Comptroller. 2015. The Importance of Agriculture to the New York State Economy. March. Accessed January 20, 2016 at: http://www.osc.state.ny.us/reports/importance_agriculture_ny.pdf.

**EXHIBIT 3-6. TOP TEN NEW YORK FARMING COUNTIES (2012)**

| COUNTY | TOTAL SALES (thousands) | NUMBER OF FARMS |
|---|---|---|
| Wyoming | $318,412 | 713 |
| Cayuga | $289,235 | 891 |
| Suffolk | $239,818 | 604 |
| Genesee | $234,292 | 549 |
| St. Lawrence | $186,431 | 1,303 |
| Livingston | $185,477 | 661 |
| Wayne | $181,511 | 873 |
| Ontario | $178,980 | 853 |
| Steuben | $177,710 | 1,667 |
| Jefferson | $177,025 | 876 |
| **TOTAL – Top Ten** | **$2,168,891** | **8,990** |
| **TOTAL – State** | **$5,471,639** | **35,537** |

Source: Source: New York State Comptroller. 2015. The Importance of Agriculture to the New York State Economy. March. Accessed January 20, 2016 at: http://www.osc.state.ny.us/reports/importance_agriculture_ny.pdf.

## 3.3 SPECIES BIODIVERSITY

As discussed in the 2015 GEIS, the biodiversity of New York includes many different species of animals, plants, fungi, benthic organisms, and microorganisms. The total number of species in New York is uncertain, but tens of thousands plants and animal species have been identified to date.[52] The New York Natural Heritage Program (NYNHP) continues to maintain the most comprehensive database on the status and location of rare species and natural communities.

According to the U.S. Fish and Wildlife Service (USFWS) 22 federally-listed threatened and endangered animal and plant species are present in New York State (**Exhibit 3-7**). Of the eight federally-listed plant species, two species are endangered and six species are threatened. Of the 14 federally-listed threatened and endangered animal species, eight species are endangered and the remaining six species are threatened.[53] Among the listed animal species, the Indiana entire bat (*Myotis sodalis*) is listed as endangered and the northern long-eared bat (*Myotis septentrionalis*) as threatened. The northern long-eared is also listed as threatened under New York State law. According to NYSDEC, the current population of the northern long-eared bat is approximately one percent of its previous size. All bats are a particularly sensitive species in New York State where existing bat species and populations face the threat of white-nose syndrome disease which has killed more than 90 percent of bats at most hibernation sites in New York. In October 2015, NYSDEC reminded residents to avoid caves and mines used as hibernation sites in New York

[52] NYSDEC. Biodiversity & Species Conservation: Sustaining New York's Animals, Plants and Ecosystems. Accessed August 14, 2014 at: http://www.dec.ny.gov/animals/279.html.

[53] U.S. Fish and Wildlife Service. Endangered Species of New York State, Listings and Occurrences for New York. Accessed January 20, 2016 at: http://ecos.fws.gov/tess_public/pub/stateListingAndOccurrenceIndividual.jsp?state=NY&s8fid=112761032792&s8fid=112762573902.

between October 1 and April 30. There is no known treatment for white-nose syndrome on bats but research is ongoing.[54]

### EXHIBIT 3-7. U.S.FWS LISTED PLANT AND ANIMAL SPECIES BELIEVED OR KNOWN TO OCCUR IN NEW YORK

| SPECIES/LISTING NAME | LISTED STATUS | TYPE |
|---|---|---|
| Bat, Indiana Entire (*Myotis sodalis*) | Endangered | Animal |
| Bat, Northern long-eared (*Myotis septentrionalis*) | Threatened | Animal |
| Bean, rayed (*Villosa fabalis*) | Endangered | Animal |
| Butterfly, Karner blue Entire (*Lycaeides melissa samuelis*) | Endangered | Animal |
| Clubshell Wherever found; Except where listed as Experimental Populations (*Pleurobema clava*) | Endangered | Animal |
| Knot, red (*Calidris canutus rufa*) | Threatened | Animal |
| Plover, piping except Great Lakes watershed (*Charadrius melodus*) | Threatened | Animal |
| Sea turtle, green Except where endangered (*Chelonia mydas*) | Threatened | Animal |
| Sea turtle, hawksbill Entire (*Eretmochelys imbricata*) | Endangered | Animal |
| Sea turtle, leatherback Entire (*Dermochelys coriacea*) | Endangered | Animal |
| Snail, Chittenango ovate amber Entire (*Succinea chittenangoensis*) | Threatened | Animal |
| Tern, roseate northeast U.S. nesting pop. (*Sterna dougallii dougallii*) | Endangered | Animal |
| Turtle, bog (=Muhlenberg) northern (*Clemmys muhlenbergii*) | Threatened | Animal |
| Wedgemussel, dwarf Entire (*Alasmidonta heterodon*) | Endangered | Animal |
| Amaranth, seabeach (*Amaranthus pumilus*) | Threatened | Plant |
| Bulrush, Northeastern (*Scirpus ancistrochaetus*) | Endangered | Plant |
| Fern, American hart's-tongue (*Asplenium scolopendrium var. americanum*) | Threatened | Plant |
| Gerardia, sandplain (*Agalinis acuta*) | Endangered | Plant |
| Goldenrod, Houghton's (*Solidago houghtonii*) | Threatened | Plant |
| Monkshood, northern wild (*Aconitum noveboracense*) | Threatened | Plant |
| Pogonia, small whorled (*Isotria medeoloides*) | Threatened | Plant |
| roseroot, Leedy's (*Rhodiola integrifolia ssp. leedyi*) | Threatened | Plant |

Source: U.S. Fish and Wildlife Service. Endangered Species of New York State, Listings and Occurrences for New York. Accessed January 20, 2016 at: http://ecos.fws.gov/tess_public/pub/stateListingAndOccurrenceIndividual.jsp?state=NY&s8fid=112761032792&s8fid=112762573902.

[54] NYSDEC. 2015. DEC Reminds the Public to Avoid Seasonal Caves and Mines to Protect Bat Populations. [Press Release] http://www.dec.ny.gov/press/103720.html.

## 3.4 OPEN SPACE

Open space may be defined as an area of land or water that either remains in its natural state, free from intensive development for residential, commercial, industrial, or institutional use. Such spaces provide a variety of benefits to a State's economy, culture, environment and well-being of its residents.

As noted in the 2015 GEIS, New York State has one of the largest and oldest public land bases in the country. The statewide park system administered by NYSDEC and New York State Office of Parks, Recreation and Recreation (NYSOPRHP) currently contains close to 215 State parks and historic sites.[55] New York State ranks first in the nation in the number of operating facilities and total number of campsites.[56] In 2014, the State park system attracted more than 62 million visitors, up two million from visitation levels in 2012.[57]

As shown in **Exhibit 3-8**, on the following page, of the 6.8 million acres of land under the NSOPRHP's stewardship, the vast majority of the State's protected areas fall within the Adirondack Park, which is approximately six million acres in size and the Catskill Parks, approximately 700,000 acres in size. The remainder of the State's park areas account for a relatively small percentage of total park lands (approximately 330,000 acres or less than five percent of the total park lands.

Created in 1892, the Adirondack Park (the "Park") accounts for one-fifth of the State's total land area making the Park one of the largest state parks in the U.S., greater in size than Yellowstone, Everglades, Glacier, and Grand Canyon National Parks combined, and comparable to the size of the entire state of Vermont. The boundary of the Park encompasses a unique combination of public and private lands. Of the approximately six million acres within the Park's boundaries, 48 percent is constitutionally protected to remain "forever wild" forest preserve while the remaining 52 percent consist of private land, including a mix of settlements, farms, timber lands, businesses, homes and camps.[58] To ensure responsible stewardship of Park areas, the New York State Legislature created the Adirondack Park Agency (the "Agency") in 1971 and charged the Agency with developing a master land use for both public and private lands to assure that development occurs in balance with the Park's unique natural resources. The Agency created the Park's first land use plans in the early 1970s and continues to maintain and update the Adirondack Park Land Use and Development Plan (the "Plan") to reflect changes and current trends and conditions. The Plan establishes and classifies all private lands into one of six land use categories, each category consistent with a different land use and development objective, including rural use, moderate intensity use, low intensity use, industrial use, resource management and hamlets. In addition to the Plan, Park lands are subject to a number of land use and natural resource regulations, for

[55] New York State Council of Parks, Recreation, and Historic Preservation. 2015. 2014 Annual Report. January. Accessed January 20, 2016 at: http://nysparks.com/state-council/documents/2014StateCouncilAnnualReport.pdf/.

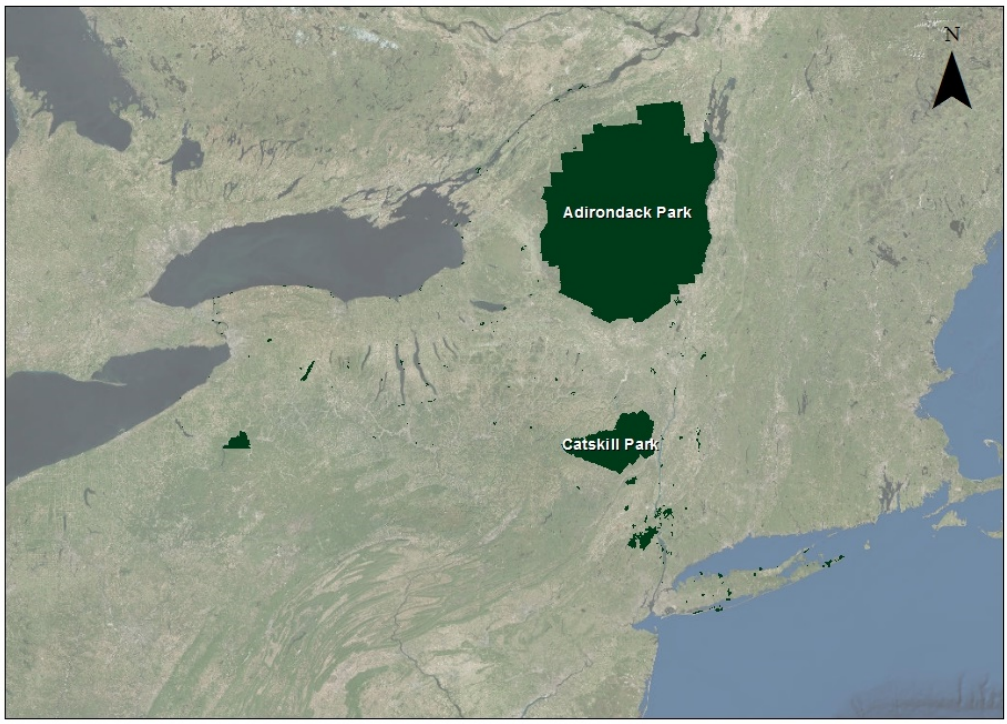
[56] *Ibid*.

[57] New York State Council of Parks, Recreation and Historic Preservation. 2013. 2012 Annual Report. Accessed August 20, 2014 at: http://nysparks.com/state-council/documents/2012StateCouncilAnnualReport.pdf.

[58] Adirondack Park Agency. Citizen's Guide to Adirondack Park Agency Land Use Regulations. Accessed January 22, 2016 at: http://apa.ny.gov/Documents/Guidelines/CitizensGuide.pdf.

example the New York State Freshwater Wetlands Act and the New York State Wild, Scenic and Recreational Rivers System Act. Additional regulations provide further guidance to potential project proponents to ensure development is undertaken in a manner that minimizes adverse impacts to sensitive natural resources, including but not necessarily limited to Critical Environmental Areas (CEAs),[59] wetlands, shorelines, rivers and trees.[60]

### EXHIBIT 3-8. NEW YORK STATE PARK SYSTEM




## 3.5 SOCIOECONOMICS

The socioeconomic setting that may be affected by the proposed action comprises several factors, such as: patterns and trends in income and wages, employment levels, and housing requirements. The following section updates information on the socioeconomic setting presented in the 2015 GEIS.

[59] For more discussion on CEAs, see **Section 3.6** of the 2015 GEIS.

[60] Adirondack Park Agency. Citizen's Guide to Adirondack Park Agency Land Use Regulations. Accessed January 22, 2016 at: http://apa.ny.gov/Documents/Guidelines/CitizensGuide.pdf.

### Income and Wage Characteristics[61]

Statewide trends in employment, income and wage remain largely as described in the 2015 GEIS. As of December 2015, the New York State Department of Labor (NYSDOL) estimates approximately 9.4 million employed in non-farm positions, up from 9.2 million one year prior.[62] In December 2015, unemployment remained steady at 4.8 percent, the lowest level since November 2007 and consistent with the U.S. unemployment rate at 5.0 percent. Exhibit 3-6, on the following pages, shows unemployment rates by county from the NYSDOL for November 2015.

The annual mean wage for all occupations in New York State was $55,630 in 2014, an increase of 1.9 percent from 2013. Counties with the highest median household income in 2013 include Nassau County ($97,690), Putnam County ($95,117), and Suffolk County ($87,763). In Upstate New York, Saratoga County had the highest median household income in 2013 ($69,826). Counties with the lowest median household incomes in 2013 include Bronx County ($34,388), Chautauqua County ($42,429), and Allegany County ($42,445). **Exhibits 3-9 and 3-10**, present key economic characteristics for the entire State of New York.

**EXHIBIT 3-9. SELECT INCOME AND WAGE CHARACTERISTICS OF NEW YORK STATE (2010-2014)**

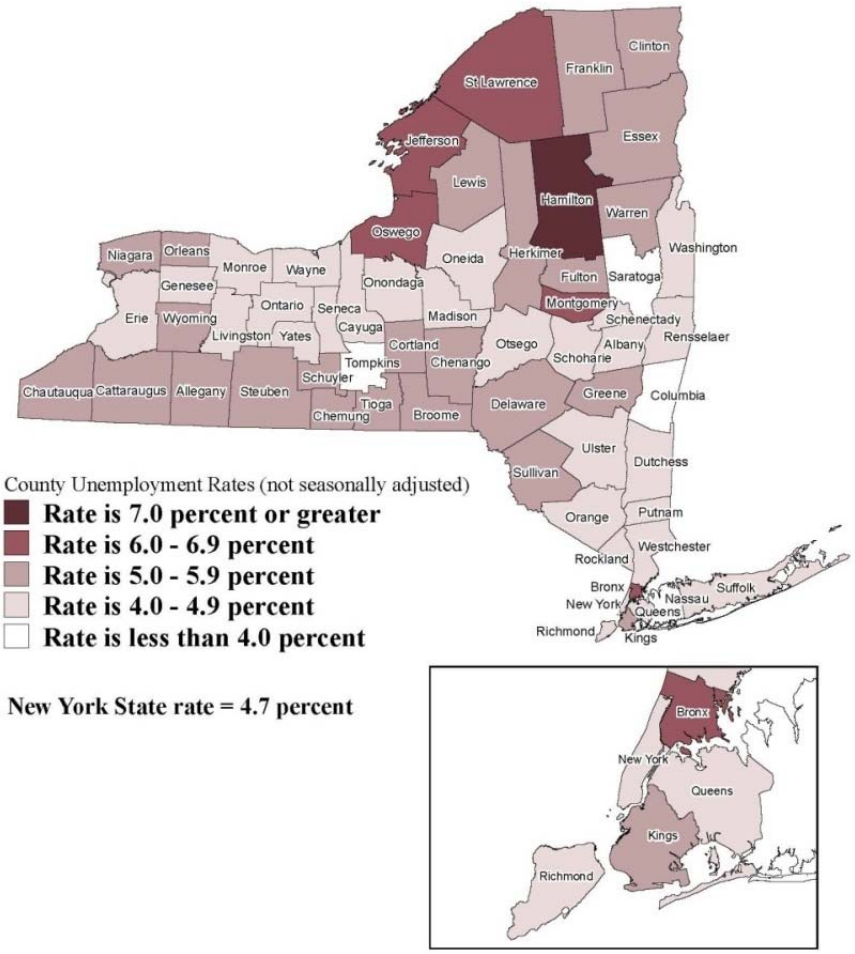
| METRIC | NEW YORK STATE | U.S. |
|---|---|---|
| Households | 7,255,528 | 116,211,092 |
| Homeownership rate | 53.8% | 64.4% |
| Median home value | $283,700 | $175,700 |
| Per capita income ($2014) | $ 32,829 | $ 28,555 |
| Median household income | $ 58,687 | $ 53,482 |
| Persons below poverty level | 15.9% | 14.8% |

Source: U.S. Census Bureau. New York QuickFacts. Accessed January 21, 2016 at: http://www.census.gov/quickfacts/table/PST045215/36,00.

[61] U.S. Bureau of Labor Statistics. Occupational Employment Statistics. Last updated March 25, 2015. Accessed January 21, 2016 at: http://www.bls.gov/oes/tables.htm.

[62] New York State Department of Labor. Current Employment Statistics. Preliminary. Accessed August 22, 2014 at: http://labor.ny.gov/stats/cesemp.asp.

**EXHIBIT 3-10. UNEMPLOYMENT RATES BY COUNTY (NOVEMBER 2015)**




### Housing Characteristics

In 2014, the housing vacancy rate in New York State was estimated by the American Community Survey at 11.0 percent, a slight increase from 10.89 percent in 2012.[63] According to the 2014 American Community Survey, 53.8 percent of occupied housing units are owner-occupied, down slightly from one year period (54.5 percent).[64] In 2014, 46.9 percent of housing units were single unit residences, while 27.4 percent of housing units were a part of structures containing two to 19 housing units, and 23.3 percent of housing units were a part of structures containing 20 or more housing units. Mobile homes accounted for 2.4 percent of all housing units.[65] The 2014

[63] U.S. Census Bureau. 2012 American Community Survey. Accessed August 22, 2014 at: http://www.census.gov/acs/www/data_documentation/2012_release/.

[64] U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates. Accessed on January 21, 2016 at: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_12_5YR_DP04&prodType=table.

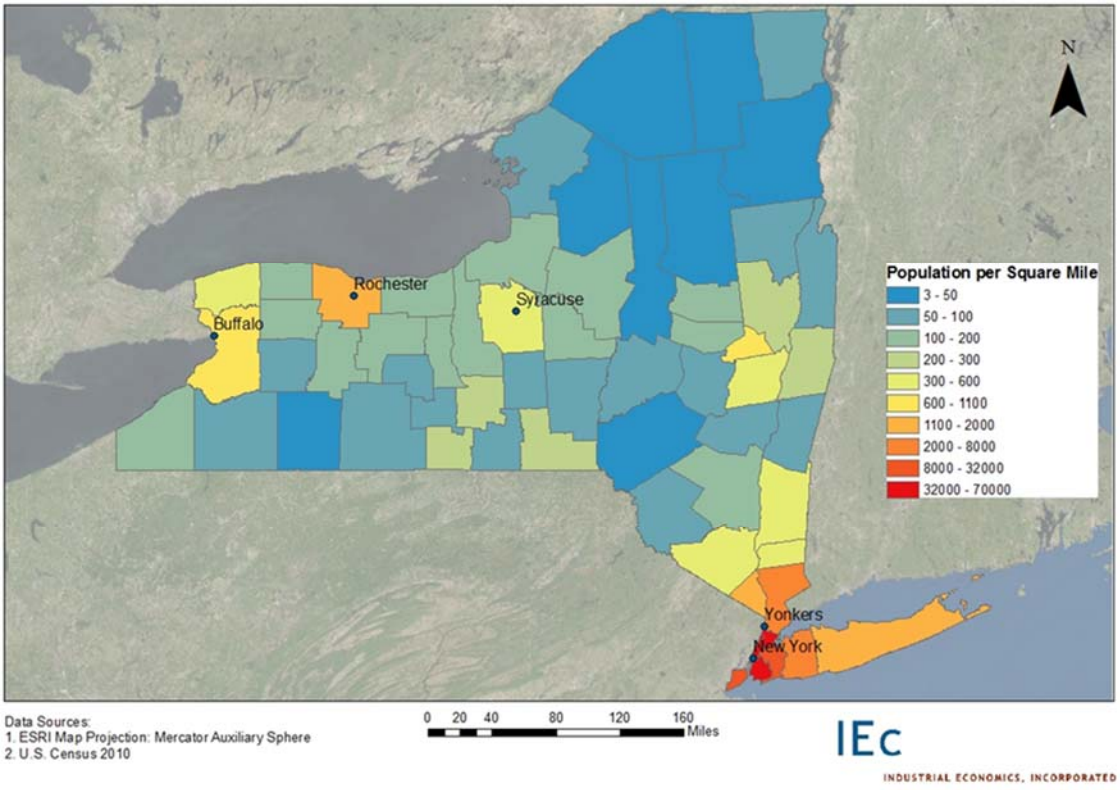
[65] *Ibid*.

American Community Survey estimated that 44.8 percent of renters in New York paid gross rent costs totaling 35.0 percent or more of household income.[66]

## 3.6 COMMUNITY CHARACTER

As discussed in the 2015 GEIS, a community's character is defined by a combination of elements, including local natural features, land uses, development patterns, population growth and density, and regional socioeconomic patterns. As discussed in **Section 3.1** (Population), **Section 3.2** (Land Use) and **Section 3.5** (Socioeconomics) patterns of population, land use, development and economic activity vary considerably across New York State. As shown in **Exhibit 3-11,** population is highest within the five counties making up New York City and in portions of the counties adjacent or close to New York City, and in the western portion of Suffolk County. Population density outside of the New York Metropolitan area exhibits an inverse relationship, as distance to the New York City metropolitan area increases, population densities are considerably lower, development less intense, attributes reflecting communities more rural in nature.

### EXHIBIT 3-11. NEW YORK STATE POPULATION DENSITY BY COUNTY (2010)




Community character, however, is not defined only by patterns in population and development. Residents often describe community character in terms associated with more intangible community quality such as visual landscape, demographics, open space, noise, air quality, or traffic patterns. The 2015 GEIS provides a greater discussion on such intangible community

[66] *Ibid*.

characteristics and how such characteristics, along with patterns in population and development, shape a community's character over time, often times working in both positive and negative ways, concurrently attracting and deterring residents, businesses, or visitors.

# CHAPTER 4 | ALTERNATIVES CONSIDERED

A full understanding of the potential environmental impacts of the CES requires consideration of reasonable alternatives to the proposed action. This chapter characterizes two relevant alternative scenarios that contribute to the SEIS analysis:

- Section 4.1 describes the baseline or "no action" scenario and alternative scenarios for renewable supply, along with related modeling results; and
- Section 4.2 describes the "no action" scenario for nuclear power, along with related analytic results.

These results frame the discussion of broader environmental and socioeconomic impacts in subsequent chapters.

## 4.1 BASELINE AND ALTERNATIVES DEFINITION: RENEWABLE SUPPLY

Defining a baseline or "no action" condition is necessary to provide a common point of reference for understanding the impacts of the action and any alternatives. This baseline should represent the most likely state of resources, activities, markets, and behaviors that would exist absent any efforts to achieve or accomplish the goals of the CES.

In the case of renewable supply, the proposed CES converts the 2015 SEP targets to mandated requirements that will ensure their achievement. It is uncertain the extent to which the SEP targets would be achieved absent this mandate. It is likely that State agencies, including the Commission, would take other actions aimed at reaching the 50 by 30 goal and that the State would make progress in that direction over time. However, it is also likely that in the "no action" scenario, progress would be slower than the CES would allow, and that the State would not achieve the carbon and greenhouse gas reductions targeted in the SEP. With slower growth in the renewable generation portfolio, some impacts to the environment may be delayed or avoided. At the same time, fossil fueled generation would continue to dominate the State's supply, and emissions of carbon and other pollutants would not decline as much or as fast as they would with implementation of the proposed CES.

With the proposed CES, alternative outcomes are also possible. Because the CES complements other State energy policies and programs, such as REV and the CEF, its impacts on the environment will depend to some extent on how well the objectives of those programs are achieved. In particular, efforts under REV to reduce demand could directly affect the targets set for the CES. A stand-alone analysis of the impacts of the CES would not show the interplay of these programs and might over or understate the quantity of new renewable generation that may be needed.

To frame the analysis, the SEIS utilizes a large-scale renewable (LSR) supply curve model. The supply curve model develops a least-cost plan of annual incremental renewable capacity additions

needed to meet the target, based on a projection of demand growth, market data, cost estimates, and other factors. The model considers several types of renewable resources individually, including multiple size categories of land-based wind; utility-scale solar; upgraded hydroelectric facilities; retrofitting non-powered dams; off-shore wind; anaerobic digestion and additional biomass-source generation.

Outputs of the model are in shown in Exhibit 4-1 by comparing two "base case" settings, reflecting either adoption through long-term fixed-price power purchase agreement (PPA) procurement arrangements or long-term fixed-REC procurements. The PPA approach assumes that renewable energy project developers will be able to sign up to long-term contracts offering a fixed level of total compensation per MWh generated, thus shielding generators in particular from commodity price risk. The fixed REC base case reflects the approach whereby generators receive a fixed top-up premium payment above energy and capacity revenue, in which case they would be exposed to commodity price fluctuations. These approaches are presented as "book end" benchmarks. The actual outcome would be expected to be a mix of these contracting approaches.

The base case uses the demand forecast developed in connection with the Staff White Paper.[67] That forecast includes adjustments for both increased loads related to new electrification (e.g., electric vehicles, heat pumps) and other adjustments reflecting expected energy efficiency gains and peak load reductions.[68] Using the adjusted forecast, the base case model shows a need for approximately 34,000 GWh of new renewable energy supply in 2030. The model further suggests that approximately 5,000 GWh of that new supply will be met with "behind-the-meter" generation (such as customer-sited solar PV). With this assumption, and subtracting forecast installations in 2015 and 2016, the base case yields a total LSR increment of approximately 29,000 GWh needed to meet the 50 by 30 goal.

The alternative, or high renewable, case illustrates the possibility that a larger amount of LSR may be needed if future demand grows more than the Staff White Paper load forecast anticipates. The demand projection used for the high renewable case follows the most recent NYISO forecast, which is based on anticipated economic activity, extended to 2030. A higher load forecast means a higher renewable energy supply goal. Using this alternative demand projection, the high renewable case suggests that meeting the 50 by 30 target will require approximately 40,000 GWh of incremental LSR.

For purposes of evaluating potentially adverse environmental impacts, this SEIS assumes that the incremental need in both the base cases and the high renewable cases is met with LSR resources. This approach is recommended because, (1) the 2015 GEIS already addresses the potential impacts of distributed renewable resources, and (2) the environmental impacts of LSR projects are more likely to be significant. Thus, if the actual proportion of LSR to distributed renewable resources turns out to be smaller than this SEIS estimates, the consequence is likely to be a reduction in overall impacts.

[67] NYS DPS. 2016. Staff White Paper on Clean Energy Standard. CASE 15-E-0302. January 25.

[68] NYS DPS. 2016. Staff White Paper on Clean Energy Standard. Appendix B. CASE 15-E-0302. January 25.

### Results

**Exhibit 4-1** summarizes the some relevant outcomes of the base case and high load case modeling. As shown in the exhibit, the results indicate that land-based wind could be largest contributor to the incremental renewable generation, accounting for approximately 40 to 45 percent of the incremental supply. Utility-scale solar is the next largest contributor, at approximately 20 to 35 percent of total generation. Different procurement methods are expected to influence the mix of LSR and behind-the-meter renewable generation that is ultimately installed; this impact assessment considers the conservative scenario where the incremental need is met primarily by LSR.

#### EXHIBIT 4-1. LARGE-SCALE RENEWABLES GENERATION AND INSTALLED CAPACITY, BY ALTERNATIVE

| RENEWABLE SOURCE | RENEWABLE GENERATION (GWH) | | | | INSTALLED CAPACITY (MW) | | | |
|---|---|---|---|---|---|---|---|---|
| | BASE CASE | | HIGH LOAD | | BASE CASE | | HIGH LOAD | |
| | PPA | FIXED REC | PPA | FIXED REC | PPA | FIXED REC | PPA | FIXED REC |
| Land-based Wind | 12,977 | 11,276 | 16,748 | 16,199 | 4,051 | 3,495 | 5,330 | 5,120 |
| Utility-scale Solar | 5,655 | 10,235 | 9,144 | 13,603 | 3,721 | 6,773 | 6,050 | 9,122 |
| Hydro | 2,911 | 2,750 | 2,976 | 2,823 | 631 | 594 | 648 | 610 |
| Biomass/ADG | 707 | 2,443 | 1,655 | 2,466 | 107 | 355 | 243 | 358 |
| Offshore Wind | 5,189 | 825 | 8,093 | 3,614 | 1,279 | 202 | 1,988 | 891 |
| Imports | 1,615 | 1,525 | 1,633 | 1,544 | 442 | 442 | 449 | 449 |
| **Total** | **29,054** | **29,054** | **40,249** | **40,249** | **10,232** | **11,861** | **14,706** | **16,551** |

The 2015 GEIS also presents estimates of the emissions impacts likely to result from the implementation of certain initiatives related to the REV. **Exhibit 4-2** below presents estimated emissions reductions for the renewable supply alternatives identified in **Exhibit 4-1**. To facilitate comparisons, these estimates use the same emission factors that were used to develop the emissions estimates in the 2015 GEIS.

### EXHIBIT 4-2. EMISSIONS REDUCTIONS, BY ALTERNATIVE

| ALTERNATIVE | NITROGEN OXIDES[A] (1,000 TONS) | SULFUR DIOXIDE[A] (1,000 TONS) | CARBON DIOXIDE[B] (1,000 TONS) |
|---|---|---|---|
| Base Case (PPA & Fixed REC) | 9.8 | 11.6 | 8,239 |
| High Case (PPA & Fixed REC) | 13.5 | 16.1 | 11,414 |

Notes:

[A] Biomass/ADG generation (representing less than 10% of total renewable generation) is excluded from $NO_x$ and $SO_x$ emissions reductions estimates, due to large variability in these emissions depending on fuel-type, combustion technology, emissions controls, and operating characteristics.

[B] Biomass/ADG generation is assumed to be carbon neutral.

## 4.2 NUCLEAR POWER NO ACTION ALTERNATIVE

Combined, the James A. Fitzpatrick and R.E. Ginna nuclear facilities provide approximately 10,500 GWh of annual energy generation, and 1,400 MW of generating capacity. Under a "no action" scenario, discontinuing operations at these facilities would require that an approximate annual 10,500 GWh of electricity generation be met through alternative sources, likely fossil fuels. The plants have announced plans to close in approximately April 2017, after providing only a quarter of their annual electrical generation for that year. **Exhibit 4-3** provides an illustration of anticipated GWh energy loss from James A. FitzPatrick and R.E. Ginna nuclear facilities in the no action alternative scenario.

### EXHIBIT 4-3. ESTIMATED GWH ELECTRICITY GENERATION LOSS IN THE NO ACTION SCENARIO

| SITE NAME | SUMMER CAPACITY | 2014 NET GENERATION (GWH) | POTENTIAL CLOSURE DATE | LICENSE EXPIRATION | GWH TOTAL GENERATION LOSS* | AVOIDED CO2 EMISSIONS (MILLION SHORT TONS)** |
|---|---|---|---|---|---|---|
| James A. FitzPatrick | 855 | 5,829 | April 2017 | October 2034 | 77,234 | 2.6 |
| R. E. Ginna | 581 | 4,662 | April 2017 | September 2029 | 60,606 | 2.1 |
| **Total** | **1,436** | **10,491** | **-** | **-** | **137,840** | **4.7** |

* Calculated based on CES timeframe to 2030.

** Calculated assuming typical gas plant replacement of energy at 450 million short tons of $CO_2$ per GWh.

Under the CES initiative, this lost generation may be recovered. **Chapter 5** describes the general impacts that arise during normal operations and fueling of nuclear facilities and that would continue under the proposed maintenance program.

# CHAPTER 5 | ENVIRONMENTAL IMPACTS OF PROPOSED ACTION

SEQRA requires State and local agencies to assess the potential of their actions to affect the use, appearance, or condition of the environment. This chapter evaluates the impacts that could arise from the implementation of the proposed CES. All energy generation has impacts to the environment; however renewable energy tends to involve lower risks and impacts. [69]

As previously discussed, the REV and CEF are intended to transform the ways in which the State generates, distributes and manages energy and, in so doing, increase system resiliency, reduce harmful environmental pollution, and lower the overall costs of power across all sectors of the economy. In the modern electric system envisioned under the REV, clean energy at the bulk level will be integrated with distributed generation and dynamic load management at the customer level. By establishing a mandate and interim targets for renewable generation, the CES will further support and promote the REV's basic principle of a customer-oriented market that encourages innovative, market-based solutions that reduce costs while meeting critical environmental needs.

To identify and analyze the impacts of the proposed CES in the context of REV and the CEF, this chapter incorporates by reference the analysis of environmental impacts presented in Chapter 5 of the 2015 GEIS and then updates and expands the information provided therein by more fully describing the potential environmental impacts associated with LSR generation and with the proposed nuclear maintenance tier.

## 5.1 FRAMEWORK FOR EVALUATING THE ENVIRONMENTAL IMPACTS OF THE CES

As presented in **Chapter 4,** this SEIS considers two scenarios for LSR generation designed to meet the overarching target of the CES of 50 percent renewable energy generation by 2030: (1) a base case, assuming approximately 28,700 GWh of incremental LSR; and (2) an alternative, or high, case, assuming installation of approximately 39,900 GWh of incremental LSR. In addition, this chapter considers the potential environmental impacts of the proposed CES nuclear tier.

Appendix C to the Staff White Paper identifies a list of the technology and fuel stocks that will likely be eligible under the CES, a list that largely mirrors the current RPS Main Tier program. While the proposed CES establishes an overall target for meeting the mandate, the CES, like the REV and CEF initiatives, does not prescribe one pathway; that is, the CES does not contemplate establishing technology-specific carve-outs or targets other than the overall 50 percent mandate.

Finally, the exact location of potential new LSR projects is uncertain. For this reason, the evaluation of environmental impacts in this chapter is largely qualitative. That is, a quantitative assessment of the potential environmental impacts would require site-specific information

[69] NYSERDA 2009. Comparison of Reported Effect on and Risks to Vertebrate Wildlife from Six Electricity Generation Types in the New York/New England Region. NYSERDA Report 09-02.

concerning those clean energy resources and technologies that will be implemented in response to the CES.

The qualitative assessment presented in this chapter utilizes a broad definition of environmental impacts (impacts and effects are synonymous in this context), including the full array of resource areas described in **Chapter 3.** The SEIS describes two types of effects: direct and near term impacts and possible longer-term impacts.

#### Chapter Organization

The remainder of this chapter is organized in five parts:

- Section 5.2 summarizes our analysis of the potential direct and near term environmental impacts of the seven large-scale clean energy resources likely to be affected by the CES;
- Section 5.3 summarizes our analysis of the potential longer-term environmental impacts;
- Section 5.4 considers the potential for the CES programs to spur development of new technologies, yet unknown; and
- Section 5.5 considers the potential cumulative impacts of the CES when added to other past, present, and reasonably foreseeable future actions.

Measures to mitigate the environmental impacts identified in this chapter are presented in **Chapters 6 through 8**. The economic and social impacts of the proposed CES are discussed in **Chapter 9**.

## 5.2 DIRECT AND NEAR TERM EFFECTS

This section identifies the direct environmental effects of the CES. Specifically, this section focuses on the environmental effects of seven resource categories described in **Chapter 4,** including: (1) nuclear energy, (2) solar energy, (3) land-based wind energy, (4) offshore wind energy, (5) hydropower, (6) anaerobic digestion and (7) biomass energy.[70] For each resource considered in this section, direct environmental impacts are considered on an individual basis. Examination of the potential long-term impacts of the CES – impacts which occur later in time or further away, such as displacement of fossil fuel generation – are considered in the subsequent **Section 5.3**.

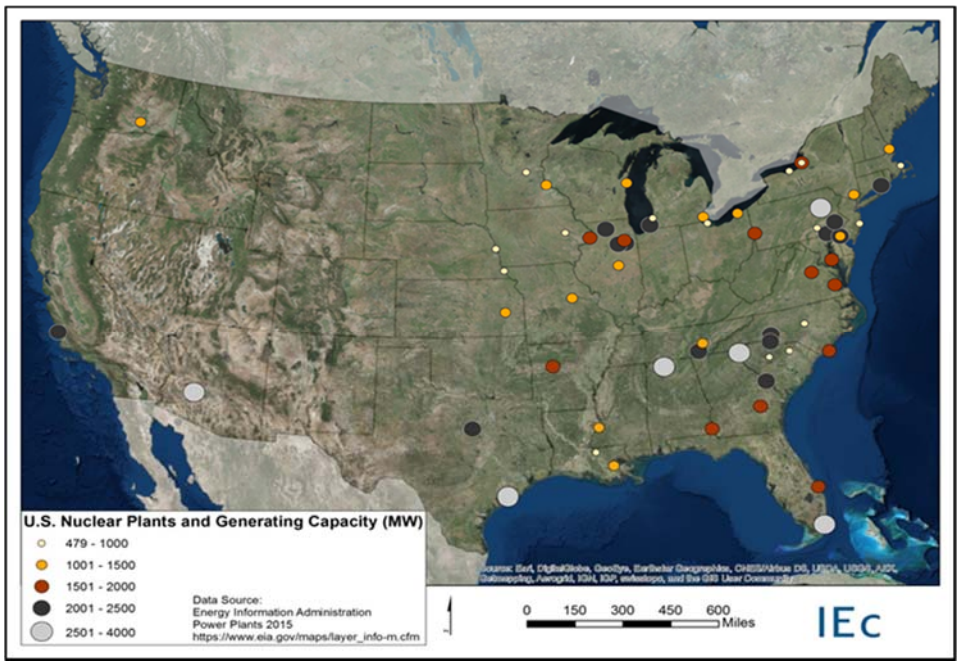
### 5.2.1 NUCLEAR ENERGY

Across the United States, 62 nuclear power plants are currently operating (**Exhibit 5-1**). Thirty-five of these plants have two or more reactors. [71] Five facilities in Illinois provide just over 11.5 GW of capacity, the most of any state followed by Pennsylvania, South Carolina, and New York (**Exhibit 5-2**).

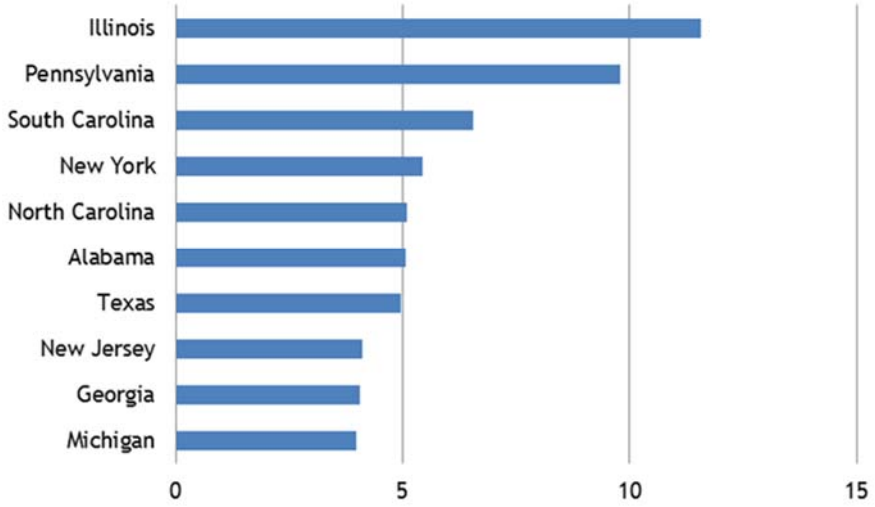
[70] As discussed in **Chapter 4**, a longer list of LSR resources was considered as possible generating options under the CES, including several forms of biomass, co-firing, IGCC, and several size categories of CHP.

[71] U.S. EIA. 2015. Despite recent closures, U.S. nuclear capacity is scheduled to increase by 2020. Accessed January 22, 2016 at: http://www.eia.gov/todayinenergy/detail.cfm?id=23592#.

## EXHIBIT 5-1. ACTIVE NUCLEAR SITES IN THE UNITED STATES AND NUCLEAR CAPACITY




## EXHIBIT 5-2. NUCLEAR CAPACITY FOR TOP TEN U.S. STATES, 2015, GIGAWATTS[72]




[72] U.S. EIA. 2015. Despite recent closures, U.S. nuclear capacity is scheduled to increase by 2020. Accessed January 22, 2016 at: http://www.eia.gov/todayinenergy/detail.cfm?id=23592#.

As discussed in **Chapter 2**, nuclear facilities contributed approximately 14 percent of New York's capacity and produced 30 percent of the State's electricity energy generation in 2014.[73] Three nuclear plants in Upstate New York, James A. Fitzpatrick, Nine Mile Point Nuclear Station, and R. E. Ginna Nuclear Power Plant, account for over 3,300 MW of capacity and nearly 26,000 GWh of annual electricity generation (see **Exhibits 5-3** and **5-4**).[74] The James A. Fitzpatrick and the Nine Mile Point Nuclear power plants are both boiling water reactors (BWR), and the Indian Point and R.E. Ginna power plants are pressurized light water reactors (PWR). BWRs contain only two heat transfer loops because the system generates steam directly in the reactor vessel. A primary loop moves the reactor vessel steam to drive the turbines which generate electricity. For PWRs, water is first heated to high temperatures under pressure inside the reactor before being pumped through a primary circulation loop to the steam generator. Water in a secondary circulation loop is converted to steam in the generator to drive the turbines and produce electricity. In either system, steam leaving the turbines is cooled through a condenser or cooling water system, and cooling water is pumped to cooling towers or discharged directly to a water body.

The growth in natural gas availability has led to lower prices in the wholesale electricity market, pricing out some nuclear operators that face increasing costs.[75] The proposed CES Tier 3 would establish a support mechanism to sustain the operations of economically distressed upstate nuclear facilities for a significant time, potentially up to their license expiration date. Two New York nuclear units face NRC license expiration before 2030: Nine Mile Point Unit 1 and R.E. Ginna Unit 1, in August and September of 2029, respectively. The James A. Fitzpatrick nuclear Unit 1 license expires October of 2034, and Unit 2 of the Nine Mile Point Nuclear Station expires in October of 2046.

[73] NYISO. 2015. Power Trends 2015: Rightsizing the Grid. Accessed January 14, 2016 at: http://www.nyiso.com/public/webdocs/media_room/press_releases/2015/Child_PowerTrends_2015/ptrends2015_FINAL.pdf.

[74] NYSIO. 2015. 2015 NYCA Generating Facilities. Accessed January 16, 2016 at: http://www.nyiso.com/public/index.jsp

[75] Office of Nuclear Reactor Regulation. 2013. Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Main Report, Final Report, NUREG-1437, Volume 1, Revision 1.

**EXHIBIT 5-3. ACTIVE NUCLEAR SITES IN NEW YORK STATE**

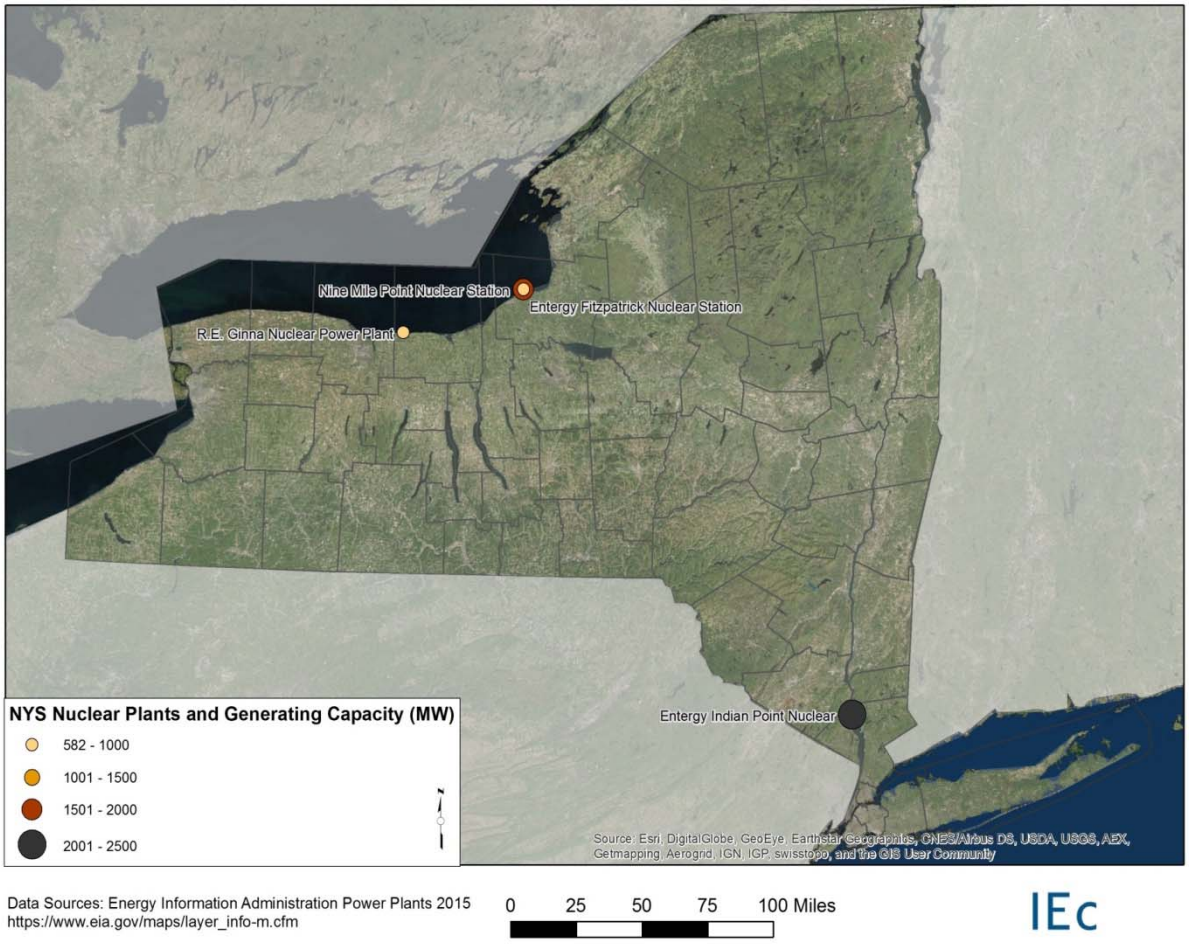
| SITE NAME | ACTIVE REACTORS | SUMMER CAPACITY (MW) | 2014 NET ENERGY (GWH) | SHARE OF STATE NUCLEAR ENERGY GENERATION | OWNER | LOCATION | DATE OF NRC LICENSE EXPIRING | POTENTIAL CLOSURE |
|---|---|---|---|---|---|---|---|---|
| Indian Point | Unit 2, Unit 3 | 2,063 | 17,310 | 40.2% | Entergy Nuclear Indian Point | Westchester County | 9/28/2013 (Unit 2) 12/12/2015 (Unit 3) License renewal process ongoing. | |
| James A. Fitzpatrick | Unit 1 | 855 | 5,829 | 13.5% | Entergy Nuclear Fitzpatrick LLC | Oswego County | 10/17/2034 (Unit 1) | Announced intent to retire in 2017 due to power price declines[76] |
| Nine Mile Point | Unit 1, Unit 2 | 1,773 | 15,239 | 35.5% | Nine Mile Point Nuclear Station LLC | Oswego County | 08/22/2029 (Unit 1) 10/31/2046 (Unit 2) | |
| R. E. Ginna | Unit 1 | 581 | 4,662 | 10.8% | R.E. Ginna Nuclear Power Plant, LLC | Wayne County | 09/18/2029 (Unit 1) | Announced intent to retire in 2017 due to power price declines[77] |
| | **Total** | **5,272** | **43.040** | **100.0%** | | | | |

Sources: U.S. Nuclear Regulatory Commission. List of Power Reactor Units Accessed January 12, 2016 at http://www.nrc.gov/reactors/operating/list-power-reactor-units.html. Accessed January 12, 2016; NYSIO. 2015. 2015 NYCA Generating Facilities. Accessed January 16, 2016 at: http://www.nyiso.com/public/index.jsp; U.S. EIA. State Nuclear Profiles. Accessed December 24, 2015 at: http://www.eia.gov/nuclear/state/newyork/

[76] PRNewswire. 2015. Entergy to Close James A. FitzPatrick Nuclear Power Plant in Central New York. Accessed January 22, 2016 at: http://www.prnewswire.com/news-releases/entergy-to-close-james-a-fitzpatrick-nuclear-power-plant-in-central-new-york-300170100.html

[77] Case 14-E-0270, Petition Requesting Initiation of a Proceeding to Examine a Proposal for Continued Operation of the R.E. Ginna Nuclear Power Plant, LLC., Petition Requesting Initiation of a Proceeding to Examine a Proposal for Continued Operation (filed July 11, 2014).

**EXHIBIT 5-4. ACTIVE NUCLEAR SITES IN NEW YORK STATE**




### Environmental Impact Overview

The proposed CES Tier 3 would establish a support mechanism to sustain the operations of economically distressed upstate nuclear facilities; thus, if the action is implemented, nuclear plants currently in operation would continue to operate. This section describes the general impacts that arise during normal operations of nuclear facilities and that would likely continue under the proposed maintenance program.

Impacts arise due to a number of facility components including: once-through cooling systems, cooling towers, cooling ponds, and transmission lines.[78] These impacts have been most recently described and evaluated by the NRC in the course of its relicensing proceedings. They are discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Main Report, Final Report* and the supplemental EIS' specific to individual nuclear facilities that

[78] Office of Nuclear Reactor Regulation. 2013. Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Main Report, Final Report, NUREG-1437, Volume 1, Revision 1.

would continue operations through the re-licensing expiration date. The results from the GEIS for License Renewal of Nuclear Plants are summarized in **Exhibit 5-5**.[79]

**EXHIBIT 5-5. SUMMARY OF IMPACTS OF NUCLEAR FACILITY OPERATION**[80, 81]

| AFFECTED ENVIRONMENT | CONCLUSIONS |
|---|---|
| Threatened and Endangered Species | Requires site- and project-specific information. |
| Surface Water Quality, Hydrology, and Use | Regardless of cooling system type effects on water intake and discharge structures, salinity gradients, temperature effects on sediment transport, altered thermal stratification of lakes, scouring from discharged cooling water, eutrophication, discharge of biocides, discharge of chemical contaminants (e.g., metals), and discharge of sanitary waste were found to be small. No mitigation measures are warranted to due to small environmental benefits and high cost.<br>Small potential for water use conflicts or riparian plan and animal community impacts for plants with open-cycle cooling systems. No mitigation measures are warranted due to small potential environmental benefits and high cost.<br>Moderate potential water use conflicts and effects of consumptive water on in-stream aquatic and riparian terrestrial communities that employ cooling-tower or cooling-pond systems because they are often located near smaller water bodies. |
| Aquatic Ecology | • Small impacts at all types of plants to:<br>o entrainment of phytoplankton and zooplankton;<br>o cold shock;<br>o thermal plume barriers to migrating fish;<br>o premature emergence of aquatic insects;<br>o stimulation of nuisance organisms;<br>o losses from predation, parasitism, and disease among organisms exposed to sublethal stresses;<br>o gas supersaturation;<br>o low dissolved oxygen in the discharge; and<br>o accumulation of contaminants in sediments or biota<br>No mitigation measures are warranted due to small environmental benefits and high cost.<br>• Small impacts at cooling-tower cooling system plants to: |

[79] For a full assessment of operational impacts of nuclear facilities relevant to this EIS please see: Generic Environmental Impacts Statement for License Renewal of Nuclear Plants: Main Report (NUREG-1437, Volume 1), and the relevant supplemental EIS for Upstate facilities: Supplement 31 Regarding James A. FitzPatrick Nuclear Power Plant, Supplement 24 Regarding Nine Mile Point Nuclear Station, Units 1 and 2, and Supplement 14 Regarding R.E. Ginna Nuclear Power Plant.

[80] Office of Nuclear Reactor Regulation. 2013. Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Main Report, Final Report, NUREG-1437, Volume 1, Revision 1.

[81] The GEIS for License Renewal of Nuclear Plants the NRC established three levels of significance for potential impacts: small, moderate, and large. "**Small impact**: Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small. **Moderate impact**: Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource. **Large impact:** Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource" (p S-6).

| AFFECTED ENVIRONMENT | CONCLUSIONS |
|---|---|
| | o entrainment of fish and shellfish;<br>o impingement of fish and shellfish; and<br>o thermal discharge effects).<br>Potential greater significance at plans employing open-cycle or cooling-pond systems. |
| Groundwater Use and Quality | • Small impacts on ground water use from plants with groundwater use of less than 100 gal/min. Moderate or large impacts on groundwater with plants that extract more than 100 gal/min.<br>• Cooling system makeup water consumption may cause groundwater use conflicts, but the significance of such impacts is site specific.<br>• Small potential impacts to groundwater quality due to ground water withdrawals. No mitigation measures are warranted<br>• Potential small, moderate, or large impacts to groundwater quality due to cooling ponds in areas not located in salt marshes. Small potential groundwater quality impacts of ponds located in salt marshes. |
| Air Quality | • Air quality impacts associated with operational transmission lines are small. No mitigation measures are warranted due to small environmental benefits and high cost. |
| Terrestrial Ecology | • Small potential impact of cooling tower drift on crops and ornamental vegetation. No mitigation measures are warranted because there have been no measurable effects on crops or ornamental vegetation.<br>• Impacts of cooling tower drift on native plants are expected to be small. No mitigation measures are warranted due to small environmental benefits and high cost.<br>• Small impact on bird mortality from collision with power lines and cooling towers and will remain a small fraction of total collision mortality with all man-made objects. No additional mitigation measures are warranted.<br>• Small potential impacts to wildlife due since there is no threat to the stability of local wildlife populations or vegetation communities for any cooling pond. Potential mitigation measures would include excluding wildlife from contaminated ponds, converting to a dry cooling system, or reducing plant output during fogging or icing conditions. No additional mitigation measures are warranted. Effects of cooling ponds are small and localized; cumulative impacts are not a concern.<br>• Long-term effects of painting power-line ROWs are small but cause fluctuations in wildlife populations. Small impacts to floodplains and wetlands due to transmission line maintenance and repair. No additional mitigation measures are warranted due to small environmental benefits and high cost.<br>• Potential impacts of EMF on terrestrial resources during the license renewal term is small for all plants. No additional mitigation measures are warranted due to the potential to create additional environmental impacts and high cost. |
| Land Use | • Small impacts to land use due to necessary land use restrictions within transmission-line ROWs. No additional mitigation measures are warranted due to the small environmental benefits and high cost. |
| Human Health | • Small risk at all plans associated with occupational radiation exposures. The radiation dose commitment to the total worker population is projected to increase less than 5 percent at nuclear power plants under the typical scenario and less than 8 percent at any plant under the conservative scenario. No additional mitigation measures are warranted because existing mitigation measures (ALARA process) are effective in reducing radiation doses. |

| AFFECTED ENVIRONMENT | CONCLUSIONS |
|---|---|
| | • Public exposure to radiation is small at all sites, estimated annual cancer risk to the individual is less than 1 x $10^{-6}$. No additional mitigation measures are warranted because current mitigation practices are effective at reducing public radiation doses.<br>• Potential for electric shock from transmission line charges must be evaluated at a site-specific level.<br>• Inconclusive scientific evidence on the impact of 60-Hz electromagnetic field on human health, impacts cannot be categorized and are addressed in license renewal applicants if conclusive scientific evidence emerges.<br>• Small adverse occupation health effects associated with microorganisms at all sites. No additional mitigation measures are warranted due to effectiveness of current industrial hygiene procedures.<br>• Magnitude of public health impacts associated with thermal enhancement of *N. fowleri* are site specific. |
| Noise | • Principal noise sources at power plants do not considerably change during continued operations. Noise impacts have been found to be small and generally not noticed by the public therefore they are small at all sites. No additional mitigation measures are warranted due to small impacts and high cost. |
| Socioeconomics | • Small impacts to education, public safety, social services, recreation and tourism, housing, transportation, public utilities (especially water supply), and aesthetics. No additional mitigation measures are warranted due to small benefit, and high cost. |

Impacts to threatened and endangered species from continued operations are possible, but these impacts would not be more than the impacts already presented in an individual site's supplemental EIS. The SEIS for the James A. Fitzpatrick nuclear facility identified five federally or State-listed species in the vicinity of plant operations: the Indiana bat, bog turtle, Eastern massasauga *(Sistrurus catenatus catenatus),* bald eagle *(Haliaeetus leucocephalus),* and piping plover *(Charadrius melodus).*[82] Required consultations with U.S. FWS concluded that no further coordination pursuant to the ESA was required for the bald eagle, Eastern massasauga, or piping plover and that activities associated with plant operations were not likely to adversely affect the Indian bat or bog turtle. However additional consultations with FWS were required to determine if maintenance activities would adversely affect the presence of bog turtle suitable habitat along transmission lines.[83] A 2008 correspondence between Entergy and FWS indicates that the New York Power Authority (NYPA) regularly schedules vegetation surveys to identify wetland areas as part of its System Right-of-Way Management Plan, and these surveys should fulfill the needs of the FWS to evaluate potential effects to bog turtle.[84] The SEIS for the R.E. Ginna nuclear facility

[82] These four species were listed at the time of re-licensing in 2008.

[83] U.S. NRC. 2008 Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Supplement 31 Regarding James A. FitzPatrick Nuclear Power Plant, Final Report. NUREG-1437 Supplement 31. January.

[84] U.S. NRC. 2008. Biological Assessment for James A. FitzPatrick Nuclear Power Plant License Renewal Application Review. Letter Dated April 28, 2008 to U.S. Fish and Wildlife Service, New York Field Office. Accessed January 26, 2016 at: http://pbadupws.nrc.gov/docs/ML0807/ML080780070.pdf.

concludes that continued operation of the plant and maintenance of the transmission lines and right-of-way are not likely to have an effect on any federal or State-listed species, since no species on these lists are likely to occur in the site vicinity.[85]

Under continued operations, impacts to surface water quality, hydrology, and use would be small for the James A. Fitzpatrick and Ginna nuclear power plants. Continued operations would have small effects on water intake and discharge structures, salinity gradients, temperature effects on sediment transport, altered thermal stratification of lakes, scouring from discharged cooling water, eutrophication, discharge of biocides, discharge of chemical contaminants (e.g., metals), and discharge of sanitary waste. Continued operations would also have small potential impacts to aquatic ecology. Groundwater use and quality impacts would be negligible since all NYS nuclear plants rely on either large lakes or rivers for the cooling intake waters.[86] Adverse air quality impacts associated with operational transmission lines would also be small. Continued operations would have small impacts to terrestrial ecology, land use, and human health. Principal noise sources at power plants do not considerably change due to continued operations; therefore, the impacts of continued operations on noise would also be small. Socioeconomic impacts to education, public safety, social services, recreation and tourism, housing, transportation, public utilities, and aesthetics from continued operations would also be small. Additional, in-depth discussion of the socioeconomic impacts of the proposed action is in **Chapter 9.**

Sustaining operations of nuclear facilities would require the facilities to continue using uranium fuel. The NRC has also evaluated this issue. **Exhibit 5-6** below, recreated from the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Main Report, Final Report* identifies the maximum environmental effects per annual fuel requirement. These include impacts to land, water, fossil fuel use, and gas, liquid, and solid effluents, radiological effluents, thermal effluents, and exposure of workers and the public to radiation sources. **Exhibit 5-7** from the same report bounds the environmental impact of transporting fuel and waste to and from a light-water-cooled nuclear power reactor. The impacts from transportation were found to be small and stated as,

"The impacts of transporting spent fuel enriched up to 5 percent uranium-235 with average burnup for the peak rod to current levels approved by NRC up to 62,000 MWd/MTU and the cumulative impacts of transporting high-level waste to a single repository, such as Yucca Mountain, Nevada are found to be consistent with the impact values contained in 10 CFR 51.52(c), Summary Table S-4, "Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor." If fuel enrichment or burnup conditions are not met, the applicant must submit an assessment of the implications for the environmental impact values reported in 10 CFR 51.52."[87]

The sustained operations of any nuclear facilities under the CES proposal would continue the use of nuclear fuel, production of nuclear waste, and the transport of fuel and waste to and from the

[85] U.S. NRC. 2004 Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Supplement 14 Regarding R.E. Ginna Nuclear Power Plant, Final Report. January.

[86] U.S. EIA. New York Nuclear Profile. 2010. Accessed January 22, 2016 at http://www.eia.gov/nuclear/state/newyork/

[87] Office of Nuclear Reactor Regulation. 2013. Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Main Report, Final Report, NUREG-1437, Volume 1, Revision 1. p. 4-196.

facilities. However, the level of these impacts is not likely to exceed the ranges analyzed by the NRC in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Main Report, Final Report*, and the individual facility supplemental EIS'. Thus, continued operations would result in no additional significant impact to the environment than those previously considered. It would not entail any change in storage location or practices or change in the ultimate disposition of the spent fuel.

**EXHIBIT 5-6. TAKEN FROM 10 CFR 51.51 ON URANIUM FUEL-CYCLE ENVIRONMENTAL DATA[(A),88,89]**

| ENVIRONMENTAL CONSIDERATIONS | TOTAL | MAXIMUM EFFECT PER ANNUAL FUEL REQUIREMENT OR REFERENCE REACTOR YEAR OF MODEL 1,000 MWE LIGHT WATER REACTOR |
|---|---|---|
| **Natural resource use** | | |
| *Land (acres)* | | |
| Temporarily committed, acres[(b)] | 100 | |
| Undisturbed area | 79 | |
| Disturbed area | 22 | Equivalent to a 110-MWe coal-fired power plant. |
| Permanently committed, acres | 13 | |
| Overburden moved, millions of MT | 2.8 | Equivalent to a 95-MWe coal-fired power plant. |
| *Water (millions of gallons)* | | |
| Discharged to air | 160 | Equal to 2 percent of model 1,000 MWe light water reactor with cooling tower. |
| Discharged to water bodies | 11,090 | |
| Discharged to ground | 127 | |
| Total | 11,377 | Less than 4 percent of model 1,000 MWe light water reactor with once-through cooling. |
| *Fossil fuel* | | |
| Electrical energy, thousands of MWh | 323 | Less than 5 percent of model 1,000-MWe LWR output. |
| Equivalent coal, thousands of MT | 118 | Equivalent to the consumption of a 45-MWe coal-fired power plant. |
| Natural gas, millions of scf | 135 | Less than 0.4 percent of model 1,000 MWe energy output. |
| **Effluents-chemical (MT)** | | |
| *Gases (including entrainment)[(c)]* | | |
| SOx | 4,400 | |
| NOx[4] | 1,190 | Equivalent to emissions from 45-MWe coal-fired plant for a year. |
| Hydrocarbons | 14 | |

[88] Normalized to model light-water reactor annual fuel requirement (WASH-1248) or reference reactor year (NUREG-0116).

[89] U.S. NRC. Generic Environmental Impacts Statement for License Renewal of Nuclear Plants: Main Report (NUREG-1437, Volume 1) Table S.3 Uranium fuel-cycle environmental data.

| ENVIRONMENTAL CONSIDERATIONS | TOTAL | MAXIMUM EFFECT PER ANNUAL FUEL REQUIREMENT OR REFERENCE REACTOR YEAR OF MODEL 1,000 MWE LIGHT WATER REACTOR |
|---|---|---|
| CO | 29.6 | |
| Particulates | 1,154 | |
| Other gases | | |
| F | 0.67 | Principally from UF6 production, enrichment, and reprocessing. Concentration within range of state standards--below level that has effects on human health. |
| HCl | 0.014 | |
| *Liquids* | | |
| $SO^{-}_{4}$ | 9.9 | From enrichment, fuel fabrication, and reprocessing steps. Components that constitute a potential for adverse environmental effect are present in dilute concentrations and receive additional dilution by receiving bodies of water to levels below permissible standards. The constituents that require dilution and the flow of dilution water are NH2—600 ft3/sec, NOx—20 ft3/sec, Fluoride—70 ft3/sec. |
| NO | 25.8 | |
| Fluoride | 12.9 | |
| Ca | 5.4 | |
| C1 | 8.5 | |
| Na | 12.1 | |
| NH | 10 | |
| Fe | 0.4 | |
| Tailings solutions (thousands of MT) | 240 | From mills only—no significant effluents to environment. |
| *Solids* | 91,000 | Principally from mills—no significant effluents to environment. |
| **Effluents Radiological (curies)** | | |
| *Gases (including entrainment)* | | |
| Rn-222 | — | Presently under reconsideration by the NRC |
| Ra-226 | 0.02 | |
| Th-230 | 0.02 | |
| Uranium | 0.034 | |
| Tritium (thousands) | 18.1 | |
| C-14 | 24 | |
| Kr-85 (thousands) | 400 | |
| Ru-106 | 0.14 | |
| I-129 | 1.3 | Principally from fuel reprocessing plants. |
| I-131 | 0.83 | |
| Tc-99 | — | Presently under consideration by the Commission. |
| Fission products and transuranics | 0.203 | |
| *Liquids* | | |
| Uranium and daughters | 2.1 | Principally from milling—included tailings liquor and returned to ground—no effluents; therefore, no effect on environment. |
| Ra-226 | 0.0034 | From UF6 production. |
| Th-230 | 0.0015 | |
| Th-234 | 0.01 | From fuel fabrication plants—concentration 10% of 10 CFR 20 for total processing 26 annual fuel requirements for model LWR. |
| Fission and activation products | 5.9 x 10-a | |
| *Solids (buried on site)* | | |

| ENVIRONMENTAL CONSIDERATIONS | TOTAL | MAXIMUM EFFECT PER ANNUAL FUEL REQUIREMENT OR REFERENCE REACTOR YEAR OF MODEL 1,000 MWE LIGHT WATER REACTOR |
|---|---|---|
| Other than high level (shallow) | 11,300 | 9100 Ci comes from low-level reactor wastes and 1500 Ci comes from reactor decontamination and decommissioning— buried at land burial facilities. 600 Ci comes from mills—included in tailings returned to ground. Approximately 60 Ci comes from conversion and spent-fuel storage. No significant effluent to the environment. |
| TRU and HLW (deep) | 1.1 x 106 | Buried at federal repository. |
| **Effluents—Thermal, (billions of Btu)** | 4,063 | Less than 5 percent of model 1000-MWe LWR. |
| **Transportation, (person-rem)** | | |
| Exposure of workers and general public | 2.5 | |
| Occupational exposure | 22.6 | From reprocessing and waste management. |

[(a)] In some cases where no entry appears, it is clear from the background documents that the matter was addressed and that, in effect, the table should be read as if a specific zero entry had been made. However, there are other areas that are not addressed in the table. Table S-3 does not include health effects from the effluents described in the table, estimates of releases of radon-222 from the uranium fuel cycle, or estimates of technetium-99 released from waste management or reprocessing activities. These issues may be the subject of litigation in the individual licensing proceedings. Data supporting this table are given in the *Environmental Survey of the Uranium Fuel Cycle*, WASH-1248, April 1974; the *Environmental Survey of the Reprocessing and Waste Management Portion of the LWR Fuel Cycle*,' NUREG-0116 (Supp. 1 to WASH-1248); the *Public Comments and Task Force Responses Regarding the Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle*, NUREG-0216 (Supp. 2 to WASH-1248); and in the record of the final rulemaking pertaining to *Uranium Fuel Cycle Impacts from Spent Fuel Reprocessing and Radioactive Waste Management*, Docket RM-50-3. The contributions from reprocessing, waste management, and transportation of wastes are maximized for either of the two fuel cycles (uranium only and no recycle). The contribution from transportation excludes transportation of cold fuel to a reactor and of irradiated fuel and radioactive wastes from a reactor, which are considered in Table S-4 of Section 51.20(g). The contributions from the other steps of the fuel cycle are given in columns A¤E of Table S-3A of WASH-1248.

[(b)] The contributions to temporarily committed land from reprocessing are not prorated over 30 years, because the complete temporary impact accrues regardless of whether the plant services 1 reactor for 1 year or 57 reactors for 30 years.

[(c)] Estimated effluents based upon combustion of equivalent coal for power generation.

[4] 1.2% from natural gas use and process.

## EXHIBIT 5-7. TAKEN FROM 10 CFR 51.52 ON THE ENVIRONMENTAL IMPACT OF TRANSPORTING OF FUEL AND WASTE TO AND FROM ONE LIGHT-WATER-COOLED NUCLEAR POWER REACTOR[90], NORMAL CONDITIONS OF TRANSPORT

| CONSIDERATIONS | | ENVIRONMENTAL IMPACT | |
|---|---|---|---|
| Heat (per irradiated fuel cask in transit) | | 250,000 Btu/hr | |
| Weight (governed by Federal or State restrictions) | | 73,000 lb per truck; 100 tons per cask per rail car | |
| Traffic density –Truck | | Less than 1 per day | |
| Traffic density – Rail | | Less than 3 per month | |
| **EXPOSED POPULATION** | **ESTIMATED NUMBER OF PERSONS EXPOSED** | **RANGE OF DOSES TO EXPOSED INDIVIDUALS[91] (PER REACTOR YEAR)** | **CUMULATIVE DOSE TO EXPOSED POPULATION (PER REACTOR YEAR)[92]** |
| Transportation workers | 200 | 0.01 to 300 millirem | 4 person-rem |
| General public- Onlookers | 1,100 | 0.003 to 1.3 millirem | 3 person-rem |
| General public- along route | 600,000 | 0.0001 to 0.06 millirem | |
| **ACCIDENTS IN TRANSPORT CONSIDERATIONS** | | **ACCIDENTS IN TRANSPORT ENVIRONMENTAL RISK** | |
| Radiological effects | | Small[93] | |
| Common (nonradiological) causes | | 1 fatal injury in 100 reactor years, 1 nonfatal injury in 10 reactor years, $475 property damage per reactor year | |

[90] Data supporting this table are given in the Commission's *Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants*, WASH-1238, December 1972, and Supp. 1 NUREG-75/038, April 1975. Both documents are available for inspection and copying at the Commission's Public Document Room, 2120 L Street N.W., Washington, D.C., and may be obtained from National Technical Information Service, Springfield, VA 22161. WASH-1238 is available from NTIS at a cost of $5.45 (microfiche, $2.25) and NUREG-75/038 is available at a cost of $3.25 (microfiche, $2.25).

[91] The Federal Radiation Council has recommended that the radiation doses from all sources of radiation other than natural background and medical exposures should be limited to 5000 mrem per year for individuals as a result of occupational exposure and should be limited to 500 mrem per year for individuals in the general population. The dose to individuals due to average natural background radiation is about 130 mrem per year.

[92] Man-rem is an expression for the summation of whole body doses to individuals in a group. Thus, if each member of a population group of 1000 people were to receive a dose of 0.0001 rem (1 mrem), or if 2 people were to receive a dose of 0.5 rem (500 mrem) each, the total man-rem dose in each case would be 1 man-rem.

[93] Although the environmental risk of radiological effects stemming from transportation accidents is currently incapable of being numerically quantified, the risk remains small regardless of whether it is being applied to a single reactor or a multireactor site.

#### No Action Alternative Impacts

Discontinuing operations nuclear facilities would have nearly the same impacts as those discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Main Report, Final Report* related to not renewing a nuclear license and ceasing operations.[94] These impacts include affects arising from:

- Nuclear reactor decommissioning;
- Termination of plant operations and cessation of electrical power production; and
- Failure to meet the need of delivering baseload power to meet future electric system needs.

Discontinuing operations at eligible nuclear facilities would create a need for replacement power that may be met by installation of alternative energy sources (i.e., fossil fuel electricity generation, renewable energy alternatives, hydroelectric, geothermal, wind, biomass, solar, energy storage technologies, PV technologies, or ocean wave and current energy), adoption or expansion of energy efficiency programs, imported out-of-state power, or a combination of these. The GEIS for License Renewal indicates that fossil fuels will be the primary source of commercial electric power generation through 2050 and would likely be the primary source of replacement power.[95] Increased use of fossil fuels for electricity generation would adversely impact air emissions through increased production of nitrogen dioxide, sulfur dioxide, and carbon dioxide.

### 5.2.2 SOLAR ENERGY

According to National Renewable Energy Laboratory (NREL) 2014 renewable energy data book, the cumulative installed solar PV capacity in New York State was approximately 397 MW in 2014. Among the State's installed capacity is the Long Island Solar Farm, one of the largest utility scale solar energy (USSE) installations at a federal facility. Installed on Brookhaven National Laboratory, the Long Island Solar Farm is currently under contract to provide 32 MW of solar-PV energy to the Long Island Power Authority (LIPA). Another noteworthy LIPA USSE contract is the Eastern Long Island Solar Project which provides for up to 17 MW of solar carport facilities on various sites owned by Suffolk County.

The supply curve model discussed in Chapter 4 estimates the contribution of USSE under the CES to range between 3,721 and 9,122 MW, depending on the scenario, beginning in the later years of the program. In the PPA base case, the majority (87 percent) of capacity comes online in the last four years of the program (2027-2030). In contrast, in the other three scenarios, only 54-66 percent comes online in the last four years. Under either of the base case scenarios, the majority (90 percent) of the projected USSE capacity is expected to occur in four upstate zones, including West, Central, Mohawk Valley and Capital. In the high renewable scenario, four zones also

[94] U.S. NRC. Generic Environmental Impacts Statement for License Renewal of Nuclear Plants: Main Report (NUREG-1437, Volume 1)

[95] U.S. NRC. Generic Environmental Impacts Statement for License Renewal of Nuclear Plants: Main Report (NUREG-1437, Volume 1)

account for the majority (73 percent) of the estimated USSE capacity, including West, Central, Capital and Mohawk Valley. **Exhibit 5-8** shows the estimated USSE projected to develop under the CES by NYISO Zone under the base case and high renewable case scenarios, respectively.

**EXHIBIT 5-8. ESTIMATED USSE PROJECTED TO DEVELOP UNDER THE CES (2019-2030)**

| NYISO ZONE | ESTIMATED NEW CAPACITY (MW) | | | | ESTIMATED NEW GENERATION (GWH) | | | |
|---|---|---|---|---|---|---|---|---|
| | BASE CASE | | HIGH LOAD | | BASE CASE | | HIGH LOAD | |
| | PPA | FIXED REC | PPA | FIXED REC | PPA | FIXED REC | PPA | FIXED REC |
| Zone A, West | 841 | 1,463 | 1,467 | 2,013 | 1,234 | 2,148 | 2,154 | 2,955 |
| Zone B, Genesee | 0 | 196 | 0 | 777 | 0 | 290 | 0 | 1,151 |
| Zone C, Central | 105 | 2,117 | 1,555 | 2,076 | 160 | 3,215 | 2,362 | 3,154 |
| Zone D, North | 0 | 81 | 81 | 281 | 0 | 125 | 126 | 437 |
| Zone E, Mohawk Valley | 0 | 0 | 0 | 1,011 | 0 | 0 | 0 | 1,376 |
| Zone F, Capital | 1,954 | 1,919 | 1,931 | 1,945 | 3,038 | 2,984 | 3,003 | 3,025 |
| Zone G, Hudson Valley | 438 | 620 | 632 | 630 | 623 | 881 | 898 | 896 |
| Zone H, Millwood | 7 | 7 | 7 | 7 | 10 | 10 | 10 | 10 |
| Zone I, Dunwoodie | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Zone J, NYC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Zone K, Long Island | 377 | 371 | 377 | 382 | 590 | 581 | 590 | 599 |
| **TOTAL** | **3,721** | **6,773** | **6,050** | **9,122** | **5,655** | **10,235** | **9,144** | **13,603** |
| Note: Estimates may not sum to the totals reported due to rounding. | | | | | | | | |

The estimates of USSE development under the CES are in line with a 2014 statewide study published by NYSERDA, which examined the technical and economic potential for energy efficiency and renewable energy, including solar.[96] This study estimates that the New York State technical and economic potential for utility scale solar is 8,493 MW and 2,254 MW, respectively. However, the potential for utility scale solar is only a small portion of the total solar resources identified in the study; including residential and commercial scale solar, NYSERDA estimates the technical and achievable potential at 42,643 MW and 10,137 MW, respectively.[97]

### Environmental Impact Overview

As discussed in the 2015 GEIS, key environmental impacts due to USSE stem primarily from the relatively large land use requirements of such systems and the potential for such systems to destroy and fragment habitat, disrupt ecosystem processes, harm animals, interrupt natural animal

[96] NYSERDA. 2014. Energy Efficiency and Renewable Energy Potential Study of New York State. Prepared by Optimal Energy, Inc. April. Accessed February 1, 2016 at: http://www.nyserda.ny.gov/About/Publications/EA-Reports-and-Studies/EERE-Potential-Studies.

[97] *Ibid*.

behaviors (e.g., foraging, hunting, migration patterns, etc.) and introduce barriers to the movement of species.

USSE environmental impacts are typically greatest at the beginning of a project during construction of the facility and associated infrastructure (e.g., transmission corridors, substations, and roads). Environmental impacts during construction will vary depending on the land cover and topography of the selected site and its proximity to habitat relied upon by sensitive plant and/or animal species. To the extent that USSE are sited outside of, and at distances sufficient to reduce interaction with sensitive species, the environmental impacts of such systems can be minimized. Another promising trend is the development of 'brightfields:' USSE developed on degraded lands, such as brownfields, landfills, mine sites and other types of contaminated or previously-disturbed lands. For example, Hernandez et al. describe plans for conversion of a 30,000 acre salt-contaminated agricultural area in San Joaquin Valley into a 2.4 GW solar power plant.[98]

Construction and operation may also impact local air quality for plant employees and the surrounding community. For example, increased vehicle use associated with site construction and operation can elevate local levels of CO, NOx emissions and airborne dust ($PM_{2.5}$ and $PM_{10}$ emissions). While solar PV cells emit no criteria pollutants and require little maintenance during operations, chemicals such as dust suppressants, rust inhibitors, antifreeze and herbicides will be used to some extent throughout a plant's lifespan to ensure proper operation and maintenance of USSE infrastructure. Soil disturbance during site preparation (e.g., vegetation clearing and surface grading) can also further interfere with natural ecosystems by introducing exotic species, which can compete with, and in some cases extirpate, native species.

As discussed in the 2015 GEIS, solar PV systems have low rates of water consumption, required only for panel washing and dust suppression, estimated at a rate of 0.02 $m^3$/MWh. The Long Island Solar Farm estimated annual water usage for panel washing of approximately 500,000 gallons, equivalent to a per MWh rate of approximately 0.04 $m^3$/MWh.[99] Past studies of USSE in arid lands of the southwestern U.S. have identified dust suppression as a significant source of water use, although the New York humid continental climate is far less susceptible to generating the type of dust issues faced by USSE constructed in the much drier climate in southwestern US. To minimize fugitive dust emissions at the Long Island Solar Farm, native short-growing shade-tolerant grass was planted below the PV arrays.[100]

Connecting USSE to the existing electricity system can also result in both short- and long-term adverse environmental impacts. Similar to site construction, development of transmission lines can destroy and fragment habitat, displace and disrupt local wildlife, introduce invasive species and serve as barriers to the movement of species and their genes. And similar to site construction, the scope and magnitude of such impacts is substantially dependent on such factors as corridor

[98] Hernandez, R.R., et al. 2014. "Environmental Impacts of Utility-Scale Solar Energy." *Renewable and Sustainable Energy Reviews*. 29(1): 766-779.

[99] DOE. 2009. Environmental Assessment for BP Solar Array Project. DOE/EA-1663. December. 68 pp. Accessed January 20, 2016 at: http://www.lipower.org/pdfs/company/projects/solar/bpsolar-ea.pdf.

[100] DOE. 2009. Environmental Assessment for BP Solar Array Project. DOE/EA-1663. December. 68 pp. Accessed January 20, 2016 at: http://www.lipower.org/pdfs/company/projects/solar/bpsolar-ea.pdf.

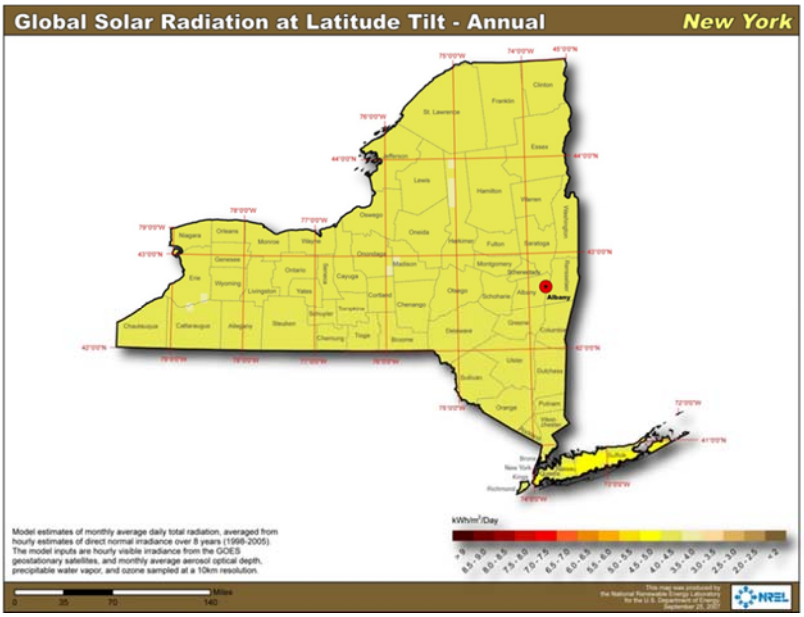
location, distance to existing electricity infrastructure and corridor placement. In the case of the Long Island Solar Farm, approximately 900 feet of transmission cables were required to connect the PV solar arrays to the LIPA substation. To minimize adverse environmental impacts, the project relied on below ground horizontal directional drilling, which avoided the need for vegetation removal.[101]

During the decommissioning phase, PV cells can be recycled to minimize the potentially adverse environmental impacts of the PV cell materials. Proper dismantling, handling, and disposal of PV cells and associated plant materials will minimize the potential environmental impacts that can result from exposure to toxic materials such as cadmium, selenium and arsenic dust, which are contained within PV cells.

### Land Use Requirements

NYSERDA's 2014 resource potential study also considered the land use requirement for the installation of solar energy. **Exhibit 5-9** shows the global solar radiation throughout New York State. As shown, the level of solar radiation is relatively consistent across the state, with slightly lower solar intensity in some parts of upstate, and a slightly higher solar intensity in Long Island. Overall, the 2014 study concluded that more than 187 million GWh of solar energy fall on New York each year, more than 1,200 times larger than New York's electric use.[102]

**EXHIBIT 5-9. NEW YORK STATE GLOBAL SOLAR RADIATION**




[101] *Ibid*.

[102] NYSEDA. 2014. Energy Efficiency and Renewable Energy Potential Study of New York State. Volume 3. Prepared by Optimal Energy, Inc. April. Accessed February 1, 2016 at: http://www.nyserda.ny.gov/About/Publications/EA-Reports-and-Studies/EERE-Potential-Studies.

NYSERDA's 2014 potential study estimates that solar energy in New York requires approximately one square kilometer of land for every 155 GWh of electricity production, equivalent to approximately two acres per MW capacity, and 1.6 per GWh of annual production.[103] Assuming installation of between 3,721 and 9,122 MW of USSE and a land use requirement ratio of two acres per MW capacity from NYSERDA's 2014 potential study, between 7,442 and 18,244 acres would be dedicated to USSE, a land area equal to approximately 0.02 percent to 0.05 percent of the State's total land area of approximately 35 million acres.

#### Visual Resources

As discussed in the 2015 GEIS, USSE may raise community concerns regarding visual impacts. As most USSE are located in relatively flat areas and/or valleys, USSE operations can often be seen from long distances. The reflective nature of the PV panels can further increase visibility, creating glare that can cause visual discomfort and temporary after images even at long distances. Argonne National Laboratory's Environmental Science Division, with support from the U.S. Department of the Interior's National Park Service and Bureau of Land Management, examined the visual characteristics of various PV, power tower, and parabolic trough facilities located in Nevada, California, and Spain. Based on field observations, PV and parabolic trough facilities were easily visible at long distances during both daytime and nighttime observations. Other visual effects observed included dramatic and rapid changes in color and/or reflectively of the solar PV cells. The study authors concluded that the industrial nature of USSE sites can offer strong contrasts to the relatively rural landscapes that USSE often inhabit.[104]

Additional visual impacts can accrue from the infrastructure surrounding a developed solar array, including buildings, parking and other work areas. To the extent that periodic maintenance activities such as panel washing occur are conduct at night, such activities can increase light pollution such as skyglow, light trespass, and glare.[105]

Best practices during installation can minimize visual impacts, including proper siting and site operations, screening with fencing, berms, or vegetation, using non-reflective support structures, avoiding removal of vegetation near modules when possible, prohibiting commercial messages and symbols on modules, and identifying ways to preserve the historic character of potential sites, particularly for historic buildings.[106]

### 5.2.3 LAND BASED WIND ENERGY

According to the American Wind Energy Association (AWEA), installed wind capacity in the U.S. is estimated at 67,870 MW, associated with over 49,000 wind turbines. Texas leads the nation in

[103] *Ibid*.

[104] Argonne National Laboratory's Environmental Science Division. Visual Impacts of Utility-Scale Solar Energy Facilities on Southwestern Desert Landscapes. Accessed on January 21, 2016 at: http://visualimpact.anl.gov/solarvis/.

[105] BLM. 2013. Best Management Practices for Reducing Visual Impacts of Renewable Energy Facilities on BLM-Administered Lands. Accessed on January 21, 2016 at: http://www.blm.gov/style/medialib/blm/wy/programs/energy/reco.Par.61853.File.dat/BLMvisual-BMP.pdf.

[106] *Ibid*.

terms of installed wind capacity with over 15,000 MW followed by California with over 6,000 MW of installed wind capacity.

While wind currently accounts for a relatively small proportion of the New York State's overall energy portfolio, development of wind is a renewable energy resource rapidly expanding. AWEA currently ranks New York 12th in the nation for installed wind power capacity.[107] According to the 2015 SEP, "as of the end of 2011, 860 wind turbines had been installed in the State with a total capacity of 1,403 MW; and an additional 37 turbines were under construction with 74 MW of expected capacity."[108]

As shown in NYISO's 2015 Gold Book, between 2007 and 2015 installed nameplate capacity of wind plants in New York nearly tripled, from 425 MW in 2007 to 1,746 MW in 2015.[109] **Exhibit 5-10** summarizes the state's operating and planned wind capacity across five size classes. Summer 2015 generating capacity in from wind plants totaled 1,461 MW across 21 projects. In addition, as of December 31, 2015, there were 28 projects totaling 3,459 MW of wind generation capacity proposed in NYISO's interconnection queue.

**EXHIBIT 5-10. OPERATING AND PROPOSED WIND CAPACITY IN NEW YORK STATE (MW)**

| CAPACITY | 2015 CAPACITY(1) | PROPOSED CAPACITY(2) |
|---|---|---|
| >10 MW | 0 MW (5 projects) (3) | 0 MW (0 projects) |
| 10-29 MW | 32 MW (2 projects) | 60 MW (4 projects) |
| 30- 99 MW | 527 MW (7 projects) | 639 MW (9 projects) |
| 100-199 MW | 671 MW (6 projects) | 969 MW (8 projects) |
| 200 MW and over | 231 MW (1 project) | 1,790 MW (7 projects) |
| **Total** | **1,461 MW (21 projects)** | **3,459 MW (28 projects)** |

Sources:
(1) Summer capacity data, reflecting dependable maximum net generating capacity values that are applicable to the Summer 2015 ICAP Market. NYISO. 2015 Load & Capacity Data "Gold Book." April 2015; and NYISO's "2015 NYCA Generating Facilities.xlxs" accessed on February 1, 2016 at: http://www.nyiso.com/public/markets_operations/services/planning/documents/index.jsp.
(2) Summer capacity data from: NYISO Interconnection Queue. December 31, 2015.
(3) The NYISO Interconnection Queue, December 31, 2015 includes five projects for which summer capacity values were shown as zero.

**Exhibit 5-11** shows the current distribution of operating and proposed wind capacity by county. Wind projects have been constructed in eight counties, with the majority of wind capacity coming from just four counties (Clinton, Wyoming, Lewis and Steuben). New capacity proposed for

[107] American Wind Energy Association. 2015. U.S. Wind Industry Second Quarter 2015 Market Report. July 22. Accessed January 25, 2016 at: http://www.ourenergypolicy.org/wp-content/uploads/2015/07/2Q2015-AWEA-Market-Report-Public-Version.pdf.

[108] NY State Energy Planning Board. 2015 New York State Energy Plan. Volume 2. Accessed February 1, 2016 at: http://energyplan.ny.gov/Plans/2015.

[109] NYISO. 2015 Load & Capacity Data "Gold Book." April 2015.

development (i.e., projects in the NYISO interconnection queue) represents a much more geographically diverse distribution, with projects proposed for the first time in 13 new counties.

**EXHIBIT 5-11. CURRENT INSTALLED AND PROPOSED WIND CAPACITY BY COUNTY**

| COUNTY | 2015 CAPACITY (MW)[1] | PROPOSED CAPACITY (MW) [2] |
|---|---|---|
| Steuben, NY | 180.4 | 590.7 |
| Jefferson, NY | | 494.8 |
| Clinton | 279.0 | 449.0 |
| Chautauqua | | 324.0 |
| Niagara, NY | | 201.3 |
| Franklin-Clinton, NY | | 200.0 |
| Lewis, NY | 321.8 | 157.9 |
| Cattaraugus | | 148.5 |
| Rensselaer, NY | | 120.0 |
| Oswego, NY | | 105.6 |
| Steuben-Allegany, NY | | 103.3 |
| St. Lawrence, NY | | 100.0 |
| Cortland | | 90.0 |
| Madison, NY | 46.1 | 82.6 |
| Genesee, NY | | 79.8 |
| Franklin | 106.5 | 77.7 |
| Delaware | | 68.4 |
| Herkimer, NY | 74.0 | 33.0 |
| Otsego, NY | | 19.8 |
| Tompkins, NY | | 12.5 |
| Erie | 20.0 | |
| Wyoming | 432.9 | |
| **Grand Total** | **1,460.7** | **3,458.9** |

Sources:
(1) Summer capacity data from: NYISO. 2015 Load & Capacity Data "Gold Book." April 2015; and NYISO's "2015 NYCA Generating Facilities.xlxs" accessed on February 1, 2016 at: http://www.nyiso.com/public/markets_operations/services/planning/documents/index.jsp.
(2) Summer capacity data from: NYISO Interconnection Queue. December 31, 2015.

The proposed CES would stimulate further development of the State's land-based wind resource. As discussed in **Chapter 4,** modeling conducted to assist this impact analysis found that incremental land-based wind capacity could provide between 3,495 MW and 5,330 MW and between 11,276 GWh and 16,748 GWh of generation under the base case and high load case scenarios, respectively. As shown in **Exhibit 5-12**, the majority of this capacity is anticipated to

be developed through wind projects between 30 and 99 MW in size. In terms of geographic distribution, the majority of projected new wind capacity is expected to be developed in Zone A (West) and Zone E (Mohawk Valley), accounting for between 60 and 75 percent of total incremental land-based wind capacity under the four scenarios.[110]

The 2014 NYSERDA potential study also looked at the technical and economic potential for wind capacity through 2030. The study estimated a total technical potential of 12,651 MW and an economic potential of 4,074 MW.[111] These estimates are consistent with the supply curve model results used for this SEIS.

**EXHIBIT 5-12. ESTIMATED UTILITY SCALE LAND-BASED WIND ENERGY PROJECTED TO DEVELOP UNDER THE CES (2019-2030)**

| | ESTIMATED NEW CAPACITY (MW) | | | | ESTIMATED NEW GENERATION (GWH) | | | |
|---|---|---|---|---|---|---|---|---|
| | BASE CASE | | HIGH LOAD | | BASE CASE | | HIGH LOAD | |
| CAPACITY | PPA | FIXED REC | PPA | FIXED REC | PPA | FIXED REC | PPA | FIXED REC |
| 10-29 MW | 567 | 387 | 704 | 559 | 1,996 | 1,426 | 2,426 | 1,979 |
| 30-99 MW | 2,159 | 1,790 | 3,013 | 2,949 | 6,881 | 5,765 | 9,438 | 9,308 |
| 100-199 MW | 1,017 | 1,012 | 1,308 | 1,311 | 3,148 | 3,141 | 3,967 | 3,997 |
| 200 MW and over | 308 | 306 | 305 | 302 | 952 | 944 | 917 | 915 |
| **Total** | **4,051** | **3,495** | **5,330** | **5,120** | **12,977** | **11,276** | **16,748** | **16,199** |
| Note: Estimates may not sum to the totals reported due to rounding. | | | | | | | | |

[110] In response to the increasing pace of wind energy development in the State, NYISO conducted an extensive study on the integration of wind energy across the State in 2010. While the study does not represent a full cost-benefit analysis of wind generation, the study provides an in-depth focus on the technical impacts of increasing the penetration of wind resources statewide. Among the technical issues considered, NYISO evaluated the State's existing transmission infrastructure to determine what constraints, if any, may impede higher levels of wind generation. Based on this evaluation, NYISO estimated that as much as nine percent of potential wind energy production may not be able to be delivered due to a need for transmission upgrades. NYISO's analysis identified three areas in upstate New York facing transmission constraints: the Central Zone, in Northern New York, where wind resources are limited by the Willis Exit, and in the Watertown area. (NYISO. 2012. Growing Wind: Final Report of the NYISO 2010 Wind Generation Study. September.) If such constraints are not alleviated, wind projects are likely to be concentrated geographically in the unconstrained areas of the State.

[111] NYSEDA. 2014. Energy Efficiency and Renewable Energy Potential Study of New York State. Volume 3. Prepared by Optimal Energy, Inc. April. Accessed February 1, 2016 at: http://www.nyserda.ny.gov/About/Publications/EA-Reports-and-Studies/EERE-Potential-Studies.

### Environmental Impact Overview

This section expands on the 2015 GEIS by more fully describing impacts that occur during the construction and operation of utility-scale, land-based wind energy generation facilities. Environmental impacts arise due to the land disturbance during the construction and operation of wind turbines and associated equipment, and due to the structure and movement of turbines themselves. The primary impacts of wind turbines relate to the high land use requirement, possible collisions of wildlife with turbines, and habitat fragmentation due to construction of arrays. However, the impacts on wildlife across all life stages of a wind turbine are still likely to be significantly less than impacts of traditional fossil fuel energy.[112]

### Land Use Impacts

Utility-scale land-based wind projects are relatively land-intensive, consisting of an array of turbines that require a minimum amount of spacing between turbines to maximize effectiveness. As discussed in the final 2015 GEIS, the NREL conducted a nationwide survey in 2009 of the land use associated with large (defined as facilities with a nameplate capacity of greater than 20 MW) land-based wind facilities. Based on data collected for over 172 existing or proposed wind projects between 2000 and 2008, representing over 26 GW of capacity, the NREL estimated an average land use between 30 and 141 acres per MW of wind capacity, although only a small portion of that land is permanently disturbed (roughly 0.5 to 2 percent). Approximately 80 percent of this permanent disturbance on average is associated with roads, with the remaining attributable to turbine area and associated equipment.[113] These estimates are in line with a 2009 wind energy toolkit published by NYSERDA which cites land requirements between 30 to 80 acres per MW for utility-scale projects in open, flat terrain and 20 to 40 acres per MW for utility-scale wind projects located on ridgelines in more hilly terrain.[114]

The 2009 NREL study also examined the extent to which land use intensities for large wind projects varied with land cover (**Exhibit 5-13**). While temporary direct impacts were the highest among wind facilities located in forested areas, likely due to the need to clear forest to create access roads, turbine pads and setback areas, wind facilities in forested areas also reported the lowest total area impacted. Notably, wind projects sited on row crops had the greatest total area requirement followed by grasslands.

[112] Alliance for Clean Energy New York, Inc. 2011. Wind and Wildlife.

[113] Denholm et al. 2009. Land-use requirements of modern wind power plants in the United States. Bolder CO: National Renewable Energy Laboratory.

[114] NYSERDA. 2009. Wind Energy Toolkit. Accessed January 24, 2016 at: http://www.nyserda.ny.gov/-/media/Files/EERP/Renewables/wind-energy-toolkit.pdf

**EXHIBIT 5-13. AVERAGE LAND USE REQUIREMENTS BY COVER TYPE**

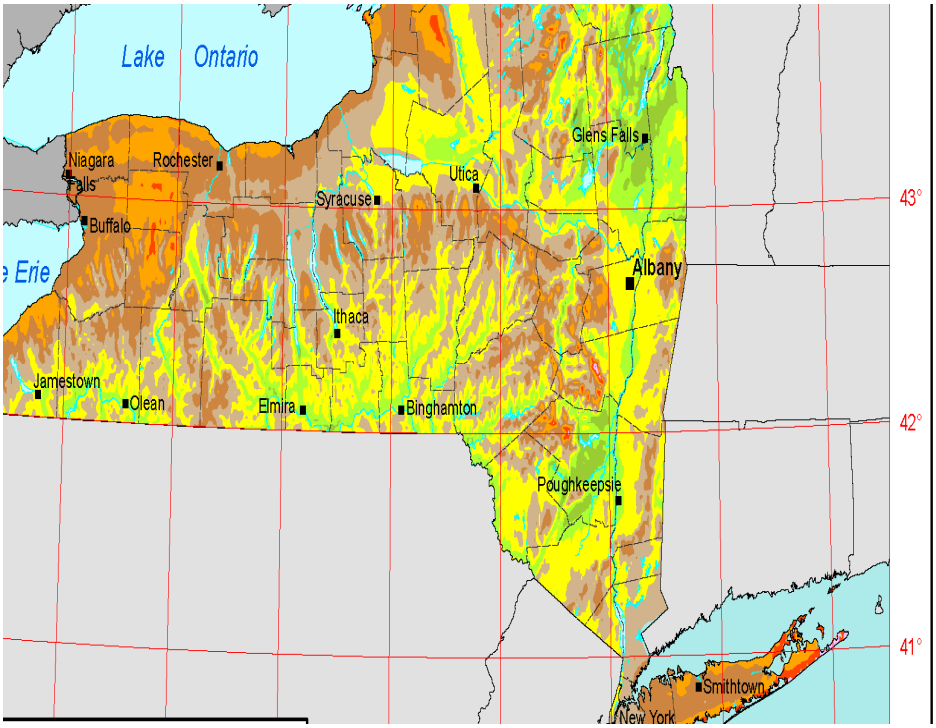
| PRIMARY LAND COVER TYPE | AVERAGE AREA (ACRES /MW) | | | |
|---|---|---|---|---|
| | DIRECT IMPACT AREA (PERMANENT) | DIRECT IMPACT AREA (TEMPORARY) | TOTAL AREA | PERCENT OF TOTAL AREA PERMANENTLY IMPACTED |
| Shrubland | 0.54 ± 0.30 | 1.56 ± 1.24 | 64.99 ± 31.63 | 0.8% |
| Forest | 0.89 ± 0.54 | 2.74 ± 2.82 | 45.22 ± 31.13 | 2.0% |
| Grasslands/Herbaceous | 1.01 ± 0.54 | 0.91 ± 0.27 | 88.21 ± 41.27 | 1.1% |
| Pasture/Hay | 0.59 ± 0.37 | 1.46 ± 1.63 | 67.71 ± 38.05 | 0.9% |
| Row Crops | 0.59 ± 0.69 | 2.15 ± 1.61 | 117.62 ± 62.02 | 0.5% |
| Small Grains | 0.77 ± 1.28 | 1.24 ± 0.42 | 60.54 ± 19.03 | 1.3% |

Source: Denholm et al. 2009. Land-use requirements of modern wind power plants in the United States. Bolder CO: National Renewable Energy Laboratory.

To date, there are two efforts that have mapped out areas in the State that may be suitable for development of land-based wind energy. In 2010, the U.S. DOE NREL WIND Exchange project mapped out wind speeds and capacity factors[115] relevant to different turbine heights across the U.S. In New York, as shown in **Exhibit 5-14,** NREL's analysis shows the areas with the highest wind speeds and capacity factors occur generally in Long Island, the Eerie-Ontario Lowlands, the Western Adirondack Mountains, and the northern side of the Allegheny Plateau.

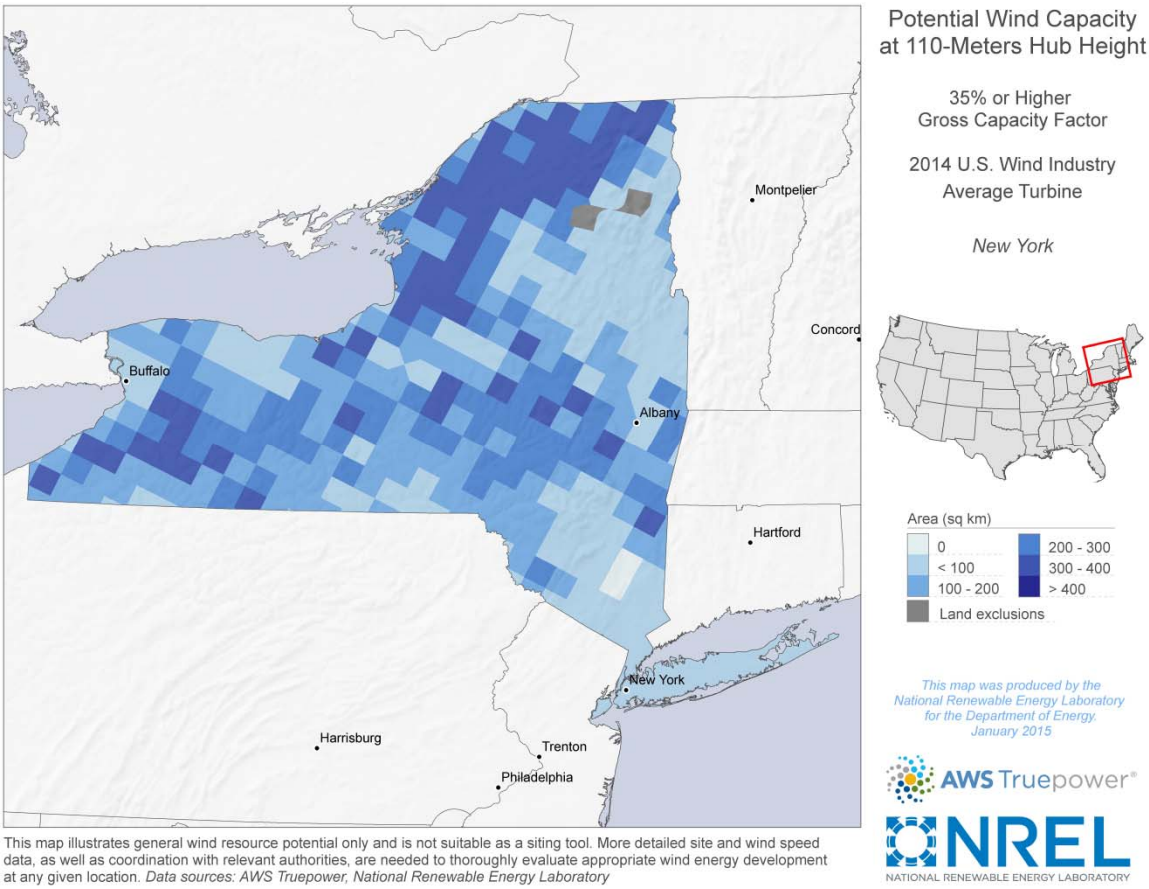
[115] A capacity factor is equal to the ratio of energy generated by an energy generating unit divided by the total amount of energy that could have been generated under full capacity. (see: EIA. Glossary. Accessed January 20, 2016 at: http://www.eia.gov/tools/glossary/index.cfm?id=C.)

**EXHIBIT 5-14. WIND SPEEDS IN NEW YORK STATE AT 80M**



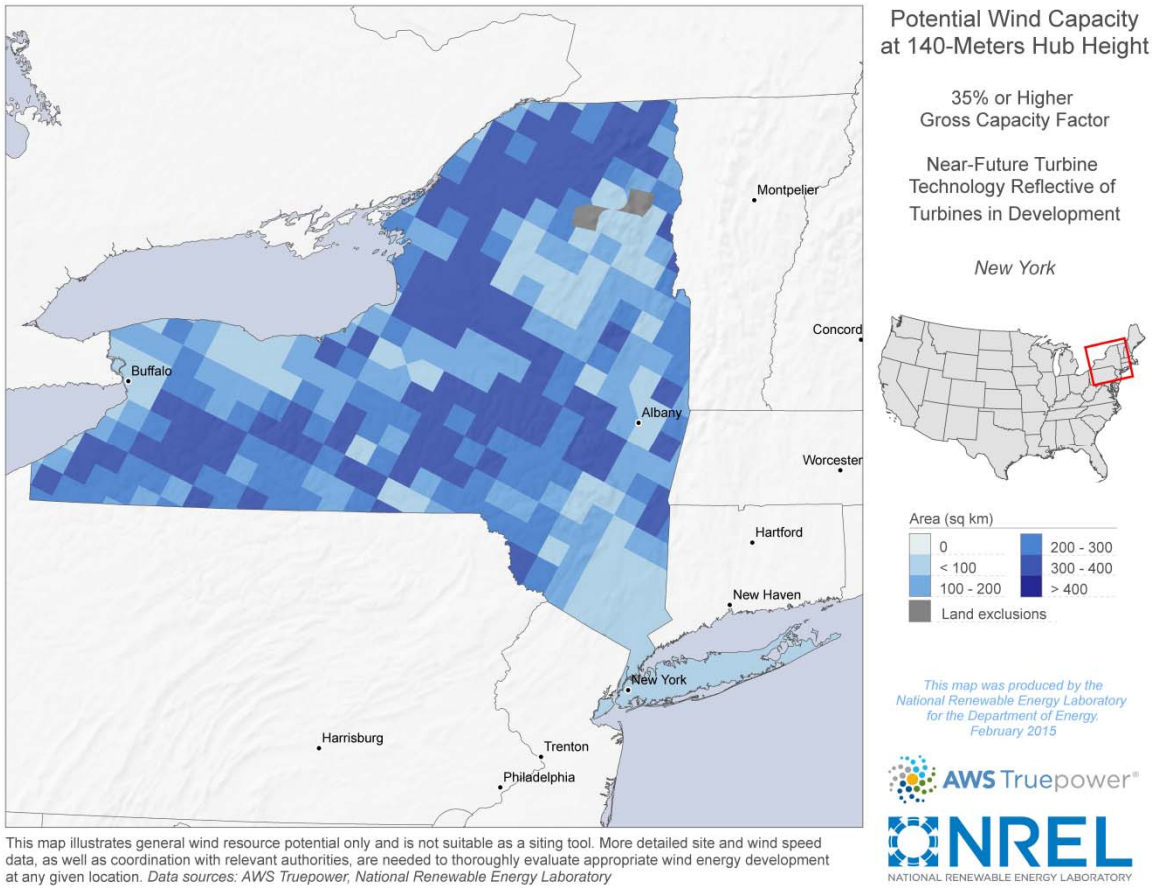

NREL also produced another relevant potential wind capacity map based on a 2014 industry standard wind turbine installed on a 110-m tower (**Exhibit 5-15**). NREL indicates that this map represents plausible current technology options, and a wind turbine on a 140-m tower represents near future technology options (**Exhibit 5-16**). Darker shades on the map correspond to larger potentially developable areas with a cell; the maps exclude areas unavailable for development (e.g., protected areas, urban areas and water bodies).

## EXHIBIT 5-15. POTENTIAL WIND CAPACITY AT 110-METERS HUB HEIGHT




This map illustrates general wind resource potential only and is not suitable as a siting tool. More detailed site and wind speed data, as well as coordination with relevant authorities, are needed to thoroughly evaluate appropriate wind energy development at any given location. *Data sources: AWS Truepower, National Renewable Energy Laboratory*

**EXHIBIT 5-16. POTENTIAL WIND CAPACITY AT 140-METERS HUB HEIGHT**



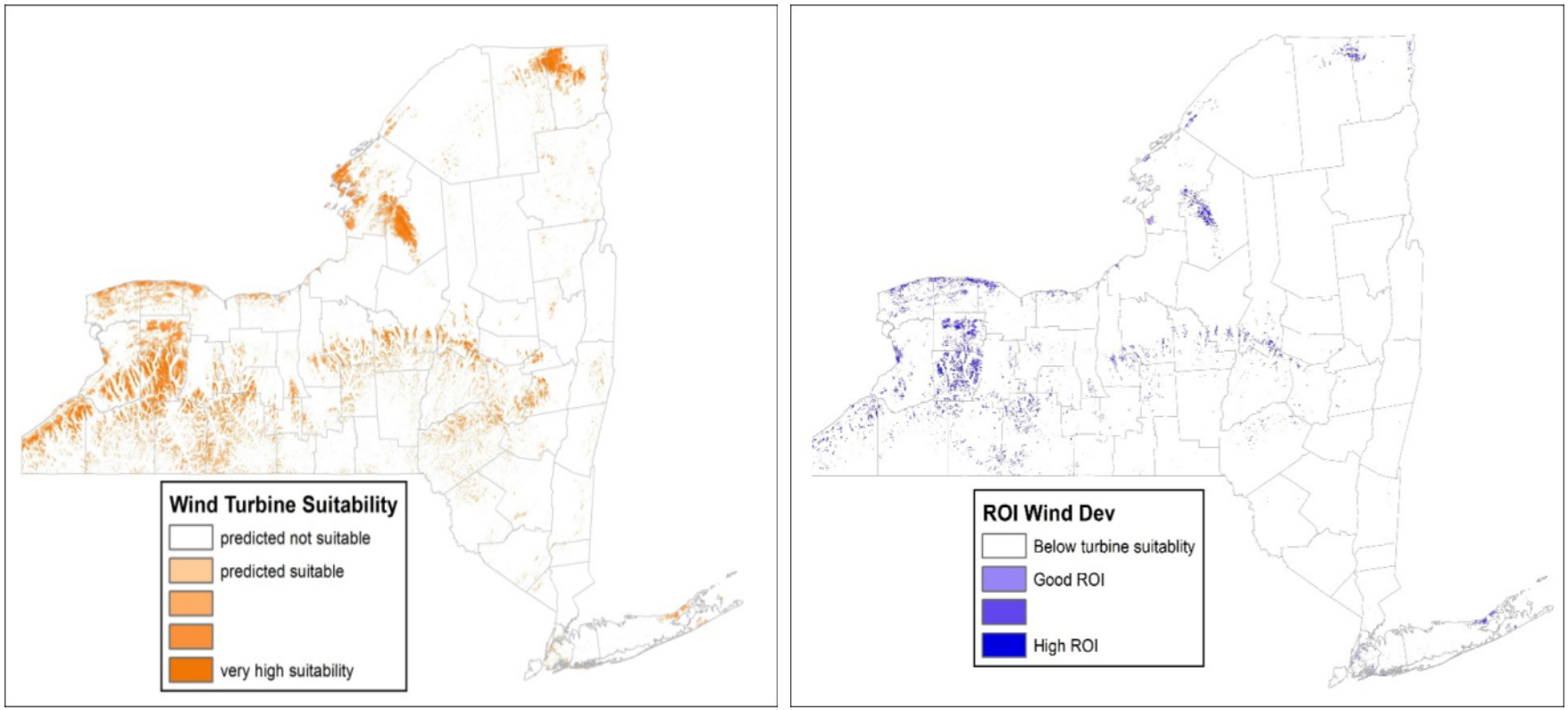

This map illustrates general wind resource potential only and is not suitable as a siting tool. More detailed site and wind speed data, as well as coordination with relevant authorities, are needed to thoroughly evaluate appropriate wind energy development at any given location. *Data sources: AWS Truepower, National Renewable Energy Laboratory*

In a November 2014 study, the New York Natural Heritage program (NYNHP) also undertook an analysis of suitable lands in New York State for wind projects. Unlike the NREL study, the NYNHP study took a more comprehensive approach to wind suitability taking into consideration a range of factors in addition to wind production capacity, including elevation, slope, aspect, surface relief ratio, terrain wetness, distance to transmission, and land cover (e.g., developed, open, forest, etc.).[116] Accounting for a wider range of factors, NYNHP identified the northern Alleghany Plateau and Eerie-Ontario Lowlands as the most suitable areas for siting new wind projects.

As a recognized partner working with NYSDEC, NYNHP's mission is to facilitate conservation of the State's biodiversity. NYNHP expanded its analysis to identify the subset of lands suitable for wind development which present conflicts with areas of significant biodiversity, including the presence of birds and bats, species particularly vulnerable to adverse impacts from the rotating turbine blades. **Exhibit 5-17** depicts the results of NYNHP's analysis with economically suitable lands (left) as compared to areas identified as both economically and ecologically suitable (right).

[116] Howard and Schlesinger. 2014. Wind Power and Biodiversity in New York: A Tool for Siting Assessment and Scenario Planning at the Landscape Scale. New York Natural Heritage Program.

## EXHIBIT 5-17. RESULTS OF THE NEW YORK NATURAL HERITAGE PROGRAM STUDY OF WIND ENERGY'S IMPACTS ON WILDLIFE




Source: Howard and Schlesinger. 2014. Wind Power and Biodiversity in New York: A Tool for Siting Assessment and Scenario Planning at the Landscape Scale. New York Natural Heritage Program.

Overall, the NYNHP project identifies approximately 1.3 million acres of land in New York as potentially suitable for wind development, considering contributing factors from both technical and biodiversity perspectives. Assuming a conservative range of land use requirements from NREL's 2009 study of 30 to 141 acres per MW, total land use requirements for 3,495 MW of land-based wind under the base case fixed REC scenario (the scenario which projects the lowest amount of land-based wind development) may require between 105,000 and 493,000 acres of land; this range increases to approximately 160,000 to 752,000 acres for 5,330 MW under the high load PPA scenario (the scenario which projects the highest amount of land-based wind development). These potential land use requirements appear to fall within the approximately 1.3 million acres that the NYNHP estimates as economically and biologically suitable for land-based wind energy development.

#### Species Biodiversity: Birds and Bats

As discussed in the 2015 GEIS, birds and bats are particularly vulnerable to injury and mortality from collision with land-based wind energy projects. Wind turbines used in commercial operations typically consist of an array (or multiple arrays) of turbines with rated capacities ranging from 660 kW to 3.6 MW for each unit. Turbines blades range in size depending on the turbine capacity; the most common size is 150 feet, roughly equal to half the length of a football field. In contrast, wind turbines for residential or small-scale projects are much smaller, with blade lengths a third of the size of commercial-sized turbine (approximately 50 feet).

In 2014, the National Wind Coordinating Committee (NWCC) examined 18 post-construction bird and bat surveys at 11 different projects in New York and found a range of bird mortality from 0.66 to 9.59 birds per turbine during a survey period that extended from mid-April to mid-November. These estimates are consistent with a 2010 NYSERDA survey which estimated bird mortality between 0.63 to 7.70 birds per turbine per year.[117] While mortality rates varied by plant, no plant reported a rate greater than 14 birds per MW per year.[118]

More recently, in 2015, DOE published a report which reviewed recent literature on bird and bat mortality from wind projects. The report found that songbirds accounted for the majority of bird mortality, although the total turbine-related mortality was still relatively small, under 0.02 percent of the total songbird populations.[119] Compared to other sources of bird mortality, turbine-related bird mortality is likely a very small fraction of the total bird mortality each year from collisions with human-made obstacles. For example, studies from 2013 and 2014 suggest that current bird mortality rates due to collisions with wind turbines are only 0.2 percent of those for power lines, and only 0.06 percent of those for buildings.[120] However, impacts on certain birds may be higher. For example, DOE found higher than expected rates of mortality of eagles due to turbine

[117] NYSERDA. 2010. Pre-Development Assessment of Avian Species for the Proposed Long Island – New York City Offshore Wind Project Area. October.

[118] US DOE. 2015. Wind Vision: A New Era for Wind Power in the United States.

[119] US DOE. 2015. Wind Vision: A New Era for Wind Power in the United States.

[120] US DOE. 2015. Wind Vision: A New Era for Wind Power in the United States.

collisions.[121] While raptors (including the bald and golden eagles) exist in New York, data on their migration patterns are limited.[122] For example, the November 2014 NYNHP analysis was unable to find statewide data on the movement patterns of the State's raptor populations.[123]

Turbine-related mortality of bats appears higher than for birds. For example, bat mortality was more than 200 percent of bird mortality at six New York State wind farms monitoring over a seven month period.[124] The same 2009 NREL study estimated a bat mortality rate from wind turbine of 0.5 to 40.5 bats per turbine per year. As discussed in **Chapter 3,** New York has two federally listed bat species: the Indiana entire bat (*Myotis sodalis*) is listed as endangered and the northern long-eared bat (*Myotis septentrionalis*) as threatened. Given recent stressors including habitat loss and white nose syndrome, there is greater concern over the population of bats and their vulnerability to any additional stressors that may adverse impact survival rates.[125] As part of its 2014 wind and biodiversity mapping project, NYNHP project created a map which overlaid distribution and migration patterns for six bat species, including hibernacula and data on movements for Indiana bats and brown bats. **Exhibit 5-18** identifies a discrete number of areas in the State where conflicts could arise between bats and wind projects if such projects are sited overlapping or in close proximity to mapped areas.

To minimize the potential impacts on birds and bats, NYSDEC guidelines suggests wind developers site land-based wind projects at least five miles away from major rivers, a great lake, or the Atlantic Coast, at least 2 miles away from any area where special status birds are known to concentrate and/or 40 miles away from an identified bat hibernaculum.[126] In a review of 21 post-construction facilities studies at 19 facilities across five US regions and one Canadian province, bats were more often killed on nights with lower wind speed (generally under six meters per second). The review also found that bats often fly more directly after storm events, which can also lead to higher turbine-related bat fatalities. Curtailing during these times could help to reduce fatalities.[127] For example, several studies have shown that increasing the "cut-in" speed of turbines during the summer and fall has reduced bat mortalities by 44 to 93 percent, while only reducing the amount of energy generated by one percent or less.[128] In addition, avoiding siting turbines near areas frequented by bats such as water sources or known cove roosts can help further mitigate the potential for collisions.[129]

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[121] US DOE. 2015. Wind Vision: A New Era for Wind Power in the United States.

[122] NYNHP. Animal Guides. Accessed January 25, 2016 at: http://www.acris.nynhp.org/animals.php.

[123] Howard and Schlesinger. 2014. Wind Power and Biodiversity in New York: A Tool for Siting Assessment and Scenario Planning at the Landscape Scale. New York Natural Heritage Program.

[124] Alliance for Clean Energy New York, Inc. 2011. Wind and Wildlife.

[125] US DOE. 2015. Wind Vision: A New Era for Wind Power in the United States.

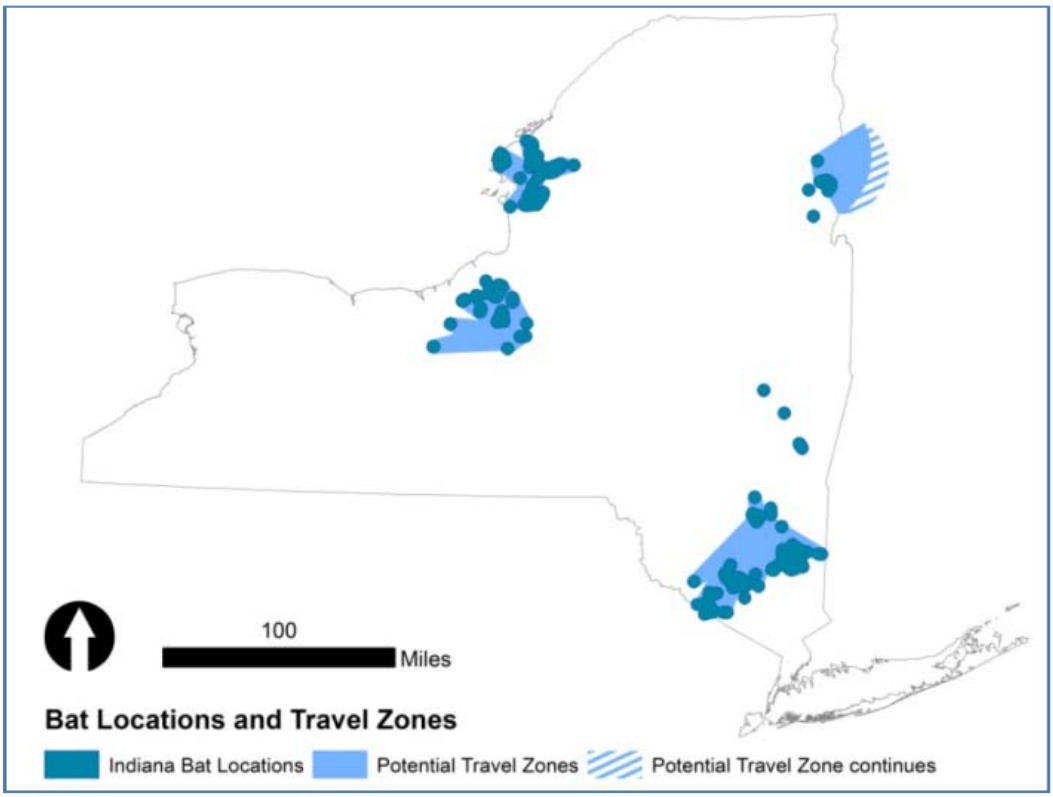
[126] NYSDEC. 2009. Guidelines for Conducting Bird and Bat Studies at Commercial Wind Energy Projects

[127] Arnett et al. 2008. Patterns of Bat Fatalities at Wind Energy Facilities in North America. Journal of Wildlife Management 72(1):61–78

[128] Alliance for Clean Energy New York. 2011. Wind and Wildlife.

[129] Arnett et al. 2008. Patterns of Bat Fatalities at Wind Energy Facilities in North America. Journal of Wildlife Management 72(1):61–78

**EXHIBIT 5-18. NEW YORK STATE BAT LOCATIONS AND TRAVEL ZONES IDENTIFIED[130]**



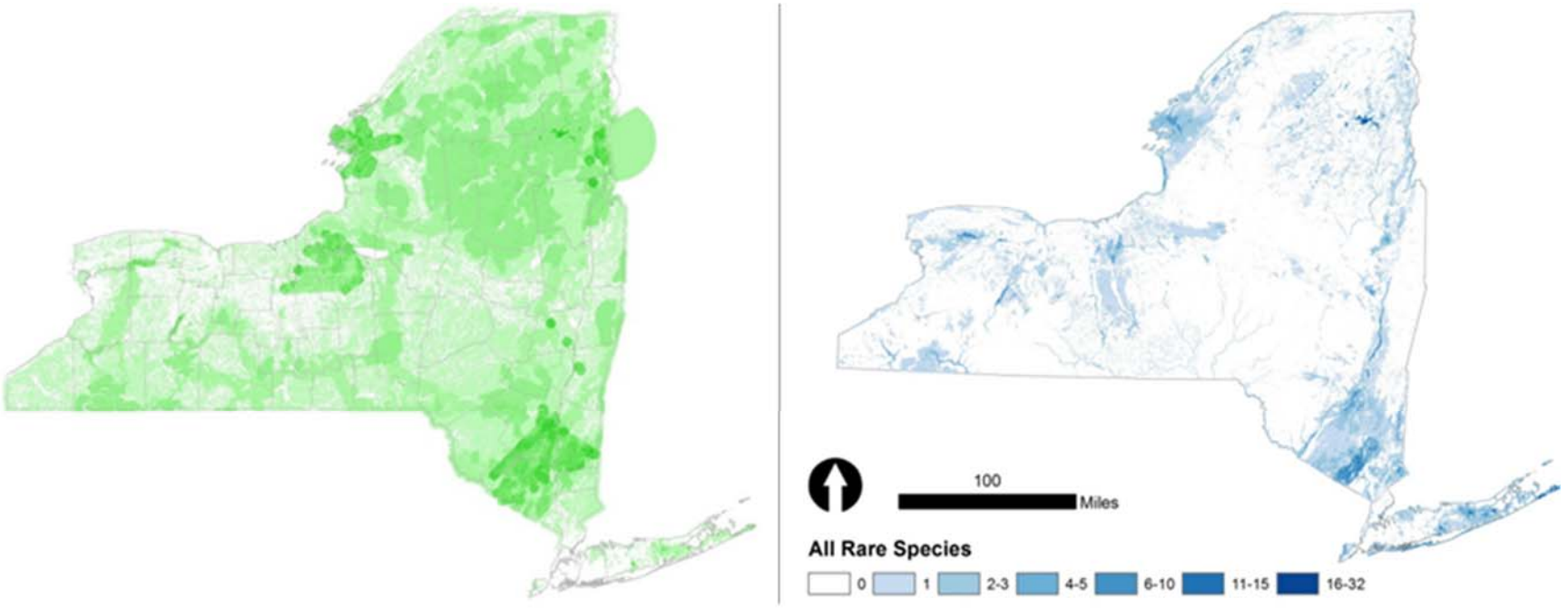

### Habitat Destruction and Fragmentation

In addition to the direct impacts of injury and mortality from collisions with wind turbine infrastructure, wind development can also fragment habitat for a range of animals though the placement of the turbines, access roads, and new transmission lines. In general, populations of animals confined to smaller areas are less likely to persist, due to reduced gene flow and ability to respond to area specific events such as changes in weather and climate.

To assess the potential for habitat fragmentation in New York State, the NYNHP study compiled geographic data on wide range of indicators in New York State, including endangered species distribution and migration, large forested areas, connectivity zones, migrating bird stopover sites, information on streams, and terrestrial landscape resilience. **Exhibit 5-19** displays the results of this work, specifically a map of areas likely to have the highest regulatory burden due to biodiversity issues, and the areas with the most at-risk species. Overall, the project identified a range of areas likely to have important biodiversity considerations (**Exhibit 5-19).** These included some of the high wind potential areas identified, especially in some parts in the western Adirondacks and Eerie-Ontario lowlands.

[130] Howard and Schlesinger. 2014. Wind Power and Biodiversity in New York: A Tool for Siting Assessment and Scenario Planning at the Landscape Scale. New York Natural Heritage Program.

**EXHIBIT 5-19. AREAS WITH HIGHER REGULATORY BURDEN DUE TO BIODIVERSITY (LEFT) AND NUMBER OF RARE ANIMALS BY AREA**



### Noise Pollution

As discussed in the 2015 GEIS, while operating wind projects do not generate air emissions, the operation of wind turbines can create sound that can become a source of noise pollution. Wind turbines emit two types of sound: (1) aerodynamic sounds (such as "whooshing") created by the rotating turbine blades moving through the air and (2) mechanical sounds created from the internal gears of an operating wind turbine.[131] In 2013, NYSERDA conducted an extensive review of existing literature on sound and noise associated with wind energy. The highest sound levels reported across the wind energy studies reviewed ranged from 20 to 50 dBA, sound levels associated with a whisper (< 30 dBA) up to the sound levels found inside a house or office (30 to 50 dBA).[132]

Wind energy-related sound, however, is affected by a number of site-specific variables including turbine design, wind direction and speed, atmospheric conditions, vegetation cover, topography, local background noise conditions, as well as the person or place impacted by the noise. Another 2013 NYSERDA report measured sound levels associated with wind turbines at the 126 MW wind farm, located in Wethersfield, New York and found that the winter campaign had the highest wind speeds and monitored sound levels.[133] Several studies have also focused on identifying the environmental conditions that collectively produce the 'worst case scenario.' Such conditions include wind turbines operating at night, at low wind speeds and under stable or calm atmospheric conditions. Under such conditions, sound from wind turbines can become trapped (much like fog or smoke) at lower elevations, close to ground.[134] Other factors that can influence sound levels include the number and size of turbines. Researchers have found that more turbines often sound louder due to the synergistic effects across turbines, and larger turbines emit higher amounts of low-frequency noise than smaller turbines.

### Visual Aesthetics[135]

NYSERDA's 2009 wind energy toolkit identifies visual aesthetics as one of the most significant issues that local communities face when considering new wind energy projects. Such impacts can be especially acute for utility-scale wind projects which consist of larger turbines, higher turbine heights and multiple turbines configured in arrays; however, project location (e.g., exposed hilltop areas), project footprint, turbine spacing, local topography, existing vegetation and land cover, and existing land uses can all influence the visual impacts of a wind project. Importantly, as discussed in the 2015 GEIS, visual impacts vary based on the subjective preferences of affected individuals and an individual's personal viewshed; for example, the number of points from which a resident can see the turbines, the number of turbines the resident routinely sees, the time of day during which turbines are most visible, and/or the location and length of time that a project is visible (e.g., while traveling in the car). Under certain lighting conditions, the moving blades of a turbine can

[131] NYSERDA. 2013. Wind Turbine-Related Noise: Current Knowledge and Research Needs. NYSERDA Report 13-14. June.

[132] *Ibid*.

[133] NYSERDA. 2013. Wind Turbine-Related Noise in Western New York. NYSERDA Report 13-03. January.

[134] *Ibid*.

[135] NYSERDA. 2009. Wind Energy Toolkit. Accessed January 24, 2016 at: http://www.nyserda.ny.gov/-/media/Files/EERP/Renewables/wind-energy-toolkit.pdf.

generate "shadow flicker," which may be disruptive to nearby residents and drivers. Seasonality can also change the visual impact of a wind project with visibility increasing during winter seasons when many surrounding areas trees are bare.

While some may consider wind turbines "graceful sculptures," others believe wind turbines mar the beauty of the existing natural scenery. Residents of rural communities often value such areas for their openness, remoteness and tranquility. NYSERDA's 2009 wind energy toolkit notes that utility scale wind projects in rural areas can be particularly disruptive "by introducing large-scale structures and machinery into previously undeveloped areas. This includes the wind turbines themselves, as well as electrical transmission equipment and construction vehicles such as cranes and service trucks."

While the research on the impact of noise and sound from wind energy is still evolving, literature to date suggests that most direct impact of wind turbines is annoyance, an effect which naturally differs by person and can be further compounded by multiple sensory effects (e.g., residents annoyed both visually and acoustically by wind turbines). A survey of local residents living in close proximity to a wind farm in Cape Vincent, New York supports this concept; for example, while 38 percent of Cape Vincent residents noted periodic annoyance with the sound of wind turbines, 88 percent indicated annoyance from the seeing the new wind turbines, whereas 92 percent indicated annoyance at the shadow flare effects and flickering lights. These survey results, however, are inconsistent with a more recent 2013 NYSERDA survey of wind turbine related noise in western New York, which found no correlation between an individual's satisfaction with their living environment, their annoyance with wind turbine noise and the number of turbines visible from their house.[136]

NYSERDA's 2013 literature review also highlighted examples of surveys provided to residents living in close proximity to wind energy projects about changes in resident's quality of life. As expected, residents living closer to wind projects more often reported lower overall quality of life as compared to residents living farther away. Reported levels of annoyance were also proportional to sound levels; as sound levels approach 40 dBA, the frequency of complaints and instances of annoyance increases significantly. The World Health Organization (WHO) also conducted a literature review on the health effects of noise. Similar to NYSERDA's 2013 literature review, the WHO's literature review also concluded that annoyance rises with increasing sound pressure levels, but that only three percent of the population experiences annoyance from exposures to sound pressure levels less than 55 dBA.[137]

A recent 2013 NYSERDA study surveyed residents in Wethersfield, New York, and found levels of noise annoyance were statistically correlated with an individual's general opinion on wind turbines, their opinion on whether the turbines altered the landscape, their concern over health effects associated with the turbines, and their sensitivity to noise in general. This suggests that people who felt negatively about the wind turbines and were worried about their aesthetic and health impacts were also more likely to be annoyed by turbine noise. Those who felt more

[136] NYSERDA. 2013. Wind Turbine-Related Noise in Western New York. NYSERDA Report 13-03. January.

[137] *Ibid*.

positively toward the turbines and were not as concerned by the aesthetic and health impacts were less likely to be annoyed by the noise.[138]

In addition to annoyance, some residents have reported problems with sleep. While the exact level of sound that disrupts sleep varies by person, the WHO's 2011 literature review suggested that sleep disturbance is more often associated with sounds levels beginning at 40 to 50 dBA. Problems with sleep can also differ based on resident's baseline environmental setting; one study found that six percent of residents in rural communities reported sleep disturbance from wind turbines as compared to four percent of residents in urban communities.

Concerns have also been raised about the potential for more direct health effects created by sound from wind turbine operations, including cardiovascular effects such as blood pressure; heart rate variability; and symptoms such as hypertension, myocardial infarction, angina and cardiovascular disease. The same 2013 NYSERDA report also included a survey of the current state of knowledge and research needs on wind turbine noise, including cardiovascular effects. While the research on the potential cardiovascular effects from noise is relatively extensive, the NYSERDA report notes that existing research to date has focused only in the areas of occupational exposure, road traffic and airports – all activities which typically generate higher sound levels than wind turbines. As example, the literature on road traffic noise suggests a possible link between an increased risk of myocardial infarction and cardiovascular disease rate in people exposed to sound pressure levels greater than 60 dBA. Continuous occupational noise at more than 80 dBA (very loud) suggests moderate levels of increased risk for coronary heart disease.

Existing studies on hypertension suggest increasing risk for every 5 dBA increase in sound decibel levels starting at a moderate sound level of 55 dBA and a significant increase in the relative risk of hypertension for sound levels exceeding a very loud 85 dBA. The 2013 NYSERDA survey also identified an older 1989 study that linked changes in the performance of school age children with outdoor exposure sound levels of 70 dBA. However, as previously noted, the highest sound levels identified by NYSERDA from across wind energy studies is 50 dBA; as such, the 2013 NYSERDA study noted that the applicability of the existing literature on noise and potential cardiovascular and performance effects, may therefore, not be applicable to wind turbines.

In 2011, the Massachusetts Department of Environmental Protection and the Massachusetts Department of Public Health established an independent panel charged with analyzing both peer-reviewed and non-peer reviewed literature on "the biological plausibility or basis for health effects of turbines (noise, vibration, and flicker)." The panel concluded that there was insufficient evidence to suggest any correlation between wind turbine noise and health problems or disease. The panel did, however, offer some recommendations to minimize the impact of turbine-related noise, including setback distances that cap receptor sound levels from a wind project at 37 dBA.

### 5.2.4 OFFSHORE WIND ENERGY

The first offshore wind project was developed off the coast of Denmark in 1991. Since then, AWEA reports the use of offshore wind in ten countries around the world, including Belgium, Sweden, Finland, Germany, the United Kingdom, the Netherlands, Ireland, China, and Japan with new projects under development in France, Italy, Norway, and Spain. Current estimates put

[138] *Ibid*

worldwide installed capacity from offshore wind at approximately 8.99 GW as of mid-year 2015, with another 4.45 GW under construction and an additional 40 GW either under contract or approved for development.[139]

As discussed in the 2015 GEIS, while no offshore wind projects have yet been constructed in the U.S., there are several offshore wind projects planned and/or under construction, including several along the East Coast.[140] For example, in Rhode Island, an offshore wind project is currently under consideration off the coast of Block Island, substructure installation was completed in November 2015 and are turbines scheduled to be installed and in-service by the fourth quarter of 2016.[141] In a July 2012 Technical Report, NREL estimates a gross offshore wind technical generating potential of 4,223 GW; an amount roughly four times the generating capacity of the current U.S. electric grid. While wind speeds are higher off the Pacific Coast, NREL identifies the shallower waters in the Atlantic as a more attractive option from a financial perspective. The report further states that 146 GW of the U.S. offshore wind potential is in New York (**Exhibit 5-21**).

**Exhibit 5-20** presents the incremental offshore wind capacity and generation projected to develop under the CES. While offshore wind development is possible along the Atlantic Ocean and in the Great Lakes regions, as shown in **Exhibit 5-20**, all of the incremental capacity projected to develop under the CES is anticipated to occur downstate, along the Atlantic Ocean, in Zones J (NYC) and K (Long Island). Capacity growth of between 202 MW and 1,988 MW is projected under the four scenarios, with the lowest capacity expected under the base case Fixed REC scenario and the highest capacity expected to develop under the high load PPA scenario.

**EXHIBIT 5-20. ESTIMATED OFFSHORE WIND ENERGY PROJECTED TO DEVELOP UNDER THE CES (2019-2030)**

| NYISO ZONE | ESTIMATED NEW CAPACITY (MW) | | | | ESTIMATED NEW GENERATION (GWH) | | | |
|---|---|---|---|---|---|---|---|---|
| | BASE CASE | | HIGH LOAD | | BASE CASE | | HIGH LOAD | |
| | PPA | FIXED REC | PPA | FIXED REC | PPA | FIXED REC | PPA | FIXED REC |
| Zone J, NYC | 600 | 0 | 1,292 | 174 | 2,469 | 0 | 5,315 | 716 |
| Zone K, Long Island | 679 | 202 | 696 | 717 | 2,720 | 825 | 2,778 | 2,898 |
| **TOTAL** | **1,279** | **202** | **1,988** | **891** | **5,189** | **825** | **8,093** | **3,614** |
| Note: No offshore wind is projected for Zones A –I; thus these zones are not shown in the exhibit. | | | | | | | | |

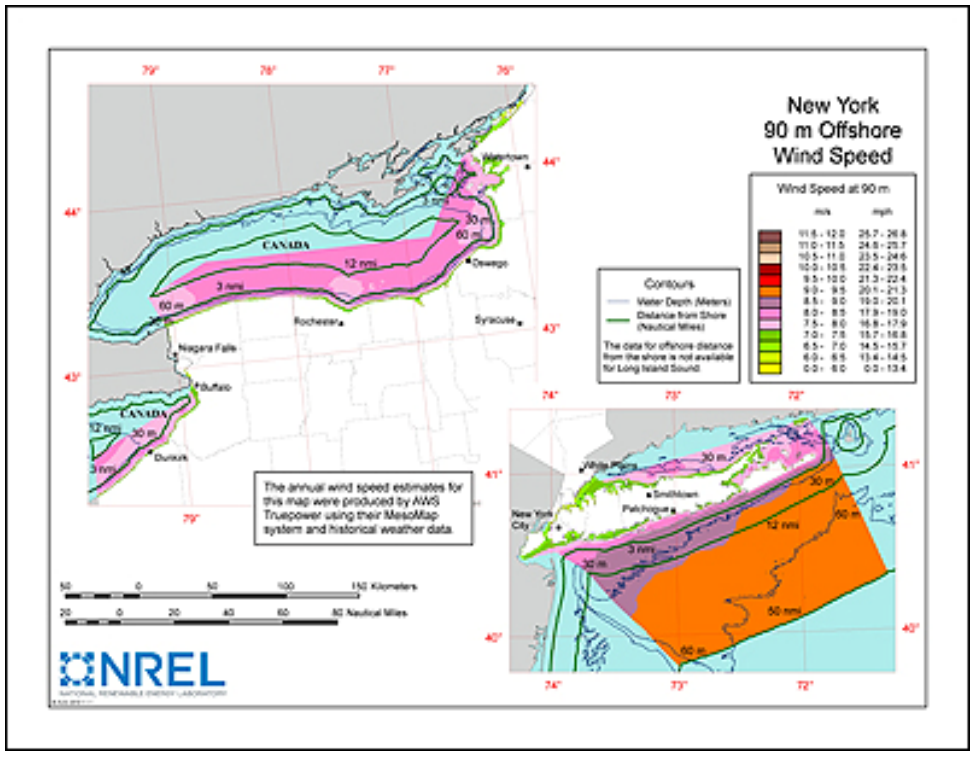
[139] National Renewable Energy Laboratory. 2014-2015 Offshore Wind Technologies Report, NREL/TP-5000-64283. http://www.nrel.gov/docs/fy15osti/64283.pdf.

[140] For more information, see BOEM's page on Renewable Energy State Activities. Accessed January 25, 2016 at: http://www.boem.gov/Renewable-Energy-State-Activities/

[141] Deepwater Wind. Accessed February 1, 2016 at: http://dwwind.com/project/block-island-wind-farm/.

Relative to other sources of renewable energy, offshore wind is expensive to develop due to complex technological conditions and the present lack of necessary operational infrastructure. The costs, however, are projected to decline over time as technological innovation continues, competition increases in the offshore wind supply chain, and further development is driven by the demand from more active European markets.[142] Offshore wind has other attributes that may encourage development, including de minimis land needs and over-land transmission requirements for dense coastal population areas with high electricity demand; and higher capacity factors and better peak load co-incidence than other renewable energy sources.

**EXHIBIT 5-21. NEW YORK STATE OFFSHORE WIND POTENTIAL**




While offshore wind is similar to land-based wind, offshore wind turbines are considerably larger than land-based wind turbines and are constructed to withstand the harsher conditions associated with a marine environment (e.g., salt-water corrosion, storm waves, hurricane-force winds, ice flows, lightning, etc.). The average wind turbine installed offshore in 2015 had a nameplate capacity of approximately 4 MW with a hub height of approximately 90 meters (295 feet) and a rotor diameter of nearly 120 meters (394 feet).[143] Turbine OEMS are producing new turbines rated from 6 to 8 MW with rotor diameters from 152 to 164 meters (499 to 538 ft). For example, the current BOEM New York call area for offshore wind is located in the Atlantic Ocean, approximately 14 nautical miles due south of Nassau County at water depths between 25 and 40 meters (82 and 131 feet). Current BOEM project feasibility studies envision the use of wind

[142] McClellan et al. 2015. New York Offshore Wind Cost Reduction Study. NYSERDA

[143] Renewable Energy Laboratory. 2014-2015 Offshore Wind Technologies Report, NREL/TP-5000-64283. http://www.nrel.gov/docs/fy15osti/64283.pdf.

turbines with a rated capacity of 6 to 8 MW, hub heights of 100 to 110 meters (328 to 361 feet) with a rotor diameters of 152 to 164 meters (499 to 538 ft); a rotor diameter more than 50% greater than the 100 meter (328 foot) rotor diameter of typical land-based wind turbines currently being installed.

### Environmental Impact Overview

Transporting, constructing and operating offshore wind infrastructure will create impacts, the magnitude of which will depend substantially on the setting, local species, and local communities. Offshore wind can cause impacts that affect human communities as well as terrestrial and marine species. Though most impacts that occur from the construction and siting process are relatively minor or temporary, long term operational impacts, such as impacts on the fishing industry, may have greater effects. The installation of offshore wind farms can take between 1 and 2 years. Once construction is complete maintenance to these facilities is completed daily, and the wind turbines would be fully inspected and serviced around twice a year. Additional repair would be acquired as needed.[144] The design life of an offshore project is within the range of 20 to 25 years.[145] Impacts associated with decommissioning tend to be similar to the impacts associated with the construction process.

### Habitat Destruction and Fragmentation

Siting of offshore turbines may permanently displace habitat for a range of animals, including but not necessarily limited to, finfish, reptiles, amphibians, crustaceans, insects, invertebrates, snails, clams and plants. A 2010 report on offshore wind potential in Long Island concludes that project siting should take into account the cumulative loss of plants and animals due to a wind project when assessing environmental impacts, including losses from other nearby human-built structures on the shoreline.[146] Turbine foundations may harm benthic fauna, which could impact fish availability. Changes in the distribution of fish could have cascading effects that could potentially change the ecological makeup of an area. For example, an increased concentration of fish could lead to a displacement in seabird population. Alternatively, there is some evidence that suggests construction of wind turbines may also encourage habitat formation for fish. The turbines, for example, may help to create artificial reefs, or serve as hard substrate for epibenthic colonizers, which could attract fish, and in turn birds. As example, epibenthic organisms were found to colonize two European offshore wind projects, although full colonies have not yet been observed, potentially due to disruption from storms. [147]

Habitat disruption may also impact the sea floor. For example, cable trenching can temporarily result in increased turbidity. Seafloor impacts are variable depending on the construction period length, the affected area, and the types of ecological communities concentrated in the area. For example, increases in turbidity could decrease photosynthesis by primary producers such as phytoplankton, which could in turn generate ecological effects for benthic organisms.

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[144] Bureau of Ocean Energy Management 2007. Alternative Energy Programmatic EIS. Pages 5-7, Page 5-69.

[145] Bureau of Ocean Energy Management 2007. Alternative Energy Programmatic EIS. Page 5-7.

[146] *Ibid*.

[147] NYSERDA. 2010. Pre-Development Assessment of Resources for the Proposed Long Island – New York City Offshore Wind Project Area.

Displacement can also occur for marine and coastal birds. The long term operation of offshore wind turbines may also obstruct the flyway of major bird species. For example, on Long Island, seabirds may also reduce their use of certain shoreline roosting, nesting and feeding sites due to the barrier created by an array of wind turbines. This avoided area can require more energy expenditure for birds and reduce their chance of survival. Similar to land-based wind, risk of collision is also a concern associated with both construction and operation of offshore wind turbines. However, the impacts of such impacts are not well characterized, and avoidance impacts may vary significantly by site and by bird species. Habitat loss is likely to be the greatest for species that are less able to move to different areas. While land birds often fly below the height of the turbines, migrating birds flying above water may be closer to the height of the turbines, creating the risk of collisions and a barrier for migration. Studies of offshore wind projects in Europe have indicated that impacts on birds are minimal and that birds tend to avoid turbines, although this may vary by species.

Finally, the construction of an offshore facility could potentially require the construction of new onshore facilities. These could have impacts on coastal habitats and could potentially alter hydrology or water quality. Reduced infiltration and increased runoff could change the hydrologic characteristics of coastal habitats. Erosion could potentially occur, having long term impacts on coastal vegetation. .[148]

**Exhibit 5-22** summarizes the major taxonomic groups NYSERDA has identified as potentially vulnerable to offshore wind development.

**EXHIBIT 5-22. SUMMARY OF MAJOR TAXONOMOIC GROUPS AND POTENTIAL ADVERSE EFFECTS FROM OFFSHORE WIND DEVELOPMENT**

| TAXA | POTENTIAL ADVERSE EFFECTS |
|---|---|
| Benthic community (e.g., corals) | Direct mortality within turbine footprint and along transmission line during construction; disturbance and lethal or sublethal effects via silting/sedimentation. |
| Fish | Disturbance during construction; displacement and attraction during operations. |
| Sea Turtles | Mortality or injury from boat collisions; mortality, injury or disturbance from pile driving noise; behavioral changes. |
| Marine mammals | Mortality or injury from boat collisions; injury or displacement from pile driving noise; displacement during operations; behavioral changes. |
| Birds | Mortality or injury from collision with turbines; displacement during construction and operations |
| Bats | Mortality or injury from collision with or effects from turbines during operations. |
| Source: NYSERDA. 2015. Advancing the Environmentally Responsible Development of Offshore Wind Energy in New York State: A Regulatory Review and Stakeholder Perceptions. NYSERDA Report 15-16. Prepared by Wing Goodale and Kate Williams (Biodiversity Research Institute, Portland, ME). June. | |

### Noise Pollution

[148] Bureau of Ocean Energy Management 2007. Alternative Energy Programmatic EIS. Page 5-85

Noise resulting from the construction process as well as long term operation can also be potentially disruptive. For example, in the construction process, the noise associated with pile driving may impact local and migratory fish, sea turtles, and marine mammals.[149] Pile driving is considered to be the most impactful noise resulting from construction; potentially perceptible to seals and porpoises for "tens to hundreds of kilometers from construction sites."[150] Noise resulting from construction activities may cause avoidance behaviors for a variety of nearby species; however, it is not expected to have significant population impacts, due to its temporary nature.[151] In addition to pile driving, other sources of noise that can occur from the construction process include ship and barge operation, as well as additional traffic from helicopter and boat operation. These can be temporarily disruptive for affected species. Noise resulting from these construction activities can also cause temporary annoyance for nearby local communities, though the impacts are not expected to be high.[152]

Following construction, normal operations could generate noise between 90 to 115 dB at frequencies that are detectable by marine mammals. An acoustic monitoring study by the Cornell Bioacoustics Research Program showed that several endangered whale species occur frequently in the State of New York's offshore planning area.[153] Sound within these areas have the potential to lead to the loss of traditional feeding or mating grounds, which ultimately can lead to long term detrimental population effects.[154] Larger organisms that have greater mobility would likely temporarily avoid areas of significant construction activity.[155]

Bird and bat populations may also be affected by above water noise from wind turbines. Little is known about how operational noise affects these species since these effects are not easily distinguishable from other aspects of a structure's presence. Avoidance or attraction behaviors may occur, depending on the affected species. For local communities located near wind projects, previous studies have found that the effects are relatively minimal. A study conducted by Pedersen and Halmstad (2003) found very low levels of annoyance from noise for seven percent of respondents, a relatively low percentage. Overall, operational noise resulting from offshore wind technologies is expected to be relatively low.[156]

#### Visual and Aesthetic Resources

The construction process and the siting of wind turbines and transmission lines could also impact visual resources, although this will depend on the viewshed being effected and the human use of

[149] NYSERDA. 2010. Pre-Development Assessment of Avian Species for the Proposed Long Island – New York City Offshore Wind Project Area.

[150] Bureau of Ocean Energy Management 2007. Alternative Energy Programmatic EIS. Page 5-23.

[151] Bureau of Ocean Energy Management 2007. Alternative Energy Programmatic EIS. Page 5-23

[152] Bureau of Ocean Energy Management 2007. Alternative Energy Programmatic EIS. Page 5-25

[153] New York Department of State. 2013. Offshore Atlantic Ocean Study. July. p. 35

[154] Bureau of Ocean Energy Management 2007. Alternative Energy Programmatic EIS. Page 5-47

[155] Bureau of Ocean Energy Management 2007. Alternative Energy Programmatic EIS. Page 5-91.

[156] Bureau of Ocean Energy Management 2007. Alternative Energy Programmatic EIS. Page 5-26

and response to changes in that viewshed.[157] The development process often involves the construction of one or more meteorological towers, which can be disruptive to a natural, coastal landscape. Coastal areas are especially visually sensitive, because land use tends to include parks, recreation areas, and high value property.[158] Once offshore facilities are operational, the presence of the structures could have visual impacts, which would manifest differently for offshore and onshore viewers. Visibility from the shore would depend on the nature of the site. A 2005 study conducted in Ireland found that 66 percent of individuals were initially opposed to a wind facility, though following its construction, 62 percent of individuals noted the visual impact as positive. A Danish study conducted in 2006 noted that most individuals had a neutral to positive perception of visual impacts. However, cultural differences should be regarded in applying results derived from European studies to sites in the U.S.[159] In addition to on-land viewers, offshore viewers may be affected as well. For example, recreational boating is common in Lake Ontario during summer months, particularly in shipping corridors in the St. Lawrence River inlet region. These activities are popular due to the natural viewshed, which could be impacted if there was development of a large offshore wind installation.[160]

### Cultural and Historical Resources

Impacts to fisheries are another concern across New York coastal waters. In particular, the presence of offshore wind turbines may restrict the ability of commercial fishermen to fish in the project area of an offshore wind installation, and such disruption may be particularly adverse for fishermen that use mobile types of gear, such as dredges and trawls.[161] On the Atlantic, New York and New Jersey are host to seven and five major commercial fishing ports, respectively.[162] In 2000, New York's commercial fishing population included roughly 84,000 people. Six of New York and New Jersey's ports were within the top 90 ports in the United States in terms of pounds landed and value of fish sold. [163] Project siting should also avoid other human-built infrastructure, such as artificial reefs, dump sites, liquefied natural gas terminals, borrow areas, and important

[157] NYSERDA.2010. Pre-Development Assessment of Natural Resources for the Proposed Long Island – New York City Offshore Wind Project Area.

[158] Bureau of Ocean Energy Management 2007. Alternative Energy Programmatic EIS. Page 5-116

[159] Bureau of Ocean Energy Management 2007. Alternative Energy Programmatic EIS. Page 5-123-5-129

[160] NYSERDA. 2010. New York's Offshore Wind Energy Development Potential in the great lakes: Feasibility Study."

[161] For a more in-depth description of each fishing practice in the Atlantic surrounding New York, see: NYSERDA. 2010. Pre-Development Assessment of Natural Resources for the Proposed Long Island – New York City Offshore Wind Project Area.

[162] NYSERDA. 2010. Pre-Development Assessment of Natural Resources for the Proposed Long Island – New York City Offshore Wind Project Area.

[163] For a more in-depth description of each port, see: NYSERDA.2010.Pre-Development Assessment of Resources for the Proposed Long Island – New York City Offshore Wind Project Area.

areas for navigation.[164] Avoiding areas used extensively for commercial shipping would help to reduce the risk of collisions and interference with commercial shipping activities.[165]

Impacts on recreational fishing are not expected to be significant. In many cases, the area between turbines is expected to be wide enough for recreational fishermen to use gear in the project area. Furthermore, many common recreationally caught fish species may increase in abundance should turbines facilitate the creation of artificial reefs.[166]

### 5.2.5 HYDROPOWER

Hydropower is one of the oldest forms of energy development, but conventional store-and-release hydropower projects have prominent environmental impacts on river systems and the plants and animals that are connected to and rely on river systems. According to the NYISO 2015 Gold Book, hydropower accounts for 11 percent of New York's summer generation capability, or a total of 4,949 MW.[167] Hydropower today is more focused on opportunities to develop new sources of energy that do not require the construction of new dams or projects that result in significant alteration of rivers and streams. Future hydropower development in New York is expected to come in one of two forms:

- Increased capacity from optimizing and/or upgrading infrastructure at existing hydroelectric projects; and
- Converting non-powered dams (NPDs) into energy producing dams.[168]

New investments are underway across the country to optimize, upgrade and/or augment operations and infrastructure at existing hydroelectric projects to increase electricity generation. Most of the country's existing dams were built in the more than 60 years ago. By installing new technologies, the lifespan and capacity of many of these older hydroelectric dams can be extended and/or increased.

In 2012, DOE completed a nationwide assessment of the electric power generation potential at existing dams that are not currently equipped to produce power (non-powered dams, or

[164] NYSERDA. 2010. Pre-Development Assessment of Natural Resources for the Proposed Long Island – New York City Offshore Wind Project Area.

[165] NYSERDA. 2010. New York's Offshore Wind Energy Development Potential in the great lakes: Feasibility Study.

[166] NYSERDA. 2010. Pre-Development Assessment of Natural Resources for the Proposed Long Island – New York City Offshore Wind Project Area.

[167] NYISO. 2015 Load & Capacity Data "Gold Book." April 2015.

[168] In recent years, several firms have developed (or are developing) NPDs to generate electricity. Hydro Green Energy has completed 28 projects in 13 states. American Municipal Power recently converted six NPDs on the Ohio River for a total installed nameplate capacity of 350 MW. (Dean, Megan. Converting non-powered dams to create a varied hydroelectric mix. August 17, 2012. Accessed January 24, 2016 at: http://www.pennenergy.com/articles/pennenergy/2012/08/converting-non-powered.html.)

NPDs).[169,170] DOE focused on approximately 54,000 existing dams, originally constructed for non-power purposes, such as flood control, water supply, navigation, or recreation, with monthly average flows of at least 1 cubic feet per second (cfs) that could be developed to produce electricity.[171,172]

As shown in **Exhibit 5-23**, DOE's study identified 33 sites in New York State with potential energy capacity greater than one MW, estimating a cumulative energy potential of approximately 240 MW.

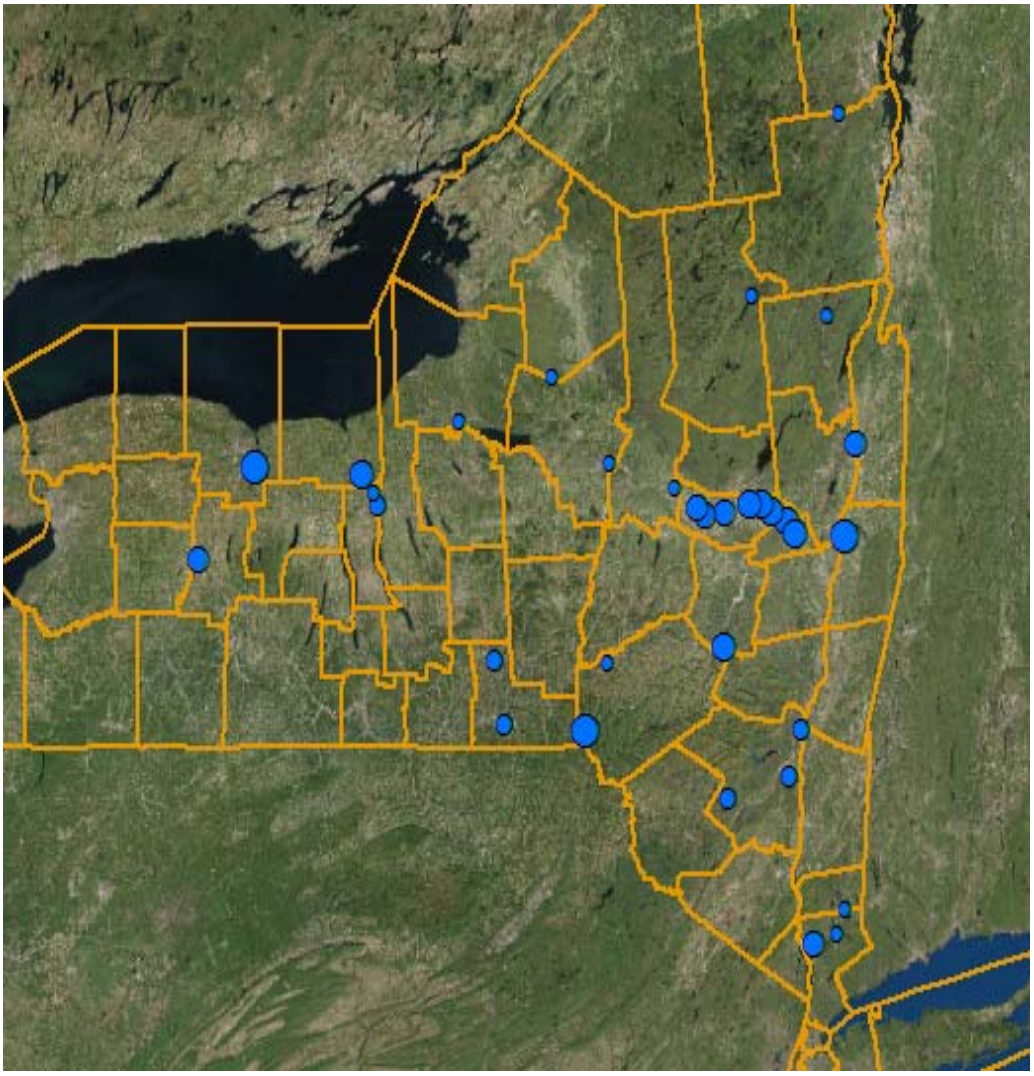
[169] According to the DOE study, only three percent (or approximately 2,500 dams) of the nation's approximately 80,000 existing dams generate electricity.

[170] DOE. 2012. An Assessment of Energy Potential at Non-Powered Dams in the United States. Wind and Water Power Program. Prepared by Oak Ridge National Laboratory. April.

[171] The definition of NPD excludes auxiliary dams because the water they store already is associated with existing hydropower production.

[172] DOE's analysis focused on the only on the energy production potential of NPDs, potential constraints that may arise from dam/integrity issues, site feasibility, economic feasibility, multiple use conflicts socioeconomic consideration or environmental costs and benefits were not addressed by DOE's analysis.

**EXHIBIT 5-23. HYDROPOWER POTENTIAL AT EXISTING NPDS IN NEW YORK STATE (2012)**



As discussed in **Chapter 4**, incremental capacity from upgrades to existing hydroelectric projects and retrofitting NPDs is expected to develop under the CES. **Exhibits 5-23 and 5-24** summarize the incremental capacity and generation gains under the various scenarios, for hydropower upgrades and hydropower NPD, respectively. As shown in **Exhibit 5-24**, NPD retrofits are expected to account for the majority (over 90 percent) of new hydropower energy development. Hydropower upgrades are expected to occur from 2019-2025, while NPD retrofits are expected to begin in 2019 and continue at varying levels through 2030. In terms of geographic distribution, hydropower development is projected to occur primarily in upstate NYISO Zones, with the highest amounts of development occurring in Mohawk Valley (Zone E) and Capital (Zone F); no hydropower development is expected to occur in Zones D (North), I (Dunwoodie), J (New York City) or K (Long Island). NPD retrofits are expected to occur in nearly all NYISO zones, while hydropower upgrades are only expected in four NYISO zones: Zone B (Genesee), Zone C (Central), Zone E (Mohawk Valley), and Zone F (Capital).

### EXHIBIT 5-24. ESTIMATED HYDROPOWER ENERGY PROJECTED TO DEVELOP UNDER THE CES (2019-2030)

| NYISO ZONE | ESTIMATED NEW CAPACITY (MW) | | | | ESTIMATED NEW GENERATION (GWH) | | | |
|---|---|---|---|---|---|---|---|---|
| | BASE CASE | | HIGH LOAD | | BASE CASE | | HIGH LOAD | |
| | PPA | FIXED REC | PPA | FIXED REC | PPA | FIXED REC | PPA | FIXED REC |
| **NPD RETROFIT** | | | | | | | | |
| Zone A, West | 8 | 8 | 8 | 8 | 43 | 43 | 44 | 44 |
| Zone B, Genesee | 30 | 30 | 30 | 30 | 158 | 158 | 160 | 160 |
| Zone C, Central | 90 | 76 | 91 | 83 | 432 | 372 | 436 | 401 |
| Zone D, North | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Zone E, Mohawk Valley | 204 | 200 | 206 | 206 | 941 | 923 | 951 | 951 |
| Zone F, Capital | 207 | 187 | 211 | 189 | 991 | 906 | 1,011 | 918 |
| Zone G, Hudson Valley | 30 | 30 | 30 | 30 | 132 | 132 | 133 | 133 |
| Zone H, Millwood | 17 | 17 | 17 | 17 | 75 | 75 | 75 | 75 |
| Zone I, Dunwoodie | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Zone J, NYC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Zone K, Long Island | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Subtotal NPD Retrofit** | **586** | **548** | **594** | **564** | **2,772** | **2,610** | **2,811** | **2,682** |
| **HYDROPOWER UPGRADES** | | | | | | | | |
| Zone A, West | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Zone B, Genesee | 8 | 8 | 8 | 8 | 24 | 26 | 25 | 25 |
| Zone C, Central | 0 | 0 | 8 | 0 | 0 | 0 | 24 | 0 |
| Zone D, North | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Zone E, Mohawk Valley | 25 | 24 | 25 | 25 | 75 | 75 | 77 | 77 |
| Zone F, Capital | 13 | 13 | 13 | 13 | 40 | 40 | 40 | 40 |
| Zone G, Hudson Valley | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Zone H, Millwood | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Zone I, Dunwoodie | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Zone J, NYC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Zone K, Long Island | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Subtotal Upgrades** | **45** | **46** | **54** | **46** | **139** | **140** | **165** | **141** |
| **TOTAL** | **631** | **594** | **648** | **610** | **2,911** | **2,750** | **2,976** | **2,823** |

Note: Estimates may not sum to the totals reported due to rounding.

## Environmental Impact Overview

Most of the environmental impacts of dam construction have already been incurred at both existing hydroelectric projects and NPDs. The environmental impact of upgrading existing hydroelectric projects or adding energy production facilities and equipment to existing NPDs is anticipated to be relatively small in comparison to the impacts already incurred and as compared to the benefits of more renewable energy generation.[173]

Adding energy production at existing NPDs requires installation of equipment designed to harness energy from the existing water flow properties at a given site. As an example, the upgrade of an existing hydroelectric facility was included under the Tenth Main Tier RPS solicitation. Owned and operated by the Northbrook Lyons Falls, LLC ("Northbrook"), the Lyon Falls Mill Development is an existing 5.6 MW hydroelectric facility located in Lewis County, NY on the Black River just downstream from the confluence of the Moose and Black Rivers. Northbrook plans to invest $40 million to double the generating capacity of the existing facility to a total capacity of 11.2 MW.[174] As part of this redevelopment, Northbrook will demolish the existing main powerhouse and mothball the single-unit powerhouse. Northbrook will then replace the decommissioned powerhouses with a single powerhouse containing two generating units.[175] In addition to the new powerhouse, the proposed project will also include a new 23 kV transmission line to connect the new powerhouse to the existing National Grid transformer in the Franklin Street Substation.[176] The upgrades will not result in any changes to the existing dam and associated ponds, and the facility will continue to operate in a run-of river mode, where the amount of water that comes into the pond equals the amount of water that flows out of the pond and down the Black River.[177]

The principal environmental impacts of upgrading existing hydroelectric plants and retrofitting NPDs for energy generation occur primarily during the construction phase; these are the types of impacts that are common to the construction of any type of energy project. As discussed in more detail in Chapter 5 of the 2015 GEIS, construction site activities such as vegetation clearing, grading, excavating, steel and building erection, equipment installation, and final restoration will potentially result in short-term increases in air emissions, dust, noise, traffic, visual intrusion, soil erosion, sediment disturbance and water pollution, and disturbance of local ecological and cultural resources. The magnitude of such impacts will vary according to the project location and other site-specific characteristics.

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[173] DOE. 2012. An Assessment of Energy Potential at Non-Powered Dams in the United States. Wind and Water Power Program. Prepared by Oak Ridge National Laboratory. April; American Rivers. Making Hydropower Safer For Rivers. Accessed on January 24, 2016 at: http://www.americanrivers.org/initiatives/dams/hydropower/.

[174] Lyon Falls Hydro. Project Description. Accessed on February 1, 2016 at: http://www.lyonsfallshydro.com/project-description/.

[175] Lyon Falls Hydro. Public Meeting Presentation. Accessed on February 1, 2016 at: http://www.lyonsfallshydro.com/wp-content/uploads/2015/03/Lyons-Falls-Joint-Agency-Public-Meeting-Presentation_20150305.pdf.

[176] Lyon Falls Hydro. Public Meeting Presentation. Accessed on February 1, 2016 at: http://www.lyonsfallshydro.com/wp-content/uploads/2015/03/Lyons-Falls-Joint-Agency-Public-Meeting-Presentation_20150305.pdf.

[177] Lyon Falls Hydro. Project Description. Accessed on February 1, 2016 at: http://www.lyonsfallshydro.com/project-description/.

In addition to the common environmental impacts of construction, hydroelectric project upgrades and NPD retrofit projects may have impacts on water quality, for example, dissolved oxygen levels, water temperature, pH, conductivity and total gas pressure. In most cases, these potential impacts can be mitigated through development and implementation of appropriate operating, management, and monitoring plans. For example, in response to concerns regarding dissolved oxygen levels, many projects are required to develop and implement a water quality protection and monitoring plan.

Another unique consideration for all hydropower projects is fish passage and protection; the addition, upgrade or expansion of intake facilities and other infrastructure such as turbines can increase the risk of fish entrainment and fish mortality. Advancements in the understanding of hydropower operations and management of fishery resources, however, are often able to mitigate such potential risks. At the aforementioned Lyon Falls Mill Development, Northbrook conducted an extensive fish entrainment and impingement study. To minimize potential adverse effects to fish, Northbrook proposed to provide a seasonal minimum fish movement flow of 45 cfs to be released annually from March 15 through November 30 and install a seasonal trashrack overlays with 1-inch clear-bar spacing.[178] At the RRHP, the environmental assessment concluded that survival of fish through the project's powerhouse would be about 95 percent for small and moderate-sized fish and 88 percent for larger fish; translating to a relatively low fish mortality rate of between five and 12 percent, a level not expected to have significant effects on the project area fishery.

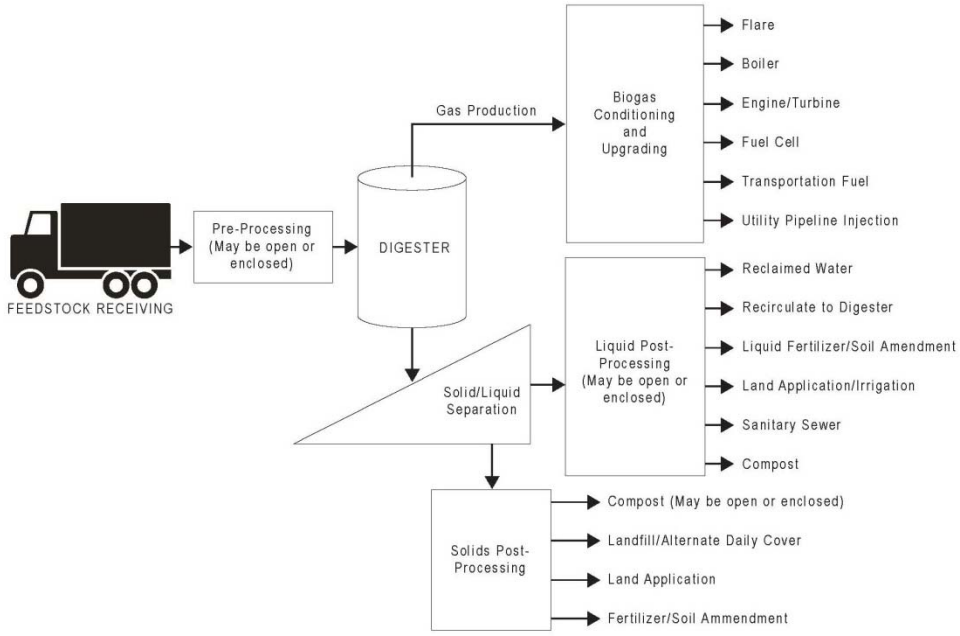
### 5.2.6 ANAEROBIC DIGESTION

As discussed in the 2015 GEIS, anaerobic digestion is a series of biological processes in which bacteria break down biodegradable material in an oxygen-free environment. The product of this process is a biogas mixture and a digestate (liquids and solids). The biogas mixture consists of primarily methane (approximately 50 to 70 percent)[179], carbon dioxide (approximately 30 to 50 percent) and trace amounts of other gases, such as hydrogen sulfide ($H_2$) and ammonia ($NH_3$). This biogas mixture can serve as a fuel to generate heat, hot water, or electricity. Digestate is the remaining solid and/or liquid residuals from the anaerobic digestion process. **Exhibit 5-25** presents a simplified graphic of the anaerobic digestion process.

[178] Lyon Falls Hydro. Public Meeting Presentation. Accessed on February 1, 2016 at: http://www.lyonsfallshydro.com/wp-content/uploads/2015/03/Lyons-Falls-Joint-Agency-Public-Meeting-Presentation_20150305.pdf.

[179] Research is ongoing to develop improvements in anaerobic digestion processes designed to increase the proportion of methane in generated biogas. EPA recently highlighted a DOE project at Argonne National Laboratory (ANL) that succeeded in developing an enhanced anaerobic digestion process, which produces biogas with more than 90 percent methane from sludge generated by municipal wastewater treatment plants. (USDA, EPA and DOE. 2015. Biogas Opportunities Roadmap Progress Report. December. 20 pp. Accessed January 23, 2016 at: http://www.epa.gov/agstar/biogas-opportunities-roadmap-report.)

### EXHIBIT 5-25. ANAEROBIC DIGESTION PROCESS FLOW CHART




Source: California Department of Resources Recycling and Recovery (CalRecycle). 2011. Final Program Environmental Impact Report for Statewide Anaerobic Digester Facilities for the Treatment of Municipal Organic Solid Waste. SCH No. 2010042100. June.

As a general matter, the need to reduce GHG emissions and improve resiliency have opened opportunities for the wastewater treatment, agriculture, food processing, and waste management sectors to develop new approaches to treating organic waste. Broad opportunities exist to transform the liability of organic waste into positive energy, environmental, and economic value. Examples of these opportunities include reducing operating costs at wastewater plants, introducing new revenue streams at farms, and developing community-based energy sources and enhanced resiliency.

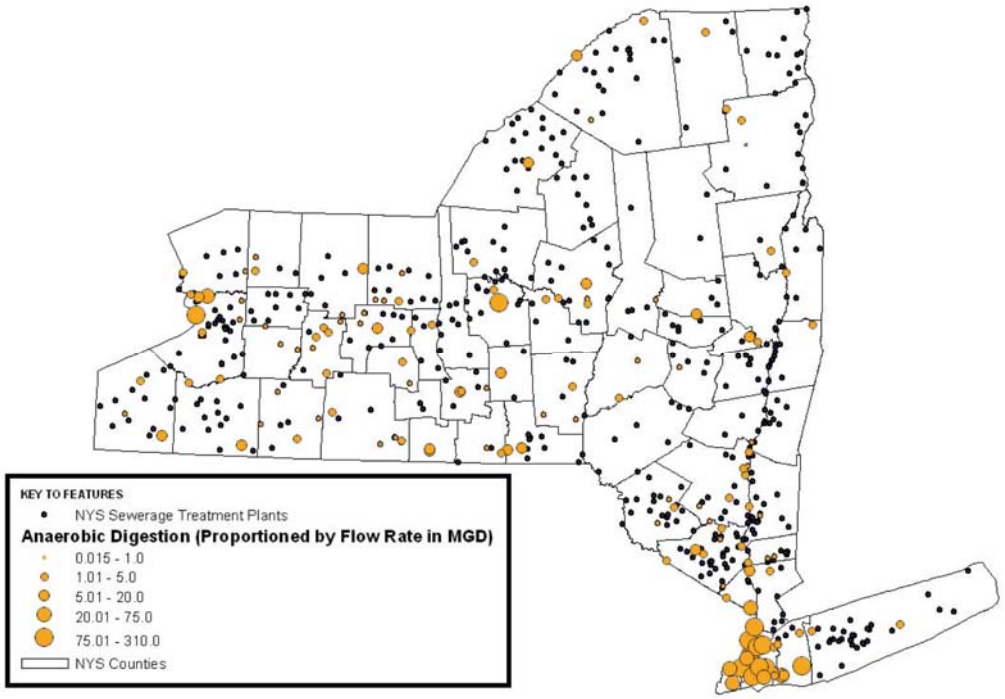
For all of these reasons, anaerobic digestion at water resource recovery facilities (WRRFs) is expected to contribute to the CES goal. Anaerobic digesters are designed to stabilize organic materials (e.g., sewage sludge, which is a byproduct of the physical, chemical and biological processes used in the treatment of sewage, manure, high strength food and beverage waste). More recently, some anaerobic digesters are increasing biogas production by accepting food waste diverted from landfills to serve as additional feedstock.

In 2007, NYSERDA conducted a market assessment of anaerobic digesters within New York's municipal wastewater sector. This analysis consisted of a survey of 590 municipal WRRFs, of which approximately 145 WRRFs were found to have anaerobic digestion facilities in place.[180]

[180] NYSERDA. 2007. Market Characterization Report: Anaerobic Digester Gas-to-Electricity for the Municipal Wastewater Sector in New York. November. Mc08-01. 7 pp. Accessed January 23, 2016 at: http://www.nyserda.ny.gov/-/media/Files/Publications/Research/Environmental/market-characterization.pdf.

**Exhibit 5-26** depicts the distribution of WRRFs in New York State and the highlights those with anaerobic digestion facilities in place.[181]

**EXHIBIT 5-26. DISTRIBUTION OF NEW YORK STATE WASTEWATER TREATMENT PLANTS (2007)**




While the 145 WRRFs identified with anaerobic digestion facilities in place were estimated to represent 75 percent of the State's overall wastewater treatment capacity, NYSERDA's market characterization also found a significant level of untapped potential across these same WRRFs. Specifically, NYSERDA found that a number of the 145 WRRFs with anaerobic digestion facilities in place did not (at the time of the survey) operate their digesters, operated their digesters at a reduced rate, or relied on undersized anaerobic digestion facilities. To the extent that existing WWTPs with anaerobic digestion facilities in place have access to food waste and other organic materials, further increases in electricity generation may also be possible.[182]

The prime potential for farm-based digester system is at New York State's large dairy farms with 750 or more mature dairy cattle equivalents (MDCEs) in their herds. About 190 of these farms have already installed a digester system or applied for incentives for one. These herds on these farms total over 300,000 MDCE which can provide enough manure feedstock to produce about 80 MW of renewable power. If the increased focus on food waste management results in significant quantities added to these farm digesters, the total power output could double. If it is projected that

[181] The American Biogas Council estimates 1,241 WWTPs across the U.S. currently using anaerobic digesters. They estimate an additional 2,440 WWTPs which could support an anaerobic digester. (American Biogas Council. Frequent Questions. Accessed January 23, 2016 at: https://www.americanbiogascouncil.org/biogas_questions.asp.)

[182] *Ibid*.

the CEF and CES initiatives are sufficient to bring enough farms to adopt anaerobic digestion so that half of the potential is reached by 2030, then the output range would be between 40 and 80 MW depending on the quantities of food waste treated.

As shown in **Exhibit 5-27**, the CES is expected to result in the development of a total of 51 MW of new generation at existing WWTPs with anaerobic digesters. Of this amount, the majority (32 MW, or 63 percent) is expected to be developed at WWTPs in Zone J, New York City. **Exhibit 5-27** displays the projections for the Base Case PPA scenario, although the amount of anaerobic digestion capacity and generation were approximately equal between scenarios.

**EXHIBIT 5-27. ESTIMATED ANAEROBIC DIGESTION ENERGY TO DEVELOP UNDER CES (BASE CASE, PPA SCENARIO, 2019-2030)**

| NYISO ZONE | ESTIMATED NEW CAPACITY (MW)[1] | ESTIMATED NEW GENERATION (GWH) [2] |
|---|---|---|
| Zone A, West | 5 | 28 |
| Zone B, Genesee | 4 | 25 |
| Zone C, Central | 2 | 14 |
| Zone D, North | 0 | 0 |
| Zone E, Mohawk Valley | 0 | 0 |
| Zone F, Capital | 2 | 12 |
| Zone G, Hudson Valley | 0 | 0 |
| Zone H, Millwood | 0 | 0 |
| Zone I, Dunwoodie | 3 | 19 |
| Zone J, NYC | 32 | 195 |
| Zone K, Long Island | 3 | 20 |
| **TOTAL** | **51** | **313** |

**NOTE:**
**(1)** Figures represent projections for the Base Case PPA scenario, which are representative of all the scenarios under both the base case and high load case. The amount of anaerobic digestion capacity was approximately equal between scenarios; capacity and generation varied by only 0.5 MW and 3 GWH between scenarios, respectively

### Environmental Impact Overview

Anaerobic digestion is generally considered a mechanism by which existing operations at WWRFs, agricultural facilities, and food and beverage manufacturing facilities can be improved. Implementation of the CES in this case will have minimal adverse environmental impacts given the expectation that it will result in more optimal use of the anaerobic digesters that are already installed. Anaerobic digestion at WRRFs will reduce the volume of sewage sludge that ultimately is transported off-site for disposal. In the agricultural context, anaerobic digestion reduces the odors associated with manure storage, such that the manure can be applied to fields close to the time the crops will need the nutrients inherent in the manure. Moreover, in cases where anaerobic

digestion facilities are adapted to accept food waste, such operations can further reduce waste that would otherwise end up in landfills.[183]

Anaerobic digestion can also reduce fugitive greenhouse gas emissions that would otherwise be released at landfill sites during natural organic decomposition processes, as they are typically equipped with flares that convert fugitive methane emissions into $CO_2$ and water.[184] When captured methane is converted into electricity on-site, such operations may contribute to greenhouse gas reductions, the magnitude of any such contributions, however, will depend on facility-specific factors such as the nature of the feedstock.

Digestate, the effluent from the anaerobic digestion process, typically consists of liquids, remaining biomass, and inorganic solids. The liquid is typically separated from the solids. Depending on the chemical composition of the liquids, some can be re-used as irrigation water for agricultural crops, recycled for use in composting processes, or converted into fertilizer. Similarly, some solids can be used for a variety of value added products, including fertilizer, compost, and soil amendments for agricultural crops.[185] In some cases, however, residual digestate may require additional treatment and/or disposal in landfills; however, the overall net impact of anaerobic digestion on waste production is generally positive. Specifically, compared to operations without anaerobic digestion, the waste generated may be reduced in volume, is chemically stable and therefore nearly odorless, and contains fewer levels of harmful pathogens.[186]

### 5.2.7 BIOMASS ENERGY

Large scale biomass plants produce electricity through the combustion of organic matter derived through recently living organisms. Biomass can consist of a variety of materials but is typically plant based. Biomass systems can either be open-loop or closed-loop. In open-loop systems, the biomass resources are typically byproducts of other activities such as the wood-processing industry in New York, or materials diverted from a municipal solid waste stream. Closed-loop systems use fuel grown from land solely dedicated to the production of energy resources. Closed-loop biomass systems are considered carbon neutral because the carbon released in the combustion of the biomass is equivalent to the carbon absorbed when the energy crops are regrown.[187] Open-loop biomass systems may be GHG negative if combustion prevents methane release during decomposition of the waste stream, or may be GHG neutral if the waste stream would have ended up in a landfill with methane capture. **Exhibit 5-28** describes the major types of biomass plants.

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[183] Further discussion of the impacts of anaerobic digester systems on farms is provided in the 2015 GEIS at Chapter 5.2.2

[184] While carbon dioxide is a byproduct of anaerobic digestion, methane has been estimated to be 20 times more effective at trapping heat in the atmosphere than carbon dioxide.

[185] Use of digestate as soil amendments for agricultural crops can create further benefits by reducing the need for synthetic fertilizers and pesticides and/or increase water retention properties when applied to farmlands; EPA. 2015. Anaerobic Digestion and its Applications. EPA/600/R-15/304. October. 17 pp.

[186] California Department of Resources Recycling and Recovery (CalRecycle). 2011. Final Program Environmental Impact Report for Statewide Anaerobic Digester Facilities for the Treatment of Municipal Organic Solid Waste. SCH No. 2010042100. June.

[187] Carbon neutral closed-loop systems rely on proper land management and agricultural practices and do not account for fuel used in harvesting and transport of the material.

The environmental impacts of large scale biomass are highly dependent on the combustion technology, the type of input, and the method by which the input is grown or collected. **Exhibit 5-28** lists common types of biomass conversion technologies. Combined heat and power (CHP) is often used as a distributed energy resource to meet onsite power needs, but a large biomass CHP installation could potentially sell large amounts of power to the wholesale market.

**EXHIBIT 5-28. COMMON TYPES OF BIOMASS CONVERSION TECHNOLOGIES**

| BIOMASS TECHNOLOGY | DESCRIPTION |
|---|---|
| Combustion Boilers | Conventional technology that produces steam through the combustion of biomass used to run a turbine that produces electricity. Typically sized from 1 to 50 MW. |
| Combined Heat and Power | Typical combined heat and power plants may use biomass fuels as input. CHP increases the total efficiency of the plant by using thermal energy that is produced as a waste product from the electric generation. In NY, biomass CHP is primarily used at wood processing facilities with large steam needs and readily available residual waste biomass. |
| Gasification | The gasification process heats biomass to high temperatures in chambers with limited oxygen to create biogas (or syngas). This gas can be used in a conventional gas turbine or combined cycle plant. Biogas may be significantly more efficient than standard combustion boilers and create fewer criteria pollutants |
| Co-firing biomass with coal | Biomass is burned alongside coal, typically in a large baseload plant. Co-firing is a low-cost option for biomass utilization and avoids adverse impacts that might occur as a result of new facility construction. Boiler efficiency losses are minimal after the biomass stream is introduced and up to 15 percent of the coal stream can be displaced with only feed intake and burner modifications. |

There are multiple types of potential biomass inputs, each with different environmental impacts. Types of biomass that may be used as main tier renewable resources under the CES include:

- Agricultural residues;
- Harvested wood;
- Silviculture waste wood;
- Mill residue wood;
- Pallet waste;
- Site conversion waste wood;
- Sustainable Yield Wood (woody or herbaceous); and
- Urban Wood Waste and Refuse Derived Fuel.[188]

These biomass sources can generally be divided into three categories – wood and agricultural waste products, forest (silviculture) resources, and dedicated energy crops. Each category of biomass will have different environmental impacts dependent on the site-specific implementation.

[188] NYS DPS. 2016. Staff White Paper on Clean Energy Standard. CASE 15-E-0302. January 25.

The remainder of this section discusses the general, potential environmental impacts of large-scale biomass implementation.

**Exhibit 5-29** presented the expected growth in capacity for biomass under the CES, confined to three NYISO zones: Zone A (West), Zone B (Genesee), and Zone C (Central).

**EXHIBIT 5-29. ESTIMATED BIOMASS ENERGY PROJECTED TO DEVELOP UNDER THE CES (2019-2030)**

| NYISO ZONE | ESTIMATED NEW CAPACITY (MW) | | | | ESTIMATED NEW GENERATION (GWH) | | | |
|---|---|---|---|---|---|---|---|---|
| | BASE CASE | | HIGH LOAD | | BASE CASE | | HIGH LOAD | |
| | PPA | FIXED REC | PPA | FIXED REC | PPA | FIXED REC | PPA | FIXED REC |
| Zone A, West | 56 | 57 | 58 | 58 | 395 | 401 | 404 | 406 |
| Zone B, Genesee | 0 | 115 | 0 | 115 | 0 | 808 | 0 | 807 |
| Zone C, Central | 0 | 131 | 134 | 134 | 0 | 922 | 936 | 936 |
| **TOTAL** | **56** | **304** | **191** | **307** | **395** | **2,130** | **1,340** | **2,150** |
| Note: No biomass is projected for Zones D-K; thus these zones are not shown in the exhibit. | | | | | | | | |

### Land Use

Expanded use of biomass may have a variety of potential land use impacts depending on the type of conversion technology and the type of input. Impacts associated with the construction of a main-tier biomass facility will be similar to a comparably sized non-biomass electric generation facility including: converted land area and short-term increases in dust, noise levels, traffic, visual intrusion, and ecological disturbances. Note that these impacts do not apply to co-fired facilities, which do not require significant new construction.

Increased closed-loop biomass under the CES may result in more significant land use changes as existing agricultural, pastoral, or forest land is converted to bio-fuel crops.[189] A large scale shift of agricultural land from food crops to energy crops may impact food prices or drive the expansion of agriculture to currently forested land. To the extent that pastoral land, marginal land, or land currently cultivating food crop is converted to energy crops, increased biofuels may positively impact native wildlife, as many biofuels have a higher wildlife quality than traditional agricultural crops.[190] For example, the predominant energy crop in New York State consists of fast growing willow trees. There are currently 1,200 acres of land in New York dedicated to willows for energy use. When properly managed, these crops can increase wildlife diversity and protect riparian

[189] USDA Farm Service Agency. 2010. Biomass Crop Assistance Program: Programmatic Environmental Impact Statement. June. Accessed January 25, 2016 at: https://www.fsa.usda.gov/Internet/FSA_File/bcapfinalpeis062510.pdf.

[190] *Ibid*.

habitats compared to traditional agricultural crops. DOE estimates that about 190 million acres of land in the United States is available for energy crops such as switchgrass, poplar trees, and willow trees.[191] One hectare of land area dedicated to willow trees can produce enough fuel to generate approximately 16 MWh annually.[192] The Northeast has an estimated two million hectares of marginal land no longer used for agriculture that could be suitable for biomass production. Willow trees also take up nutrients and heavy metals and may be used to effectively treat a number of waste sources including municipal waste, sewage sludge, and distillery effluent.

New York State has large amounts of forest land which, if managed and harvested carefully and sustainably, could provide biomass fuels without increasing GHG emissions or significantly impacting wildlife or recreational activities. To the extent that currently un-forested lands (e.g., marginal and nutritionally depleted areas) are converted to grow biomass, the net increase in vegetation may also reduce carbon levels.

#### Water Use and Quality

Water use for large scale biomass projects may also vary depending on the type of conversion technology and biomass input. Water quality may increase if food crops are converted to energy crops. Energy crops typically require less potassium, agricultural lime, herbicides, insecticides, and other agricultural chemicals but may increase use of nitrogen and phosphorus. Planting of energy crops may decrease sedimentation and nutrient and chemical deposition into surface bodies of water. If non-agricultural land is converted to energy crops, local water sedimentation may increase. The water requirement for energy crops is not significantly different than food crops.

Water is also required during the biomass combustion process. In a typical biomass plant, most of the water will be used as part of the cooling system to condense the steam for reuse. The water requirements for biomass combustion are similar to a similarly-sized fossil fuel power plant.

#### Air Emissions

Air emissions associated with biomass vary depending on the conversion technology and biofuel input. Emissions would typically decrease or remain the same for biomass that is co-fired with coal compared to coal-only electricity. Sulfur emissions would be reduced in direct proportion to the amount of biomass used in the plant because most biomass inputs have near zero sulfur content. Low mercury content in biomass would lead to a similar reduction in mercury emissions. Impacts on other criteria pollutants are less certain – $NO_x$ emissions may either increase or decrease depending on site specific conditions (e.g., properties of the fuel, type of emissions control technologies, or operating conditions at the plant). Total particulates do not typically increase after introducing biomass, but emissions of particulate matter smaller than 10 microns (PM10) and 2.5 microns (PM2.5) may increase. In some cases minor, increases in carbon

[191] U.S. EPA. 2008. State Bioenergy Primer, Chapter Two: What is Bioenergy? Accessed January 25, 2016 at: http://www3.epa.gov/statelocalclimate/documents/pdf/bioenergy_chapter2.pdf

[192] Assuming 35% generating capacity; Biomass Energy Centre. 2011. Potential Outputs of Biofuels Per Hectare, Per Annum. Accessed January 25, 2016 at: http://www.biomassenergycentre.org.uk/portal/page?_pageid=75,163231&_dad=portal&_schema=PORTAL

monoxide may occur.[193] The impact of biomass on criteria pollutants in co-firing applications is a subject of ongoing research, and is highly dependent on site specific factors.

Stand-alone combustion of biomass would likely have similar impacts to co-firing applications. Specific impacts would be highly dependent on the emissions controls at any particular power plant. Biomass plants tend to be smaller than typical fossil fuel-fired plants and are often less efficient and less well equipped with emissions controls than existing coal plants. If not carefully planned and implemented utility scale biomass may result in increased carbon monoxide and PM10 particulates than an equivalent amount of fossil fuel-based generation. Particulate emissions from biomass plants between 500 kW and 10 MW may vary significantly depending on technology and operation.[194] Other air pollutants such as mercury and sulfur would be reduced.[195] Levels of $NO_x$ emissions from biomass facilities may vary between 60 mg/MJ and 170 mg/MJ. Direct $CO_2$ emissions from biomass combustion are high compared to most fossil fuels but if sustainably managed the $CO_2$ emitted during combustion is equivalent to the $CO_2$ sequestered during growth of the stock.

Emissions of all criteria pollutants may be significantly reduced through biomass gasification. Criteria pollutant emissions from biomass gasification plants are similar to emissions from conventional natural gas plants and substantially lower than coal or oil plants.[196]

Overall lifecycle greenhouse gas emissions are highly dependent on procurement of biomass fuel. Closed-loop cycles are generally carbon neutral because the carbon released during combustion is equivalent to the carbon absorbed while the biomass is grown. Open-loop cycles result in GHG emissions reductions because the combustion process produces primarily $CO_2$ while natural biomass decay produces $CO_2$ and methane. Methane has more global warming potential than $CO_2$; decreases in methane production result in a lifecycle reduction of greenhouse gases.

#### Health Impacts

Increased biomass combustion could have adverse health impacts. Biomass is often associated with high concentrations PM10. Humans may not filter these fine particulates through the nose, and they may end up in the lungs or alveolar region. Long exposure to fine particulates may cause

[193] NYS DPS. 2004. Final Generic Environmental Impact Statement In CASE 03-E-0188—Proceeding on Motion Of the Commission Regarding a Retail Renewable Portfolio Standard. August 26. Accessed January 25, 2016 at http://www.dps.ny.gov/NY_RPS_FEIS_8-26-04.pdf.

[194] Nussbaumer et al. 2008. Particulate Emissions from Biomass Combustion in IEA Countries: Survey on Measurements and Emissions Factors. On behalf of International Energy Agency Bioenergy Task 32, Swiss Federal Office of Energy. Accessed January 25, 2016 at: http://www.ieabcc.nl/publications/Nussbaumer_et_al_IEA_Report_PM10_Jan_2008.pdf.

[195] Assuming 35% generating capacity; Biomass Energy Centre. 2011. Potential Outputs of Biofuels Per Hectare, Per Annum. Accessed January 25, 2016 at: http://www.biomassenergycentre.org.uk/portal/page?_pageid=75,163231&_dad=portal&_schema=PORTAL.

[196] NYS DPS. 2004. Final Generic Environmental Impact Statement In CASE 03-E-0188—Proceeding on Motion Of the Commission Regarding a Retail Renewable Portfolio Standard. August 26. Accessed January 25, 2016 at http://www.dps.ny.gov/NY_RPS_FEIS_8-26-04.pdf.

health problems such as increased morbidity and exacerbation of respiratory and cardiovascular ailments.[197]

#### Waste Impacts

Increased large scale biomass may result in decreased wood waste because clean residual wood would be used in biomass burners instead of landfill disposal. Increased biomass combustion may result in increased solid waste such as construction wastes, solid biomass boiler ash, stillage cake and syrup, and lignin.[198] Solid biomass ash and lignin are potentially useful consumer products. Large scale biomass facilities may also produce significant amounts of bottom ash requiring disposal either in landfills or spread over area lands. Biomass produces less hazardous waste overall compared to coal combustion.[199]

### 5.3 LONGER-TERM EFFECTS

Longer-term effects are those occurring later in time and farther away, but which are still reasonably foreseeable. In considering the longer-term effects of the REV and CEF, the 2015 GEIS describes the long-term policy outcomes anticipated from implementation of the REV and CEF, designed to increase system reliability and resiliency, reduce energy-related carbon emissions and lower the overall costs of power across all sectors of the economy. The 2015 GEIS further recognizes that the changes envisioned by the REV and CEF within New York's energy industry will not result from completion of one or two large actions but rather will evolve over long periods of time in response to numerous separate individual initiatives. These same principles apply to the impacts of the CES.

As discussed in the 2015 GEIS, the greatest longer-term, indirect environmental impact of the REV and CEF, and by extension the CES, is the reduction in the amount of the State's energy generated from fossil fuel-based sources of energy. Fossil fuel power plants are the second largest (and most concentrated) source of emissions, accounting for approximately 16 percent of all greenhouse gas emissions in New York State.[200] Reductions in the State's use of and reliance on fossil fuel electric generation will in turn result in significant environmental and public health benefits. **Section 5.3** of the 2015 GEIS discusses the potential indirect effects of the REV and CEF on criteria air pollutants; greenhouse gases; water, land and ecological resources; and aesthetic, visual, cultural and historical resources; these discussions also apply to the CES and are therefore incorporated by reference here.

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[197] Nussbaumer et al. 2008. Particulate Emissions from Biomass Combustion in IEA Countries: Survey on Measurements and Emissions Factors. On behalf of International Energy Agency Bioenergy Task 32, Swiss Federal Office of Energy. Accessed January 25, 2016 at: http://www.ieabcc.nl/publications/Nussbaumer_et_al_IEA_Report_PM10_Jan_2008.pdf.

[198] U.S. DOE Golden Field Office, Office of Energy Efficiency and Renewable Energy. 2010. Final Environmental Impact Statement for the Proposed Abengoa Biorefinery Project near Hugoton, Stevens County, Kansas. August. DOE/EIS-0407. Accessed January 25, 2016 at: http://www.energy.gov/sites/prod/files/EIS-0407-FEIS-Summary-2010.pdf

[199] NYS DPS. 2004. Final Generic Environmental Impact Statement In CASE 03-E-0188—Proceeding on Motion Of the Commission Regarding a Retail Renewable Portfolio Standard. August 26. Accessed January 25, 2016 at http://www.dps.ny.gov/NY_RPS_FEIS_8-26-04.pdf.

[200] NYSERDA. 2014. New York State Greenhouse Gas Inventory and Forecast: Inventory 1990-2011 and Forecast 2012-2030. Final Report. April. Accessed September 26, 2014 at: http://www.nyserda.ny.gov/-/media/Files/EDPPP/Energy-Prices/Energy-Statistics/greenhouse-gas-inventory.pdf.

In the 2015 GEIS, **Section 5.3** recognizes that reductions in $NO_x$, $SO_x$ and particulate matter associated with avoided fossil fuel will lead to improvements in visual and cultural resources in New York by increasing visibility and reducing particle pollution that can damage and stain historical buildings and monuments. While such improvements are expected to accrue from implementation of the CES, the CES' focus on development of LSR may alter the visual and cultural landscape of the State's more rural areas in upstate New York, where large scale solar and wind facilities are more likely to be developed. As discussed in **Section 5.2**, large scale solar and wind operations have relatively large land use requirements. When such operations are sited in flat areas in rural communities, the industrial nature of solar and wind facilities can offer strong contrasts to the relatively rural landscape that they inhabit. To the extent that a specific rural community becomes host to multiple LSR projects, adverse impacts on the community's aesthetic, visual and cultural resources are possible.

### 5.4 OTHER UNANTICIPATED TECHNOLOGIES

The CES is expected to be implemented over a 13-year timeframe (2017 to 2030). It is possible that increased levels of demand for large scale renewable energy will spur innovation and the development of currently unanticipated technologies. As noted in the 2015 GEIS, New York State ranks second nationally in cleantech patents and the number of cleantech patents registered each year is on the rise.[201] As technology changes and new technologies are developed, there is potential for unforeseen environmental impacts. Depending on the type of technology, it is possible that construction activities or operation and maintenance of the technology could create environmental impacts. To the extent that any new technologies further displace or promote the displacement of fossil fuel electricity generation, or lower electricity consumption, such technologies could generate positive environmental impacts. The net impact of other unanticipated technologies is, by its nature, unknown at this time.

### 5.5 CUMULATIVE IMPACTS

As previously discussed, the CES is a program complementary to the Commission's other clean energy efforts. In the Staff White Paper, DPS Staff describes the REV and the CES as programs which "will promote each other's achievement." In addition to the REV, the CES will also work in concert with other, ongoing, State energy initiatives, including, but not necessarily limited to: (1) the Clean Energy Fund, (2) the draft 2014 New York State Energy Plan; (3) the New York Green Bank (Case 13-M-0412); and (4) the NY-Sun Initiative. In addition to State-level clean energy initiatives, a number of energy-related efforts at the federal level may interact with the CES, these other non-State initiatives are described in the **Section 5.5** of 2015 GEIS and incorporated by reference herein.

By considering cumulative impacts, the intent of SEQRA is to identify actions that may be insignificant by themselves, but which can degrade environmental resources over time when considered together. These considerations of potential cumulative effects include:

[201] SRI International. New York State Clean Energy Technologies Innovation Metrics 2012. Final Report. Prepared for NYSERDA. May 2013. Accessed on September 23, 2014 at: https://www.nyserda.ny.gov/Energy-Innovation-and-Business-Development/Innovation-and-Business-Development/Tracking-Clean-Tech-Innovation-for-New-York.aspx.

- As indicated by the modeling of alternative scenarios in **Chapter 4** and the assessment of broader impacts in **Chapters 4 and 5**, the CES is anticipated to engender overall positive environmental impacts, primarily by reducing the State's use of, and dependence on, fossil fuels.
- **As noted in Chapters 4 and 5**, many of the locations that would be considered for new large scale land-based wind and solar projects are in upstate New York. To the extent that some communities become host to multiple installations of new LSR projects, certain cumulative negative impacts (e.g., aesthetic effects of large scale wind and solar energy) may constrain the overall positive impacts of the CES. As discussed further in **Chapter 6,** a number of regulations, policies, and best practices serve as measures that will mitigate adverse impacts that may arise from activities undertaken in response to the CES.
- In general, the State and Federal policies and initiatives identified in this section as likely to interact with the CES are designed to reduce the adverse economic, social and environmental impacts of fossil fuel energy resources by increasing the use of clean energy resources and technologies.
- Cumulative site-specific impacts of the CES are not known at this time and are beyond the scope of this SEIS. This SEIS provides a generic description of the potential environmental impacts of the CES on land and water resources, agriculture, cultural and aesthetic resources, terrestrial and aquatic ecosystems and other individually relevant impacts. Appropriate federal, state, and local permitting and environmental review processes will identify, evaluate, and mitigate potential site-specific impacts.

# CHAPTER 6 | REGULATORY FRAMEWORK AND MITIGATION OF POTENTIAL ADVERSE IMPACTS

Consistent with 6 NYCRR §§617.9(b)(5)(iv) and 617.11(d)(5) of SEQRA, this chapter describes the variety of measures available to minimize or avoid, to the maximum extent practicable (incorporating all practicable mitigation measures), potentially adverse environmental impacts that may result from clean energy activities that may be implemented under the REV and CEF programs.

This chapter incorporates by reference the information presented in Chapter 6 of the 2015 2015 GEIS. This chapter provides key updates to Chapter 6 in two parts:

- Section 6.1: Federal and State Regulations Relevant to Operations of Nuclear Facilities, and
- Section 6.2: Federal and State Regulations and Guidance Potentially Relevant to Utility Scale Clean Energy Activities.

This chapter is not intended to provide an exhaustive list of potentially applicable regulations or mitigation measures, but rather a general overview of the key regulations and means by which adverse environmental impacts may be mitigated for a specific project or groups of similar projects. The focus is on applicable key federal and State regulations not previously discussed in the 2015 2015 GEIS.

## 6.1 FEDERAL AND STATE REGULATIONS RELEVANT TO OPERATIONS OF NUCLEAR FACILITIES

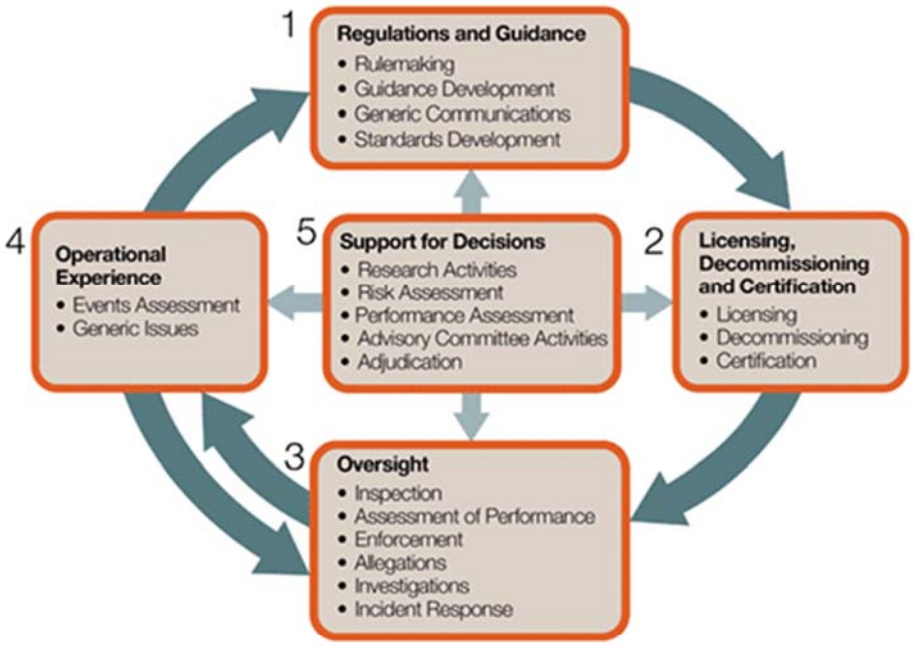
One key mitigation measure is compliance with existing federal and State regulations, which are designed specifically to protect human health and the environment from activities that could otherwise result in significant and/or adverse impacts. The U.S. Nuclear Regulatory Commission (NRC) regulates commercial nuclear power plant through licensing, inspection, and enforcement. The NRC mission states, "The NRC licenses and regulates the Nation's civilian use of radioactive materials to protect public health and safety, promote the common defense and security, and protect the environment."[202] **Exhibit 6-1** provides an overview of NRC's regulatory process used to accomplish their mission. The Occupational Safety and Health Administration coordinate with the NRC to regulate radiological and industrial safety at operating facilities.[203]

[202] U.S. NRC. 2015. About NRC. Accessed January 25, 2016 at http://www.nrc.gov/about-nrc.html.

[203] Memorandum of Understanding between the U.S. Nuclear Regulatory Commission and the Occupational Safety and Health Administration. September 6, 2013.

New York State also plays a role in ensuring the safe use of radioactive materials. Through various laws, the New York Department of Labor, New York State Department of Health, New York State Department of Environmental Conservation, and New York City Department of Health and Mental Hygiene Regulations all play a role in nuclear facility regulations.[204]

**EXHIBIT 6-1. U.S. NRC'S REGULATORY PROCESS**




1. *Developing regulations and guidance for applicants and licensees.*
2. *Licensing or certifying applicants to use nuclear materials, operate nuclear facilities, and decommission facilities.*
3. *Inspecting and assessing licensee operations and facilities to ensure licensees comply with NRC requirements, responding to incidents, investigating allegations of wrongdoing and taking appropriate followup or enforcement actions when necessary.*
4. *Evaluating operational experience of licensed facilities and activities.*
5. *Conducting research, holding hearings, and obtaining independent reviews to support regulatory decisions.*

## 6.2 FEDERAL AND STATE REGULATIONS AND GUIDANCE POTENTIALLY RELEVANT TO UTILITY SCALE CLEAN ENERGY ACTIVITIES

The section focuses on applicable federal and state regulations and guidance specific to utility scale clean energy activities (e.g., solar and wind) not previously discussed in the 2015 GEIS. The 2015 2015 GEIS discusses key federal and State regulations that may apply to clean energy activities during construction, operation, and closure of a specific project. Regulations that are particularly applicable to utility-scale renewable energy projects include site-specific permitting

[204] A complete list of the New York State regulations pertaining to nuclear facilities can be found at NRC: NMSS – State Regulations and Legislation Accessed January 25, 2016 at https://scp.nrc.gov/rulemaking.html#NY.

processes, the State Environmental Quality Review (SEQR) process, and Article 10 of the Public Service Law. Under Article 10, a state siting board is responsible for siting and permitting LSR projects with a generating capacity greater than 25 MW. The board is required to enforce environmental laws and standards except for local ordinances it specifically determines should not be applied to a particular project.[205]

The environmental impacts of a proposed renewable energy project under 25 MW in size are typically assessed in accordance with SEQRA by the host town board, regional planning commission, county agency, or other local authority. The town or local agency may impose mitigation measures that it finds are necessary to minimize any adverse environmental impacts.[206]

As a result of the RPS, state and many local agencies are familiar and experienced in applying the array of regulations, guidance and tools available to review LSR projects (on a project-by-project basis) and to identify appropriate mechanisms to avoid and/or minimize the potential adverse impacts of LSR projects.[207] In addition to the federal and state regulations identified in the 2015 2015 GEIS, **Exhibit 6-2** provides a list of additional regulations, leases, permits, reviews, or guidelines that may be applicable to utility scale wind facilities. Regulations and guidance applicable to utility scale solar installations were discussed in the 2015 GEIS.

### EXHIBIT 6-2. REGULATIONS, PERMITS, AND REVIEW PROCESSES POTENTIALLY APPLICABLE FOR UTILITY SCALE WIND PROJECTS

| LEVEL | REGULATION, LEASE, PERMIT, REVIEW, OR GUIDELINE | RELEVANT LAWS AND STATUTORY AUTHORITY | POTENTIALLY APPLICABLE TECHNOLOGIES |
|---|---|---|---|
| State | Guidelines for Conducting Bird and Bat Studies at Commercial Wind Energy Projects[208] | ECL Articles 1, 3, 11 | Wind |
| State | Tidal Wetland Permit | Tidal Wetlands Act ECL Article 25;<br>6 NYCRR Part 661 | Offshore Wind |
| Federal | Bureau of Ocean Energy Management, Regulation, and | 30 CFR Parts 250, 285, and 290 | Offshore Wind |

[205] NYS Board on Electric Generation Siting and the Environment. Accessed January 25, 2016 at: http://www.dps.ny.gov/SitingBoard/.

[206] 6 NYCRR Part 617.

[207] As example, under the Main Tier component of the RPS, as of December 31, 2014, 56 projects representing approximately 1,854 MW were operating with another nine projects, representing 181 MW, under development. Collectively, these projects included two biomass facilities, 10 landfill biogas operations, two anaerobic digester biogas facilities, 25 hydroelectric facilities, 23 wind farms, and three fuel cell facilities. (NYSERDA. 2015. New York State Renewable Portfolio Standard. Annual Performance Report through December 31, 2015. March. Accessed February 1, 2016 at: http://www.nyserda.ny.gov/All-Programs/Programs/Main-Tier/Documents.)

[208] NYS DEC Division of Fish, 2009. Wildlife and Marine Resources. Guidelines for Conducting Bird and Bat Studies at Commercial Wind Energy Projects. August. Accessed January 25, 2016 at: http://www.dec.ny.gov/docs/wildlife_pdf/finwindguide.pdf.

| LEVEL | REGULATION, LEASE, PERMIT, REVIEW, OR GUIDELINE | RELEVANT LAWS AND STATUTORY AUTHORITY | POTENTIALLY APPLICABLE TECHNOLOGIES |
|---|---|---|---|
| | Enforcement OCS Leasing Process[209] | | |
| Federal | Nuclear Regulatory Commission—Energy Reorganization Act[210] | Pub.L. 93-438 | Offshore Wind |
| Local | Local Waterfront Revitalization Program | Article 42 of the Executive Law N.Y. GEN. CITY LAW §28-a; N.Y. TOWN LAW §272-a; N.Y. VILLAGE LAW §7-700 et seq. | Offshore Wind |
| State | Coastal Erosion Hazard Areas[211] | ECL § 34-0102. ECL Article 34 and 6 N.Y.C.R.R. Part 505 | Offshore Wind |
| Interstate | Great Lakes Laws and Agreements | Boundary Waters Treaty of 1909, Convention on Great Lakes Fisheries, Great Lakes Basin Compact—Establishment of the Great Lakes Commission, Great Lakes Charter of 1985, Great Lakes Fishery Act of 1956, Great Lakes Fish and Wildlife Restoration Act of 1990, and the Joint Strategic Plan for the Management of Great Lakes Fisheries[212] | Offshore Wind in the Great Lakes |
| State | Guidelines for Agricultural Mitigation for Wind Power Projects[213] | Department of Agriculture and Markets | Wind |
| State | Assessing and Mitigating Noise Impacts[214] | DEP-00-1 | Utility scale wind and solar |
| State | Assessing and Mitigating Visual Impact[215] | DEP-00-2 | Utility scale wind and solar |

[209] NYSERDA. 2010. Pre-Development Assessment of Natural Resources for the Proposed Long Island- New York City Offshore Wind Project Area. Final Report 10-22 Task 3A. October. Accessed January 26, 2016 at: http://www.linycoffshorewind.com/PDF/10-22_linyc-collaborative-resources.pdf.

[210] NYSERDA. 2010. New York's Offshore Wind Energy Development Potential in the Great Lakes: Feasibility Study. Final Report 10-04. April. (p.142)

[211] NYSERDA. 2010. New York's Offshore Wind Energy Development Potential in the Great Lakes: Feasibility Study. Final Report 10-04. April. (p.142)

[212] NYSERDA. 2010. New York's Offshore Wind Energy Development Potential in the Great Lakes: Feasibility Study. Final Report 10-04. April. (p.142)

[213] NYS Department of Agriculture and Markets. 2013. Guidelines for Agricultural Mitigation for Wind Power Projects. Revised July 10, 2013. Accessed January 26, 2016 at: http://www.agriculture.ny.gov/ap/agservices/Wind_Farm_Guidelines.pdf

[214] NYS DEC Division of Environmental Permits. Assessing and Mitigating Noise Impacts. Issuance Date: October 6, 2000. Revised February 2, 2001. Accessed January 25, 2016 at: http://www.dec.ny.gov/docs/permits_ej_operations_pdf/noise2000.pdf

[215] NYS DEC Division of Environmental Permits. Assessing and Mitigating Visual Impacts. Issuance Date: July 31, 2000. Accessed January 25, 2016 at: http://www.dec.ny.gov/docs/permits_ej_operations_pdf/visual2000.pdf.

# CHAPTER 7 | UNAVOIDABLE ADVERSE IMPACTS

**Chapter 5** discusses the potential generic impacts that may result from implementation of the proposed CES. The purpose of the SEIS is not to evaluate specific energy projects and their site-specific impacts. As previously discussed, adverse environmental impacts could result from individual but as yet unidentified projects implemented in the future. However, the generic review presented in **Chapter 5** does not identify any unavoidable environmental impact of a type that cannot be mitigated through one or more of the techniques discussed in **Chapter 6** (Regulatory Framework and Mitigation of Potential Adverse Impacts). Unavoidable impacts of the "no action" alternative are discussed in **Chapter 4**.

# CHAPTER 8 | IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The development of the proposed CES will not, in itself, result in irreversible or irretrievable commitment of resources because no specific environmental resource or project site will be affected by the action. The construction of new renewable energy projects in the future in response to the CES may raise such concerns, but these will be identified in site-specific environmental analyses and avoided or minimized in accordance with SEQRA and other applicable law. Where the CES proposes to extend support to existing generation suppliers, including upstate nuclear power plants, any irreversible or irretrievable commitment has already been authorized under those facilities' permits and licenses.

# CHAPTER 9 | GROWTH-INDUCING ASPECTS AND SOCIOECONOMIC IMPACTS

This chapter discusses the potential growth-inducing aspects and socioeconomic impacts of the proposed CES, in the context of the expected outcomes of the REV and CEF proceedings. Thus, this chapter incorporates by reference the information presented in Chapter 9 of the 2015 GEIS and updates the information provided there, focusing on relevant factors that may assist in understanding the likely impacts of the Commission's development and implementation of the CES.

As discussed in Chapter 9 of the 2015 GEIS, the exact mix of clean energy resources and technologies that will be implemented under the REV and CEF programs is uncertain, although the general direction of those policies is known. In contrast, the proposed CES will establish a mandate directed at a more specific composition of the State's energy supply portfolio. The information provided in this chapter focuses on the potential impacts that may result from the implementation of the CES 50 by 30 goal and the CES nuclear maintenance program.

Specifically, this chapter contains the following sections:

- Section 9.1: Potential Benefits Categories;
- Section 9.2: Potential Program Costs;
- Section 9.3: Impacts on Growth and Community Character; and
- Section 9.4: Environmental Justice Impacts.

## 9.1 POTENTIAL BENEFITS CATEGORIES

Successful implementation of the REV and CEF, the additional measures proposed to meet the CES 50 by 30 goal, and the CES nuclear maintenance program (NMP) will generate several types of public benefits. This section first provides a qualitative description of the growth-inducing aspects of the programs that lead to potential public benefits. Next, this section presents a summary of potential regional economic impacts of continued generation of energy by eligible nuclear plants and the construction of additional LSR supply resources.

### Categories of Potential Public Benefits

Depending on the mechanisms employed, increasing the supply of renewable resources to meet 50 percent of New York State's demand by 2030 is expected to result the following types of public benefits:

- ***Public health benefits*** due to avoided emissions of GHG and criteria air pollutants. As increased use of renewable energy sources leads to improved air quality, society benefits from reduced health impacts and increased employee productivity. For example, as air quality improves, state health care expenditures for treatment of asthma, acute bronchitis, and respiratory conditions may be reduced.

- ***Ecosystem services benefits*** related to the reduction in emissions and due to reduced impacts on land and water uses, as renewable sources are incorporated into New York's energy supply portfolio in lieu of investment in fossil fuel sources. For example, "wind and solar energy require essentially no water to operate, and thus do not pollute water resources or strain supply by competing with agriculture, drinking water systems, or other important water needs." [216]
- ***Climate change benefits*** related to the reduction in the State's reliance on fossil fuel energy. As discussed in **Chapter 3** of the 2015 GEIS, climate change is expected to increase air temperatures which will in turn intensity water cycles through increased evaporation and precipitation. In New York, more intense water cycles are expected to lead to increases in localized flash and coastal flooding, increases in the frequency and intensity of extreme precipitation and extreme heat events, longer summer dry periods, lower summer flows in large rivers, lower groundwater tables, and higher river and in-stream water temperatures.[217]

Measures proposed under the CES 50 by 30 goal and CES nuclear maintenance program may also serve to maintain fuel diversity. It is expected that the addition of new renewable electricity supplies may reduce the State's reliance on natural gas. Such changes may also reduce the exposure to fossil fuel-related energy security challenges and supply interruptions, thereby increasing the security of New York's electric energy supply.

### Regional Economic Benefits

In addition to the regional economic benefits outlined in the 2015 GEIS, the CES programs are likely to have regional economic benefits for New York State. This section describes regional economic benefits of the CES NMP as well as from increased large scale renewable energy under the CES 50 by 30 goal.

The proposed CES NMP would provide support to eligible licensed nuclear facilities to continue operations for a significant period of time, estimated for these purposes to last until expiration of their valid NRC operating licenses. The continued operation of nuclear facilities will preserve jobs and tax revenues, which in turn have secondary regional economic impacts. The net impact of the proposed action on regional development will depend upon many dynamic, unknown factors as technology continues to change and the economy grows and shifts. However, employment levels at the various nuclear power plants provide an indication of the importance of continued operations to local and regional economies.

[216] Union of Concerned Scientists. Benefits of Renewable Energy Use. Accessed on January 26, 2015 at: http://www.ucsusa.org/clean_energy/our-energy-choices/renewable-energy/public-benefits-of-renewable.html#.VqfE4fkrL0M.

[217] Rosenzweig, C., W. Solecki, A. DeGaetano, M. O'Grady, S. Hassol, P. Grahborn (Eds). 2011. Responding to Climate Change in New York State. Synthesis Report prepared for NYSERDA. Accessed on September 10, 2014 at: http://www.nyserda.ny.gov/-/media/Files/Publications/Research/Environmental/EMEP/climaid/ClimAID-synthesisreport.pdf.

The levels of permanent employment and additional workers involved in refueling at the potentially eligible nuclear power plants are detailed below in **Exhibit 9-1**, as indicated in the applicable supplements to the NRC's GEIS for License Renewal of Nuclear Plants.

**EXHIBIT 9-1. EMPLOYMENT AT POTENTIALLY ELIGIBLE NYS NUCLEAR FACILITIES**

| SITE NAME (YEAR OF ESTIMATE) | NUMBER OF PERMANENT PERSONNEL, BY COUNTY | REFUELING EMPLOYMENT INCREASES |
|---|---|---|
| James A. Fitzpatrick Nuclear Power Plant (2006) | Oswego 556<br>Onondago 127<br>Total 716 | 700 to 900 workers for 30 days every 24 months |
| Nine Mile Point Nuclear Station (2004) | Oswego 931<br>Onondaga 298<br>Other 52<br>Total 1,281 | 1,000 to 1,250 workers for 30-40 days annually |
| R. E. Ginna Nuclear Power Plant (2002) | Wayne 240<br>Monroe 220<br>Ontario15<br>Livingston 10<br>Other 15<br>Total 500 | 700 workers for 30 to 40 days every 18 months |
| Sources: U.S. Nuclear Regulatory Commission. NUREG-1437. Supplement 14 (R.E. Ginna), Supplement 24 (Nine Mile Nuclear Station), and Supplement 31 (James A. Fitzpatrick). | | |

To understand the regional economic impact of the continued operations of a nuclear power plant, it is important to consider not only the direct impacts (i.e., employment at the plant, the value of electricity produced at the plant), but also secondary impacts that result as the plant and employees spending filters through the regional economy.[218] A fact sheet produced by the Nuclear Energy Institute presents average direct and indirect economic and employment effects for an average nuclear power plant, including:[219]

- Each year, operation of a nuclear plant generates 400 to 700 permanent jobs; and,
- The average nuclear plant generates approximately $470 million in economic output or value annually (including both direct and secondary effects); this figure includes more than $40 million in total labor income.

[218] Two recent reports produced by the Brattle Group calculate the total contribution of New York's nuclear power plants and New York's upstate nuclear power plant's to the State economy (see http://www.brattle.com/system/publications/pdfs/000/005/229/original/New_York's_Upstate_Nuclear_Power_Plants'_Contribution_to_the_State_Economy.pdf?1449526735 and http://www.nuclearmatters.com/resources/reports-studies/value-of-nuclear-new-york (accessed January 21, 2016). These reports represent a what-if analysis assuming that the power currently produced by the plants would shift be generated by natural gas power plants, rather than assessing the impacts that result from continued operation of the plant. To assess the operating impacts of a nuclear power plant, it is more applicable to model the employment and output directly attributable to the plant.

[219] NEI. 2015. Fact Sheets. Nuclear Power Plants Benefit State and Local Economies. February. Accessed on January 16, 2016 at: http://www.nei.org/Master-Document-Folder/Backgrounders/Fact-Sheets/Nuclear-Power-Plants-Contribute-Significantly-to-S.

Maintaining nuclear plant operations will also preserve tax payments (or payments in lieu of taxes) to the various taxing entities in the rural areas where the qualifying plants are located. For example, for the Fitzpatrick plant, Entergy has an agreement with Oswego County, the Town of Scriba and the Mexico Central Schools to make standardized annual payments in lieu of taxes. A recent article indicates that Entergy pays Oswego County $17.3 million in yearly property tax payments.[220] To the extent the NMP enables continued operation of nuclear facilities that would otherwise retire, the action would result in benefits to the regional economy in the form of stable wages, jobs and tax revenues.

**Case Study: R.E. Ginna Nuclear Power Plant**

A recent study looked at the economic impacts of the R.E. Ginna Nuclear Power Plant. Given the level of employment supported by the plant, the analysis found that Ginna's operation generates $358 million of economic output annually statewide. This study indicates that for every dollar of output from Ginna, the state economy produces $1.52. Nuclear power plants also provide regional economic benefits in the form of tax payment as well. The Ginna plant is the largest taxpayer in the county where it is located, Wayne County, contributing more that $10 million in state and local property tax and sales tax in 2014.

Source: Nuclear Energy Institute. 2015. Economic Impacts of the R.E. Ginna Nuclear Power Plant. February. Accessed on January 21, 2016, at: http://www.nei.org/CorporateSite/media/filefolder/Policy/Papers/GinnaEconomicBenefits.pdf?ext=.pdf.

Construction of additional large scale renewable energy resources to meet the CES 50 by 30 goal may provide similar regional economic benefits. According to a recent study conducted by the Brookings Institution, in 2010 New York had 5,147 jobs related to wind power (approximately double the number of wind related jobs in 2003), and 556 jobs related to solar power.[221] The direct macroeconomic benefits of renewable energy include the creation of jobs in construction and operation of new facilities, payments to the State and localities, payments for fuel and land leases, and in-state purchase of materials and services. While there is uncertainty regarding the technologies that will be implemented and the locations, new resources will need to be built and operated. This will result in increased jobs and regional output due to construction activity and operations. Studies have generally found that renewable energy deployment increases gross jobs in and related to the renewable energy sector; however, it is harder to understand the net impacts given other energy generation sources that may be displaced. As noted in a recent retrospective study of the impacts of meeting RPS throughout the U.S., labor-intensive solar PV installations account for the majority of construction jobs, while established wind plants account for the majority of O&M jobs created as a result of RPS in the U.S.[222] **Exhibit 9-2** illustrates the projected magnitude of wind and solar capacity by NYISO zone, providing an indication of the

[220] Knauss, T. 2015. Entergy to close FitzPatrick nuclear plant in Oswego County. November 2. Accessed on January 23, 2015 at: http://www.syracuse.com/news/index.ssf/2015/11/entergy_fitzpatrick_nuclear_plant_in_oswego_county.html.

[221] Brookings Institute. 2011. The Clean Economy in the State of New York. Accessed February 1, 2016 at: http://www.brookings.edu/about/programs/metro/clean-economy/~/media/Series/Clean Economy/36.pdf.

[222] Wiser, R., G. Barbose, J. Heeter, T. Mai, L. Bird, M. Bolinger, A. Carpenter, G. Heath, D. Keyser, J. Macknick, A. Mills, and D. Millstein. 2016. A Retrospective Analysis of the Benefits and Impacts of U.S. Renewable Portfolio Standards. Lawrence Berkeley National Laboratory and National Renewable Energy Laboratory. NREL/TP-6A20-65005. http://www.nrel.gov/docs/fy16osti/65005.pdf.

spatial distribution of potential new wind and solar energy. As illustrated, the highest potential for new development of wind and solar resources occurs in NYISO Zone E (Mohawk Valley).

Large scale wind development may produce significant regional economic impacts. A 100 megawatt (MW) wind farm can require 120 job-years of labor and generate an estimated $4 million in wages during the three-year construction period.[223] A 2005 study estimated the nominal economic impacts of utility scale wind to range from $9.71 to $10.66 per MWh for projects varying in size from 50 MW up to 350 MW.[224] NYSERDA's Frequently Asked Questions (FAQs) on large scale wind projects indicates that approximately one O&M job is created for every 10 to 20 turbines.[225]

A recent report reviewed NYSERDA's investments in 18 projects under RPS contracts, including both wind and hydropower projects.[226] This study indicated that for every $1 spent on the acquisition of RPS Attributes for the Current Portfolio of RPS projects under contract with NYSERDA, the State will capture on average approximately $3 in direct investments associated with project spending over project lifetime. Further, approximately $27 in direct investment results from project expenditures in New York State for every 1 megawatt hour (MWh) of renewable energy that is generated under the RPS.[227] In addition to these direct investments, secondary effects would result in additional jobs and spending throughout the region. These findings support the conclusion that regional economic benefits would result from projects under the renewable tier of the CES.

[223] KEMA, Inc. and Regional Economic Development Research Group, Inc. NYSERDA Main Tier RPS Economic Benefits Report, November 14, 2008.

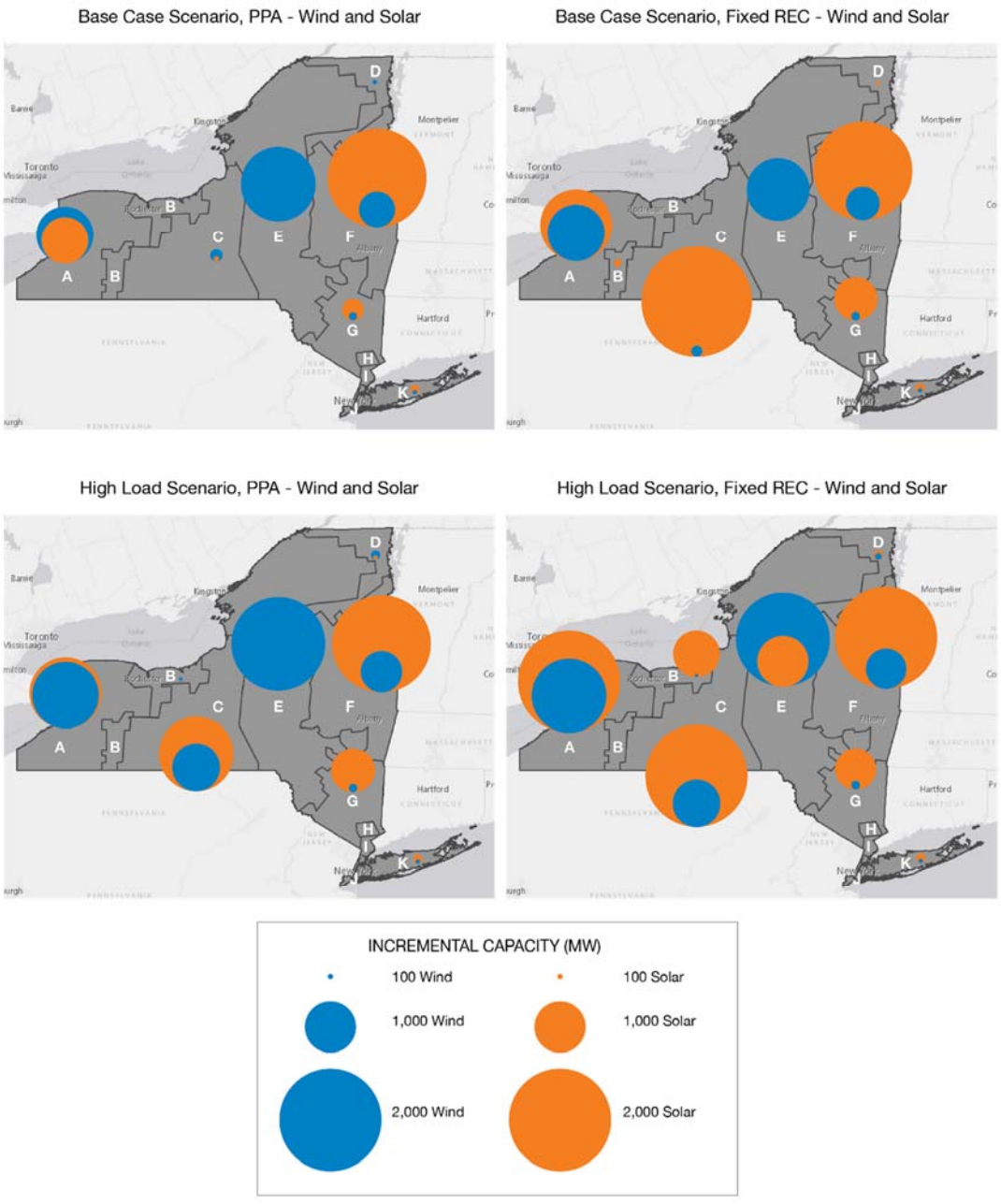
[224] NYSERDA. 2005. Major Economic Impacts of Utility Scale Wind Projects in New York. Accessed February 2, 2016 at: https://www.nyserda.ny.gov/-/media/Files/EDPPP/Energy-and-Environmental-Markets/RPS/Economic-Benefits/economic-impacts-nys-wind-projects.pdf.

[225] NYSERDA. Frequently Asked Questions on Large Scale Wind Energy. Accessed January 25, 2016 at: https://www.nyserda.ny.gov/-/media/Files/EERP/Renewables/Large-Scale-Wind-Projects.pdf.

[226] NYSERDA. 2013. Renewable Portfolio Standard Main Tier 2013 Program Review. Direct Investments in New York State. Final Report. Prepared by Sustainable Energy Advantage, LLC and Economic Development Research Group Inc. for NYSERDA. September 5.

[227] NYSERDA. 2013. Renewable Portfolio Standard Main Tier 2013 Program Review. Direct Investments in New York State. Final Report. Prepared by Sustainable Energy Advantage, LLC and Economic Development Research Group Inc. for NYSERDA. September 5.

## EXHIBIT 9-2. WIND AND SOLAR CAPACITY BY NYISO ZONE




Source: IEc Analysis.

Note: In each of the four scenarios, Zone H (Dunwoodie) had a projected 7 MW of solar capacity. However, due to the small size of the dots, they are not visible in the map.

In addition to solar and wind energy, the addition of hydroelectric power to New York State's supply can result in regional economic benefits. Construction activities associated with upgrading existing hydroelectric plants and/or retrofitting NPDs often extend over two to five years. As an example, development of 5 MW of hydroelectricity capacity at the existing Delta Dam in Albany County was estimated to employ 50 to 60 workers over a period of approximately 18 months.[228]

## 9.2 POTENTIAL PROGRAM COSTS

A supply curve model was used to estimate the least-cost mix of LSR resources needed to meet the 50 by 30 goal, as discussed in Chapter 4. From the resulting resource portfolio, the model developed an estimate of the costs[229] of procuring the incremental new resources (Tier 1), net of those resources' anticipated energy market values, through 2030. Known costs (sunk costs) that are already committed to Main Tier solicitations and the NY-Sun program are excluded from the calculation, in order to highlight the incremental cost associated with CES implementation. A separate estimate was made for the cost of maintaining existing resources (Tier 2) in New York, based on estimates of the payments necessary for CES-obligated entities to retain such resources in consideration of those projects' alternative net revenue opportunities in neighboring markets for which they are eligible. For the nuclear Tier 3, cost projections were based on the difference between expected nuclear generation costs and future wholesale energy market prices. This calculation was derived through examination of a series of high and low wholesale energy revenue and high and low costs of plant operation projections. From there, **net program benefits/costs** were developed, which reflect the incremental societal value of the avoided $CO_2$ emissions in excess of the market price forecast for carbon value embedded in the electricity price forecast as a result of the RGGI.

Because of the increased uncertainty inherent in projecting long-term costs and revenues due to changes in the broader economy, changes in wholesale electricity prices, the mix of renewable energy resources developed, technology costs, and project-specific circumstances, the model estimates a near-term net present value (NPV) cost projection through 2020, the date of the Commission's first triennial program review, as well as a longer-term estimate associated with meeting CES targets through 2030. A discount rate of 5.5% was used for the net present value (NPV) calculations. For Tier 1, costs are estimated for the full assumed 20 year lifetime of incremental renewable energy projects commencing operations through 2030. This means that Tier 1 projections to 2020 assess costs of such installations through 2039; under the 2030 time horizon, costs are assessed through 2049. For Tiers 2 and 3 – which are for maintaining the existing supply of renewables and nuclear resources – no assumption of 20 years of ongoing payments was made and program payments are therefore not assessed beyond the time horizon (2020 or 2030).

[228] City of Watervliet New York. FERC Project No. 13135 Delta Dam Hydroelectric Project. Accessed February 1, 2016 at: http://watervliet.com/files/delta.pdf.

[229] A more detailed examination of costs will be provided in the cost study supplement to the Staff White Paper in Case 15-E-0302.

For the total of Tier 1, 2 and 3 resources, the near-term NPV results a net benefit that ranges from $83 million to $622 million in the 2020 time frame. Looking at the 2030 time horizon, the NPV results in a net benefit of $1.07 billion to $3.05 billion.

In addition to the value of the benefit of avoided carbon, this cost assessment can be considered in conjunction with the other multiple benefits, both regional and State-wide, that the CES will achieve. These include the public health benefits, ecosystem benefits and significant direct and indirect local economic development benefits, discussed in **Section 9.1**. The deployment of new renewable energy installations and the continued operation of nuclear facilities will bring about or maintain significant short and long-term employment, local tax revenues to host municipalities and in-state purchases of goods and services. While not quantified for the purpose of this assessment, recent studies have shown that both renewable generation and nuclear generation facilities have generated net economic development benefits, after accounting for these local/regional effects as well as for macro-economic effects.[230]

## 9.3 IMPACTS ON GROWTH AND COMMUNITY CHARACTER

Chapter 9 of the 2015 GEIS discusses how the REV and CEF policies and investments may affect growth and community character including potential changes in the visual and physical environment of local communities. The proposed CES actions have the potential to affect community character in both similar and different ways.

The preservation of eligible nuclear facilities should not entail significant changes in the character of the host communities. The primary effect should be the preservation of jobs, local services, population levels, tax revenues, and existing community structures, although the introduction of REV and CEF programs may have the kinds of effects described in the 2015 GEIS. The same communities may face major changes toward the end of the period under analysis, as the licenses expire, but those changes are not attributable to the CES.

Meeting the 50 by 30 goal through the addition of renewable power sources will have significant impacts on some communities. Many of the locations that would be considered for new large scale land-based wind, solar, and hydropower projects are in upstate New York. In these areas, the prevailing settlement pattern is low density towns and villages, with large rural areas. These communities may see both positive and negative impacts associated with the construction and operation of new renewable power plants. For example, while construction of a wind plant will have impacts on a rural viewshed, the revenue earned by a farmer from wind leases may contribute to the preservation of existing farmland and rural/agricultural landscapes. Although leasing arrangements vary widely, a 2005 NYSERDA study estimated a typical lease payment of

230 http://www.brattle.com/system/publications/pdfs/000/005/229/original/New_York's_Upstate_Nuclear_Power_Plants'_Contribution_to_the_State_Economy.pdf?1449526735 and http://www.nuclearmatters.com/resources/reports-studies/value-of-nuclear-new-york; http://www.nyserda.ny.gov/-/media/Files/EDPPP/Energy-and-Environmental-Markets/RPS/RPS-Documents/2013/2013-RPS-investments-NYS.pdf.

approximately $4,000 per MW per year, with an annual inflationary adjustment.[231,232] A more recent study undertaken by Windustry in 2009, estimated an average fixed payment lease rate of $2,820 per MW, with values ranging from $1,515 to $5,387 per MW, equivalent to a fixed payment of approximately $4,230 for a 1.5 MW wind turbine per year.[233] As these large scale renewable resources are added, there may also be some changes to community character and viewsheds resulting from addition of transmission lines. The specific nature of the potential community impacts will be evaluated in site-specific proceedings following implementation of the CES.

## 9.4 ENVIRONMENTAL JUSTICE IMPACTS

Actions taken under the CES programs may occur in environmental justice communities and may have the potential to disproportionately affect low-income and minority populations within these communities. Regulations at 6 NYCRR Part 487 establish a framework for evaluating the potential environmental justice issues associated consistent with siting a major electric generating facility pursuant to PSL Article 10.

Implementation of actions to meet the CES 50 by 30 goals could result in locating new renewable energy facilities, such as wind, solar or biomass. Depending on siting decisions, facilities could be located in a potential environmental justice area (PEJA). Such siting proposals could result in the lead agency performing an EIS to assess, among other things, whether the action under consideration would disproportionately affect PEJA populations, and whether alternative actions would have less impact. **Exhibits 9-3 and 9-4** identify where PEJAs overlap with areas with the highest potential for solar PV and wind development, respectively, in New York State. As illustrated by the red shaded areas in **Exhibit 9-3**, areas with a high potential for solar PV overlap with existing PEJAs. As the areas with the highest wind resource potential are primarily offshore, wind energy developments are not as likely to fall within currently defined PEJAs.

In addition and as discussed above, an increase in the penetration of renewable resources could lead to an increase in electricity prices. Increased costs of electricity may affect low-income people disproportionately. While the electricity price impact are uncertain at this time, programs aimed to support low income energy consumers through the REV and CEF proceedings, and continued maintenance of nuclear power plants, may help to offset any increase in prices resulting from increased consumption of renewable energy.

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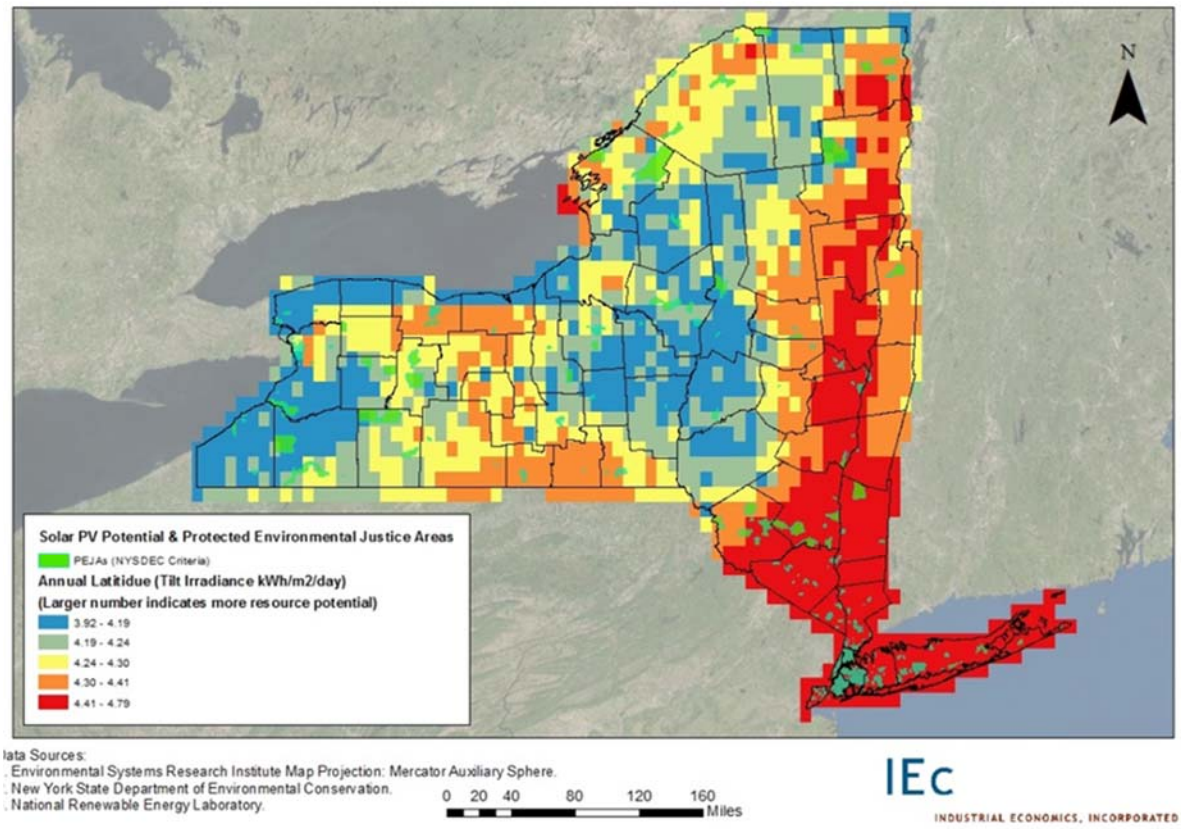
[231] NYSERDA. 2005. Major Economic Impacts of Utility Scale Wind Projects in New York. Accessed February 1, 2016 at: https://www.nyserda.ny.gov/-/media/Files/EDPPP/Energy-and-Environmental-Markets/RPS/Economic-Benefits/economic-impacts-nys-wind-projects.pdf.

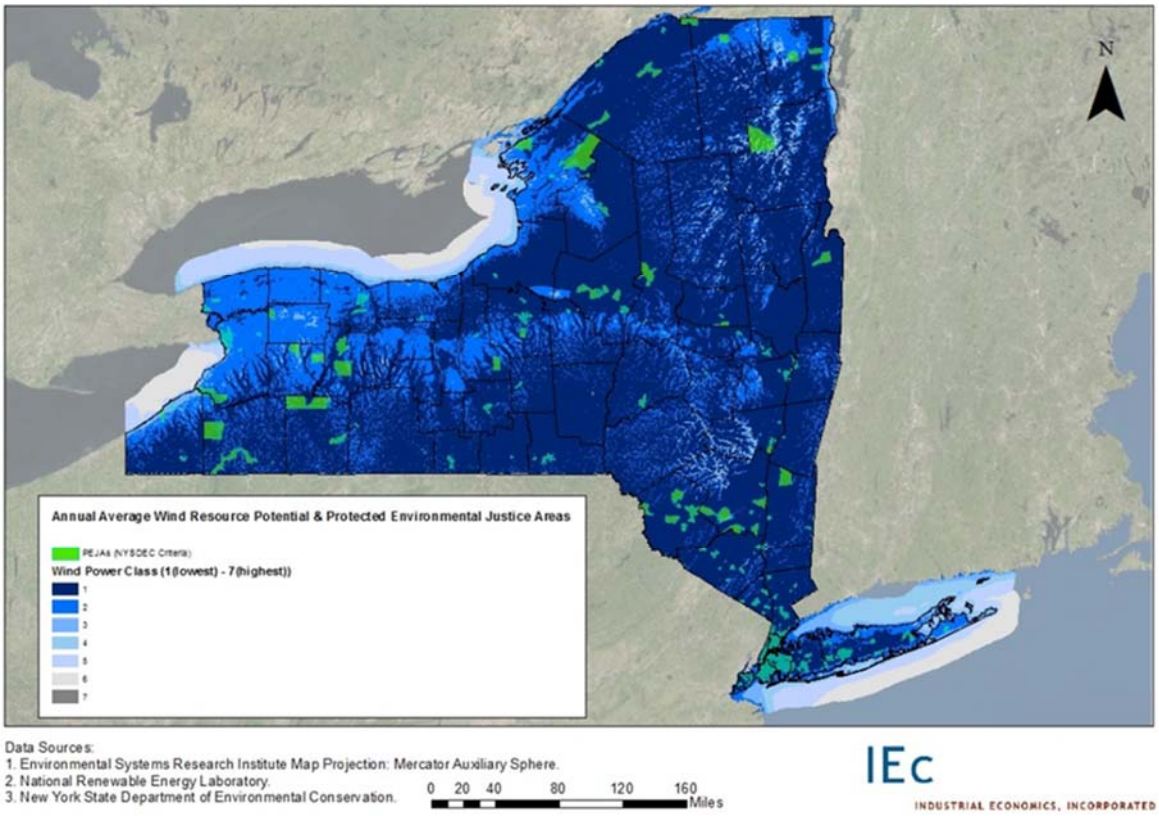
[232] As a point of comparison, DOE indicates that royalties are typically around $2,000 per year for a 750-kilowatt wind turbine or 2 percent to 3 percent of the project's gross revenues (U.S. Department of Energy, Energy Efficiency and Renewable Energy. Wind Energy for Rural Economic Development. DOE/GO-102004-1826. Revised August 2004. Accessed January 25, 2016 at: http://www.nrel.gov/docs/fy04osti/33590.pdf)

[233] NYSERDA. 2009. Wind Energy Toolkit. Accessed January 24, 2016 at: http://www.nyserda.ny.gov/-/media/Files/EERP/Renewables/wind-energy-toolkit.pdf.

## EXHIBIT 9-3. SOLAR PV RESOURCE POTENTIAL AND PEJA LOCATIONS



## EXHIBIT 9-4. WIND RESOURCE POETENTIAL AND PEJA LOCATIONS



# CHAPTER 10 | EFFECTS ON ENERGY CONSUMPTION

Consistent with 6 NYCRR §617.9(b)(5)(iii)(e) of the SEQRA regulations, this chapter considers the potential impacts of the proposed CES, in the context of the expected outcomes of the REV and CEF proceedings, on the use and conservation of energy in New York State. The impacts of actions taken under the REV and CEF on energy consumption were discussed in Chapter 10 of the 2015 GEIS, and are incorporated here by reference. The information provided in this chapter focuses on the potential impacts that may result from the implementation of the CES 50 by 30 goal and the CES nuclear maintenance program.

The proposed CES will establish a mandate that 50 percent of the electricity consumed in New York by 2030 be supplied by renewable resources. A key outcome of the mandate is expected to be greater penetration and adoption of renewable energy at the grid scale and in behind the meter installations. In addition, the CES NMP will enable continued generation of energy by eligible nuclear plants.

While the implementation of the CES is intended to change the State's electric generation portfolio, it is not expected to directly affect the amount of electricity used or the amount of energy conserved. Future actions under the State's REV and CEF policies, energy efficiency programs, as well as other factors, will directly impact demand; the effects of those initiatives are discussed in the 2015 GEIS. The maintenance of qualified nuclear facilities and installation of new renewable sources under the CES will affect the characteristics of the supply sources that will be available to meet that level of demand. Thus, the impact of the proposed CES will be to ensure at least 50 percent of the energy used in New York is sourced from renewables.

# CHAPTER 11 | REFERENCES

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