Final Generic Environmental Impact Statement In CASE 14-M-0101 - Reforming the Energy Vision and CASE 14-M-0094 - Clean Energy Fund

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LIST OF ACRONYMS AND ABBREVIATIONS

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
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
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
WTE	Waste-to-Energy
ZEV	Zero-emission vehicle

EXECUTIVE SUMMARY

In its order issued December 26, 2013 in Case 07-M-0548 (*Program Changes to the Energy Efficiency Portfolio Standard*), the New York State Public Service Commission (PSC or Commission) announced a fundamental reconsideration of New York State's regulatory paradigms and markets concerning the electric power system, calling for a re-examination of how the State's policy objectives are served both by clean energy programs and by the regulation of electric utilities. Immediately following the Commission's December 26, 2013 Order, on January 7, 2014, the New York State Energy Planning Board released a draft of the 2014 State Energy Plan. Among other initiatives, the draft 2014 State Energy Plan called on the Commission to "enable and facilitate new energy business models for utilities, energy service companies, and customers to be compensated for activities that contribute to grid efficiency."

In response to, and building on Case 07-M-0548 and the draft 2014 State Energy Plan, the Commission initiated Case 14-M-0101, *Reforming the Energy Vision* (REV) on April 24, 2014. The Commission described core policy outcomes relating to customer knowledge, market animation, system-wide efficiency, fuel and resource diversity, system reliability and resiliency, and reduction in carbon emissions.[1] In support of Case 14-M-0101, staff from the Department of Public Service (DPS) prepared a report articulating a preliminary framework for REV. In its order, the Commission also established a two-track proceeding to examine a platform for transforming New York's energy industry as well as to achieve the REV's stated policy goals. Track 1 considered issues related to the concept and feasibility of a Distributed System Platform (DSP), summarized in a Straw Proposal issued by DPS on August 22, 2014. Track 2 is focusing on regulatory changes and ratemaking issues; findings under Track 2 are still under development. As required under the State Environmental Quality Review Act (SEQRA), the Commission also made a Determination of Significance and issued a positive declaration, noting that the "action" could potentially have one or more significant adverse impacts on the environment. The Commission called for the preparation of a Generic Environmental Impact Statement (GEIS) with the Commission serving as "Lead Agency."

As a companion to the REV Order, the Commission initiated a proceeding (May 8, 2014, Case 14-M-0094) to address the future of those New York clean energy programs that are currently funded by a surcharge on the delivery portion of retail customers' utility bills. The new "Clean Energy Fund" (CEF) is intended to ensure the delivery and continuity of clean energy programs for the State's energy consumers, enhance program efficiency, and manage the transition of NYSERDA's current program approaches. Specifically, the new CEF will replace the current System Benefits Charge (SBC), the Renewable Portfolio Standard (RPS), and the Energy

[1] PSC. Case 14-M-0101, Proceeding To Consider Reforming the Energy Vision, Order Commencing Proceeding. Filing Number 3. Issued April, 25, 2014.

Efficiency Portfolio Standard (EEPS) to better align with the market outcomes envisioned through the REV proceeding. The Commission tasked the New York Energy Research and Development Authority (NYSERDA) to develop a proposal for a comprehensive CEF that takes into consideration and aligns with the goals and objectives of the REV proceeding. The CEF proceeding also received a determination of significance, thus initiating a SEQRA review, to be conducted concurrently with the SEQRA REV review.

Pursuant to the requirements of SEQRA, this GEIS provides an assessment of impacts associated with both the REV and CEF proceedings. This Executive Summary provides an overview of the full report, highlighting key analytic issues and conclusions.

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 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 such agencies to balance environmental impacts with social and economic factors when deciding to approve or undertake an action. To accomplish this overarching goal, action agencies must assess the environmental significance of all actions they have discretion to approve, fund, or directly undertake, unless exempt or excluded by the SEQRA statue or regulation. If the acting regulatory agency determines that an action may have a significant adverse impact, then the agency must prepare an Environmental Impact Statement (EIS).

For proposed actions like the REV and CEF, that consist of an entire program or plan having wide application or restricting the range of possible future alternative policies or projects, 6 NYCRR §617.10 indicates that a Generic EIS (or GEIS) is the appropriate mechanism for assessing environmental impacts. A GEIS is broader and more general than a site- or project-specific EIS, providing a discussion of the potential constraints and consequences of a proposed action(s) based on the analysis of a limited number of hypothetical scenarios.

Consistent with 6 NYCRR §617.10, this GEIS considers the potential environmental impacts associated with both the REV and CEF proceedings. Impacts are assessed as a function of the potential initiatives and system changes that may occur as a result of the REV and CEF proceedings. The goals of the REV and CEF will not be achieved by one or two large actions, but by numerous individual initiatives over several years. Moreover, the REV and CEF do not prescribe the scope and scale of individual initiatives– that is, they do not establish technology-specific standards or targets. Instead, the REV and CEF are more process-oriented, focused on establishing a framework and incentive structure that will drive new investment and activities in a direction that aligns with the State’s long-term energy goals.

The overarching goal of the REV and CEF is to transform the ways in which the State generates, distributes, and manages energy and, in so doing, reduce the State’s dependence on fossil fuels, increase system reliability and resiliency, reduce harmful environmental pollution, and lower the overall costs of power across all sectors of the economy. As discussed further in **Chapter 1,** for the purposes of this GEIS, the REV and CEF seek to achieve three outcomes:

- Increased penetration of distributed energy generation technologies including solar, wind, fuel cells, hydroelectric, and various combustion technologies (including natural gas) to address peak load demand on New York's electric system;
- Increased penetration of energy efficiency technologies and demand management measures to address peak load demand on New York's electric system; and
- Modifications in regulatory practices, public expenditures, and other system characteristics that best promote the goals and objectives of the REV and CEF proceedings.[2]

Key actions contemplated under the REV include: development of a DSP, increased participation and engagement of customers, and regulatory reform that better aligns the regulatory system with current policy goals. One of the overarching goals of CEF is to manage the transition from ratepayer surcharges to more sustainable market-based clean energy activities. Actions being considered as part of the CEF include development of a framework that establishes a transparent upper limit on contributions from taxpayers; ensures a continuous and flexible source of funding for the State's clean energy programs; and ensures that low-income customers maintain access to clean energy programs.

ES.2 AFFECTED ENVIRONMENT

The REV and CEF programs are intended to transform the ways in which energy is valued, generated, distributed, managed and used across the entire energy industry. As such, the location potentially affected by the REV and CEF is the entire State of New York. **Chapter 2** of the GEIS provides a broad description of the State's current energy industry, which the REV and CEF proceedings intend to transform. **Chapter 3** describes the environmental setting that could potentially be affected, either positive or negatively, by the REV and CEF. The background information presented in **Chapters 2 and 3** provides a baseline description of the existing conditions in New York State, against which the impacts of changes in the energy industry from the REV and CEF are evaluated and compared.

ES.3 ALTERNATIVES CONSIDERED

REV and CEF, along with other regulatory changes, are enabling mechanisms that will facilitate a variety of initiatives. This GEIS addresses the full spectrum of potential impacts from these initiatives, in both quantitative and qualitative form where possible. The quantitative modeling exercise focuses on the potential consequences of alternative outcomes based on the analysis of a limited number of hypothetical scenarios. The alternatives are meant to capture a reasonable and representative spectrum of potential effects of these enabling mechanisms.

First, **Chapter 4** of this GEIS defines the No Action alternative. Defining a baseline or "no action" condition is necessary to provide a common point of reference to which each of the alternatives can be compared. For purposes of this analysis, the baseline (or No Action alternative) represents activities expected to occur in the year 2015. This year was selected as the reference year to capture New York's existing array of clean energy programs and initiatives. The overall approach to developing the baseline uses current capacities, rates of installation, and

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[2] NYSERDA RFQ 2561. NYSERDA/DPS. Request for Task Order Work Plan. July 2, 2014.

approved levels of spending to project the additional capacity of each energy resource type that will likely be developed between the time of the analysis and the end of 2015.

Next, Chapter 4 defines two hypothetical scenarios that can be compared to the baseline. Developing the two alternatives requires first identifying the outcome or outcomes that the alternatives seek to achieve. The GEIS focuses on the central vision of the REV, i.e., increasing the use and coordination of distributed energy resources. To measure this central vision, the GEIS selects system peak reduction as the basis (or metric) for constructing the two alternatives:

1. A lower bound estimate of the potential effects of the REV and CEF proceedings, targeting a three percent peak load reduction in the near-term (i.e., over five years); and
2. An upper bound estimate of the potential effects of the REV and CEF proceedings, targeting a 14 percent peak load reduction over the longer term (i.e., over ten years).

For each alternative, the GEIS then develops a portfolio of contributions across eight clean energy resources and technologies, including energy efficiency (EE), customer-sited renewable energy, combined heat and power (CHP), demand response (or load shedding), distributed fossil fuel-based generation, vehicle-to-grid (V2G), other storage technologies, and rate structures.[3] As discussed in more detail in **Chapter 4**, the estimates projected for each individual resource category are based on a variety of factors, in addition to peak reduction potential. In other words, changing the metric by which the two alternatives are constructed will not necessarily change the portfolio of technologies and approaches considered in this analysis, nor the relative quantity that each resource is likely to contribute under each scenario. This portfolio approach is designed to capture the wide range of likely actions that may occur in response to the approval and implementation of the REV and CEF proceedings.

Exhibit ES-1 summarizes the portfolio developed for each alternative, with resource contributions presented both in gross terms and relative to the forecast baseline for each resource. Resource contributions under each alternative are also expressed in terms of changes in peak demand, measured in units of megawatts (MW), as well as changes in grid-based generation, measured in megawatt-hours (MWh). While the REV and CEF will reduce peak energy demand, net impacts on energy consumption are uncertain. That is, reductions in peak demand may affect the timing, rather than overall, energy use. As discussed in Chapters 4 and 5, energy use and conservation will further vary depending on the technology installed, the location and timing of the installed technology, and in some cases, the behavioral response elicited from energy consumers.

As illustrated in **Exhibit ES-1**, EE, demand response, and customer-sited renewables are expected to make the greatest contributions towards the targeted reductions in both peak demand and grid-based generation. **Exhibit ES-1** also presents the estimated contribution of utility-scale, (or main-tier) renewable energy resources. Main-tier renewables are of a scale that limits their ability to contribute to the distributed energy objective of the REV; however, main-tier

[3] For purposes of this GEIS, the term 'clean energy' is broadly defined to include the full breadth of energy-related technologies, programs and solutions that New York State may use to achieve its energy policy objectives including, but not necessarily limited to main-tier and customer-sited renewable energy sources (e.g., hydro, solar, wind and other carbon-free solutions), energy efficiency, energy storage, smart grid, demand response, distributed generation, and low carbon technologies (e.g., CHP and co-generation).

renewables are expected to increase in response to the REV and CEF's overarching goal to increase fuel and resource diversity and reduce carbon emissions. Additional details on the methodology and data sources used to develop each alternative scenario are provided in **Section 4.3.**

The alternatives developed for the GEIS represent only two possible scenarios of how New York's energy industry may evolve over the next several years. The two alternatives considered are meant to be illustrative, not prescriptive. They do not represent the Commission or DPS' intended or preferred outcomes, nor should they be considered targets or expectations for any individual sector or entity. Because specific projects are not analyzed in this GEIS, this approach is designed to capture a broad range of outcomes to facilitate an equally broad evaluation of the potential environmental impacts of the REV and CEF proceedings.

EXHIBIT ES-1 ESTIMATED CHANGES IN PEAK DEMAND AND ENERGY GENERATION, BY ALTERNATIVE SCENARIO AND RESOURCE TYPE

	SUMMER PEAK CAPACITY (MW)					REDUCTION IN GRID-BASED GENERATION (GWH)	
		ALTERNATIVE		INCREMENTAL			
	BASELINE	LOWER	UPPER	LOWER	UPPER	LOWER	UPPER
Energy Efficiency	437	1,335	2,539	898	2,102	5,890	13,787
Customer-sited Renewables	54	171	295	116	241	156	324
Combined Heat & Power	25	81	250	56	225	397	1,588
Demand Response	1,150	1,293	2,586	143	1,437	-	-
Fossil Fuel Distributed Generation	-	-	250	-	250	-	110
Grid Integrated Vehicles	2	21	155	19	153	(2)	(17)
Storage (flywheel and battery)	102	152	227	50	126	(6)	(14)
Rate Structures	-	188	188	188	188	-	-
Total		**3,241**	**6,491**	**1,471**	**4,721**	**6,436**	**15,778**
	Reduction from Forecast			*4.1%*	*13.2%*		
Utility-scale ("Main-tier") Renewables	165	667	1,169	502	1,004		

ES.4 ENVIRONMENTAL AND ECONOMIC IMPACTS

While this GEIS is not intended to review site-specific impacts, it does provide information on the potential range of impacts that could result from the approval and implementation of the REV and CEF proceedings. For example, assuming the REV and CEF reduce the State's dependence on fossil fuels, New Yorkers will likely realize environmental benefits in the form of reduced air emissions from fossil-fuel plants that would have otherwise continued to operate (or even expand to meet forecasted increases in peak demand). Reductions in air emissions from fossil-fuel plants can, in turn, generate improvements in air quality and potentially reduce a wide range of adverse impacts on the environment and human health.

In the following sections, we summarize the potential environmental and economic impacts of the REV and CEF, as evaluated in GEIS **Chapters 4, 5, and 9**.

Emission Impacts

One of the primary changes expected from implementation of the REV and CEF is a reduction in total emissions of air pollutants resulting from fuel combustion. In some cases (e.g., EE and renewable energy systems) the resources deployed to reduce peak demand may also result in lower total energy consumption, which translates to lower emissions. In other cases (e.g., DG and energy storage), the resources may result in no emissions change, or may increase total energy consumption and emissions.

Exhibit ES-2 summarizes the estimated emissions impacts under each alternative for three key air pollutants: nitrogen oxides (NO_x), sulfur dioxide (SO_2), and carbon dioxide (CO_2). Changes in the emissions of these three pollutants are compared against a baseline inventory of statewide emissions resulting from electric generation only. Overall, emission reductions are anticipated under both the lower and upper bound alternative scenarios. Reductions in nitrogen oxide emissions are expected to range from eight to 20 percent, depending on the alternative scenario. Reductions in sulfur dioxide emissions are expected to range from six to 14 percent, while carbon dioxide emissions could fall between five and 12 percent, depending on the alternative scenario.

As expected, emissions reductions as a percentage of the baseline closely align with the estimated reductions in grid-based energy consumption. Differences are attributable to the exclusion of CHP and DG, as these resources consume fossil fuels and therefore do not reduce total emissions.

EXHIBIT ES-2 EMISSION IMPACTS, BY ALTERNATIVE

	NITROGEN OXIDES (1,000 TONS)			SULFUR DIOXIDE (1,000 TONS)			CARBON DIOXIDE (1,000 TONS)		
ALTERNATIVE	ANNUAL EMISSIONS	CHANGE FROM BASELINE	% CHANGE	ANNUAL EMISSIONS	CHANGE FROM BASELINE	% CHANGE	ANNUAL EMISSIONS	CHANGE FROM BASELINE	% CHANGE
Baseline	24.0	-	-	43.2	-	-	33,173	-	-
Lower Bound	22.0	(2.0)	(8%)	40.8	(2.4)	(6%)	31,461	(1,712)	(5%)
Upper Bound	19.3	(4.7)	(20%)	37.6	(5.6)	(13%)	29,180	(3,993)	(12%)

Note: Emissions reductions from all resources, excluding CHP, distributed generation, and utility-scale renewables Base Case from 2011 National Emissions Inventory, Electric Generation sector only.

Environmental Impacts

In evaluating the environmental impacts of the REV and CEF, the clean energy resources and technologies considered in **Chapter 5** are necessarily more diverse than the eight resource categories discussed previously in **Section ES.2**. The greater diversity of categories reflects the uncertainty surrounding the portfolio of technologies developed, and the extent to which each technology will be used (or activated), in response to the REV and CEF.

The evaluation of environmental impacts in this GEIS is largely qualitative. That is, a quantitative assessment of the potential environmental impacts would require large amounts of information not readily available, such as information on the type and amount of installed capacity, the location and timing of such development, as well as information on how such changes will affect other parts of the State's energy industry (e.g., fossil-fuel based energy generation).

The qualitative assessment presented in **Chapter 5** focuses on two types of effects: direct and indirect, where **direct effects** are defined as effects occurring at the same time and in the same place as the action itself and i**ndirect effects** are those occurring later in time and farther away, but which are still reasonably foreseeable. Direct effects represent the expected results of increasing the use of each resource and technology on an individual basis. In other words, and for example, the analysis considers the question what are the potential environmental impacts of an increase in the installed capacity of solar PV or wind energy? As expected, the type and potential magnitude of environmental impacts varies across the different types of clean energy resources and technologies that may be employed under the REV and CEF. In addition to factors such as the type of technology, fuel source (e.g., renewable or fossil-fuel), and project location, environmental impacts are further complicated because the impacts can also differ depending on the relative difference between that resource and the fossil-fuel based energy technologies that the resource displaces. The potential environmental impacts of each resource and technology, and the unique challenges posed by different types of technologies and fuel sources, is discussed in greater detail in **Section 5.2**.

Chapter 5 also considers the indirect effects anticipated from the REV and CEF. As discussed in **Section 5.3**, the primary indirect impact of the increasing clean energy resources and technologies is the gradual displacement of fossil fuel-based energy generation. The environmental impact of a reduction in the use of fossil-fuel based energy generation on the human environment is generally positive, but will evolve over long periods of time in response to numerous separate individual initiatives.

Economic Impacts

Specific projects resulting from the REV and CEF programs have yet been proposed. Thus, the GEIS does not attempt to predict or speculate on the possible impacts of project-specific actions but focuses instead on qualitative descriptions of overall potential economic impacts, including both benefits and costs, as discussed in **Sections 9.2 and 9.3,** respectively.

Potential Benefits Categories

The successful implementation of the REV and CEF programs will generate a wide array of public benefits. **Exhibit ES-3** provides an overview of potential types of benefits from the REV program.

EXHIBIT ES-3 SUMMARY OF POTENTIAL BENEFIT CATEGORIES TO BE CONSIDERED IN THE REV PROGRAM

BENEFIT CATEGORY	PERSPECTIVE		
	RATE IMPACT MEASURES (RATES)	UTILITY COST (BILL)	SOCIETAL
Bulk System			
Avoided Generation Capacity (Installed Capacity Market (ICAP)) Costs, including Installed Reserves and Losses	✓	✓	✓
Avoided Energy (Location-based marginal price (LBMP)) Costs, including Losses	✓	✓	✓

BENEFIT CATEGORY	PERSPECTIVE		
	RATE IMPACT MEASURES (RATES)	UTILITY COST (BILL)	SOCIETAL
Avoided Ancillary Services (e.g. operating reserves, regulation, etc.)	✓	✓	✓
Wholesale Market Price Impacts	✓	✓	
Distribution System			
Avoided T&D Capacity Costs	✓	✓	✓
Avoided O&M Costs	✓	✓	✓
Avoided Distribution Losses	✓	✓	✓
Reliability/Resiliency			
Avoided Restoration Costs	✓	✓	✓
Avoided Outage Costs*			✓
External (net)*			
Avoided GHG*			✓
Avoided Criteria Air Pollutants*			✓
Water*			✓
Land*			✓
Non-Energy Benefits (e.g. health impacts, employee productivity, property values)			✓

*Note: only the portion not already included above, net of any added external costs.
Source: DPS. 2014. Case 14-M-0101 – Proceeding on the Motion of the Commission in Regard to Reforming the Energy Vision. Developing the REV Market in New York: DPS Staff Straw Proposal on Track One Issues. August 22, 2014. Page 46.

The following examples indicate the potential scale of benefits that could result from the REV:[4]

- Increasing system efficiency such that if the 100 hours of greatest peak demand were flattened, long-term avoided capacity and energy savings would range between $1 billion and $2 billion per year.
- Merely increasing the system load factor from 55% to 56% would produce potential gross benefits of $220 million to $330 million per year.
- Increasing fuel diversity will make customers less vulnerable to price spikes; the estimated total cost to New York customers from the gas-driven price spikes of the winter of 2013-2014 was over $1.0 billion.
- Carbon emissions reductions if valued at $50 per ton, for example, would provide an annual carbon value of New York's Renewable Portfolio Standard that would exceed $127 million.

[4] DPS. Case 14-M-0101. Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision. Developing the REV Market in New York: DPS Staff Straw Proposal on Track One Issues. Filed August 22, 2014. Figures have been slightly revised to reflect most recent results of Staff's studies.

In addition, **Exhibit ES-4** illustrates potential lifetime benefits from the CEF program.[5]

EXHIBIT ES-4 EXAMPLES OF POTENTIAL BENEFITS RESULTING FROM THE CEF PROGRAM 2016-2025

LIFETIME BENEFITS					
	ELECTRIC SAVINGS (MILLION MWH)	RENEWABLE ENERGY PRODUCTION (MILLION MWH)	OIL/GAS SAVINGS (MILLION	EMISSIONS REDUCED (MILLION TONS	ELECTRIC BILL SAVINGS (MILLION $)
Market Development	180	15-20	620	45	$3,400
NY-Sun		35-40		10	$600
Total	**180**	**55**	**620**	**55**	**$4,000**
Source: NYSERDA. 2014. Clean Energy Fund Proposal. September 23.					

Potential Cost Categories

Various costs are expected to be incurred in order to achieve the benefits of the REV and CEF. **Exhibit ES-5** provides an overview of potential types of costs resulting from the REV program, as well as the perspective by which these costs should be considered.

EXHIBIT ES-5 GENERIC POTENTIAL COST CATEGORIES - REV PROGRAM

	PERSPECTIVE		
COSTS	RATE IMPACT MEASURE (RATES)	UTILITY COST (BILL)	SOCIETAL
Program administrative costs (including M&V)	✓	✓	✓
Added Ancillary Service Costs	✓	✓	✓
Incremental T/D/DSP Costs (Including Incremental Metering and Communication)	✓	✓	✓
Participant DER Cost			✓
“Lost” Utility Revenues	✓		
Incentives	✓	✓	
Non-Energy Costs (e.g. indoor emissions, noise disturbance)			✓
Source: DPS. 2014. Case 14-M-0101 – Proceeding on the Motion of the Commission in Regard to Reforming the Energy Vision. Developing the REV Market in New York: DPS Staff Straw Proposal on Track One Issues. Issued August 22, 2014. Page 46.			

In addition, anticipated expenditures for CEF over the period from 2016 – 2025 total $5.9 billion. This figure includes $1.6 billion of previously approved program expenditures, $1.5 billion for already launched initiatives, and $2.8 billion for new NYSERDA programs (see **Section 9.3** for details).

[5] Note that the benefits cited in Exhibit ES-5 may not align specifically with the emissions reductions forecast in Chapter 4. This is due to the fact that the alternatives discussed in Chapter 4 are focused solely on a reduction in peak demand, whereas Exhibit ES-5 presents lifetime benefits of the Market Development and NY-Sun programs under the CEF.

Cumulative Impacts

The REV and CEF are part of, and related to, other ongoing State energy initiatives, including: (1) the draft 2014 New York State Energy Plan, (2) the New York Energy Highway Blueprint, (3) the RPS (Case 03-E-0118), (4) the EEPS (Case 07-M-0548), (5) the T&MD Portfolio (Case 10-M-0457), and (6) the New York Green Bank (Case 13-M-0412). A number of additional initiatives at the federal level are designed to reduce the adverse economic, social and environmental impacts of fossil fuel energy resources by increasing the use of cleaner energy technologies. **Exhibit ES-6** summarizes past, present and reasonably foreseeable future actions that are likely to interact with the CEF and REV.

As discussed further in **Chapters 4 and 5**, the REV and CEF are anticipated to yield overall positive environmental impacts, primarily by reducing the State's use of, and dependence on, fossil fuels, among other benefits. In general, the State and Federal policies and initiatives identified in **Exhibit ES-6** as likely to interact with the REV and CEF proceedings 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.

EXHIBIT ES-6 SUMMARY OF PAST, PRESENT AND REASONABLY FORESEEABLE FUTURE ACTIONS THAT INTERACT WITH THE PROPOSED REV AND CEF PROCEEDINGS

	PAST	PRESENT/NEAR-TERM
STATE/REGIONAL	• Office Petroleum Overcharge Restitution Fund • 1988 System Benefit Charge • New York Energy $mart Program • Electricity Restructuring • Revenue Decoupling • Energy Efficiency Portfolio Standards (EEPS) • Renewable Portfolio Standard (RPS) • Climate Action Council	• New York State Energy Plan • Regional Greenhouse Gas Initiative (RGGI) • Executive Order 24 (Goals and Climate Action Plan) • Energy Efficiency Portfolio Standards (EEPS) • Renewable Portfolio Standard (RPS) • Technology and Market Development Program • NY-Sun Initiative • Green Bank • NY Energy Highway • Climate Smart Communities • Smart Growth Public Infrastructure Policy Act • Transportation and Climate Initiative • ReCharge NY; Charge NY • Five Cities Energy Master Plans • Build Smart NY; ReBuild NY • Cleaner Greener Communities
FEDERAL	• Energy Policy Act (1992, 2005, 2007) • Kyoto Protocol • Energy Independence and Security Act of 2007 • Emergency Economic Stabilization Act of 2008 • Production, Investment ,and Advanced Energy Manufacturing Tax Credits	• President's Climate Action Plan • CAA Section 111(d) Clean Power Plan • EPA Greenhouse Gas Reporting Rule • Renewable Fuel Standard (RFS) • EPA Energy Star • Executive Order 13653: Preparing the U.S. for the Impacts of Climate Change • NESHAP and NSPS for Stationary Internal Combustion Engines

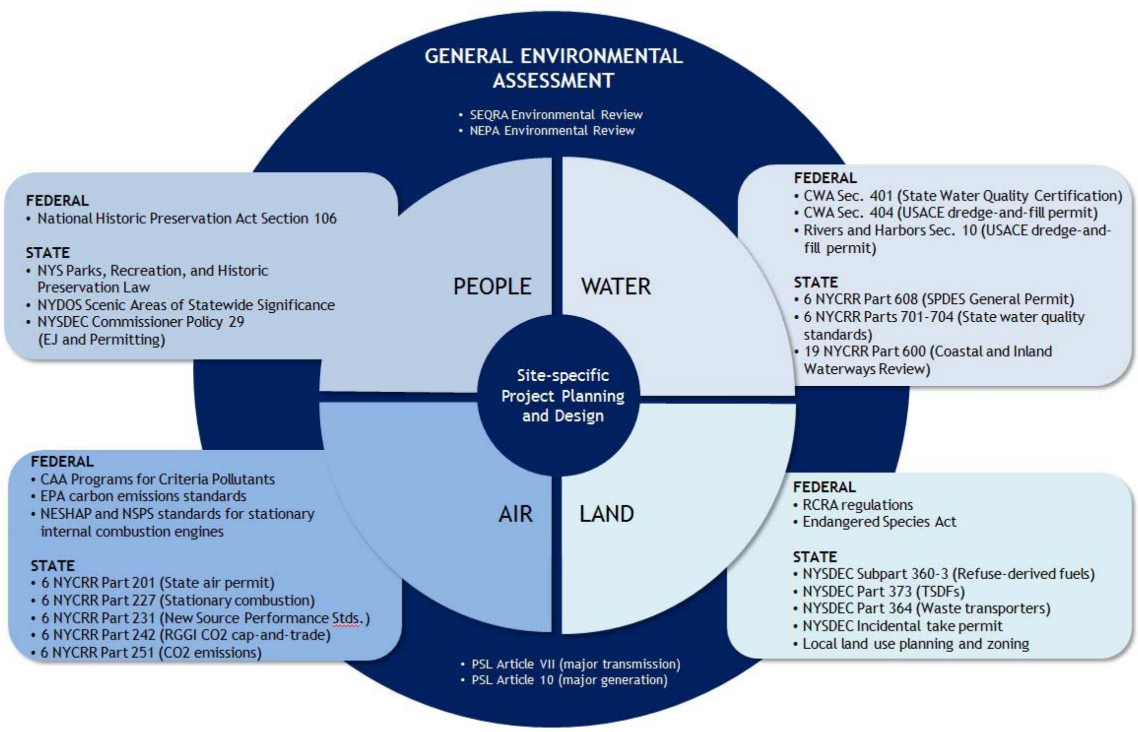
Cumulative site-specific impacts of REV and CEF are not known at this time and are beyond the scope of this GEIS. This GEIS provides a generic description of the potential environmental impacts of the REV/CEF portfolio of initiatives on land and water resources, agriculture, cultural and aesthetic resources, 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.

ES.5 MITIGATION OF POTENTIAL ADVERSE IMPACTS

A variety of measures are available to mitigate (i.e., minimize or avoid) potentially adverse environmental impacts that may result from clean energy activities implemented in response to the REV and CEF proceedings. One key mitigation measure is compliance with existing Federal and state regulations, which are specifically designed to protect human health and the environment from activities that could otherwise result in significant and/or adverse impacts. **Exhibit ES-7** summarizes potentially applicable permits and regulations, by resource area and type of review. **Chapter 6** provides a more detailed overview of the potentially applicable Federal and state regulations for key resource areas that may be affected by REV- and CEF-related activities.

For actions (or impacts) that fall outside the scope of existing federal, State, and local regulatory review, permitting and licensing programs, proper project planning, design and siting, and application of best management practices during all project phases will serve to mitigate adverse environmental impacts. As discussed in **Chapters 7 and 8,** because the REV and CEF do not entail implementation of actual projects, no unavoidable or irretrievable resource losses are likely to occur.

EXHIBIT ES-7 SUMMARY OF POTENTIALLY APPLICABLE REGULATIONS



ES.6 GROWTH INDUCING ASPECTS

Energy infrastructure investments and policy changes related to the REV and CEF are expected to provide incentives for developing distributed energy resources (DER) and renewable energy projects. These projects would, in turn, induce growth. Because information is not available on the types of and locations for future development actions, the magnitude of these growth inducing effects is difficult to quantify.

CHAPTER 1 | SEQRA AND DESCRIPTION OF THE PROPOSED ACTION

In recent years, New York has made significant strides toward building a more cost-effective and clean energy economy. New York State, for example, is among the most progressive states in terms of electricity restructuring and public policy. Development and expansion of renewable energy sources continues to grow. In this context, Long Island currently houses one of the fastest-growing residential solar photovoltaic (PV) markets in the U.S. In addition, New York State is the largest hydroelectric power producer east of the Rocky Mountains.[6] According to the U.S. Energy Information Administration (EIA), renewable energy resources accounted for 23 percent of the State's electricity generation in 2013.[7]

The State, however, faces persistent and significant energy challenges. For example, while the State's per capita energy consumption remains relatively low (second lowest in the U.S. in 2012), as of May 2014, New York had the second highest average electricity prices in the U.S. at 20.62 cents/kilowatt-hour(kWh).[8,] In addition, peak electricity demand continues to increase at a faster rate than the amount of power used on a daily basis.[9] To illustrate, in 2013, the State set two new seasonal records for peak electric load within a span of only six months.[10] Hurricane Sandy in 2012 further stressed the State's existing energy system, generating widespread power outages throughout the State.[11]

In response to these challenges, the Commission, DPS and NYSERDA have initiated multiple efforts over the last year with the overarching goal of transforming the State's existing energy paradigm. In support of these efforts, the Commission and DPS introduced two initiatives in May of 2014:

- Case 14-M-0101: REV; and
- Case 14-M-0094: CEF.

Among the goals of the REV and CEF is to develop new strategies to achieve a cleaner energy economy through greater use of distributed energy resources (DER) and increased customer

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[6] 2014 Draft New York State Energy Plan, New York State Energy Planning Board, January 7, 2014. Accessed September 1, 2014 at: http://energyplan.ny.gov/.

[7] EIA. New York State Profile and Energy Estimates. Accessed August 14, 2014 at: http://www.eia.gov/state/?sid=NY.

[8] *Ibid.*

[9] Electric Light & Power. "NYISO says peak load is outpacing electricity demand." June 17, 2014. Accessed August 14, 2014 at: http://www.elp.com/articles/2014/06/nyiso-says-peak-load-is-outpacing-electricity-demand.html.

[10] NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

[11] *Ibid.*

participation. Through the REV and CEF, New York would move closer to its long-term objectives of providing clean, reliable, and affordable power; creating jobs; and producing the other economic and environmental benefits that flow from a clean energy economy.[12] The REV, complemented by the CEF, is intended to create a new framework that enables sustainable growth, balancing the need to harness proven technologies with the flexibility to adapt to future insights and innovation.[13]

This chapter is organized into five parts. Section 1.1 describes the purpose of New York's SEQRA and the requirement to prepare a Generic Environmental Impact Statement for an action or plan having a state-wide application that may direct or restrict future policies or projects in order to assess future environmental impacts in a broad and at times conceptual context where specific actions of projects are yet to be proposed or considered for development. This will help identify important elements of the natural resource baseline as well as other existing and, where practical, projected environmental features and patterns. Sections 1.2 and 1.3 provide an overview of the public need, purpose, and actions proposed under the REV and CEF, respectively. Section 1.4 provides a summary of the public benefits anticipated from the successful implementation of the REV and CEF programs. This chapter concludes with a brief overview of the other energy programs that are intertwined with the REV and CEF programs.

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 all State and local government agencies to balance environmental impacts with social and economic factors when deciding to approve or undertake an action. To accomplish this overarching goal, agencies are required to assess the environmental significance of all actions they have discretion to approve, fund, or directly undertake, unless exempt or excluded by the SEQRA statue or regulation. If the regulatory agency determines that an action may have a significant adverse impact, then the agency must prepare an EIS.

Preparation of a Generic Environmental Impact Statement

The first analytic step in the SEQRA process is to complete an Environmental Assessment Form (EAF). The EAF is designed to assist State and local agencies in determining the environmental significance of an action based on an assessment of the proposed action, project location,

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[12] *Ibid*.

[13] *Ibid*.

purpose, potential outcomes, and potential impacts on the environment. Depending on this assessment, the acting agency then makes either a positive or negative declaration regarding the significance of the action. Negative declarations indicate that the proposed action would not have a significant adverse impact on the environment; positive declarations indicate the potential for significant adverse impacts that thereby require additional analysis and development of an EIS.

The Commission completed an EAF for the REV initiative on April 23, 2014 and for the CEF initiative on April 29, 2014. Based on the assessments contained therein, the Commission issued a "positive" declaration that one or more potentially significant environmental impacts may result from the implementation of the REV and CEF programs. Thus, the agency is required to develop an EIS. Specifically, the New York Codes, Rules and Regulations (NYCRR), 6 NYCRR §617.2(n) defines an EIS as:

> "… a written 'draft' or 'final' document … [that enables] agencies, project sponsors and the public to systematically consider significant adverse environmental impacts [of a proposed action], alternatives and mitigation. An EIS facilitates the weighing of social, economic and environmental factors early in the planning and decision-making process."

EXHIBIT 1-1 EIS CONTENT

6 NYCRR §617.9(b) requires that draft and final EIS' address the following elements:

(i) a concise description of the proposed action, its purpose, public need and benefits, including social and economic considerations;

(ii) a concise description of the environmental setting of the areas to be affected, sufficient to understand the impacts of the proposed action and alternatives;

(iii) a statement and evaluation of the potential significant adverse environmental impacts at a level of detail that reflects the severity of the impacts and the reasonable likelihood of their occurrence.

(iv) a description of the mitigation measures;

(v) a description and evaluation of the range of reasonable alternatives to the action that are feasible;

(vi) whether the action in the coastal area is consistent with applicable coastal policies and/or local program policies;

(vii) whether the action within a heritage or urban cultural park is consistent with approved plans; and,

(viii) a list of any underlying studies, reports, EISs and other information obtained and considered in preparing the statement including the final written scope.

For proposed actions like the REV and CEF, which consist of an entire program or plan having wide application or restricting the range of possible future alternative policies or projects, 6 NYCRR §617.10 indicates that a Generic EIS (or GEIS) is the appropriate mechanism for assessing environmental impacts. A GEIS is broader and more general than a site- or project-specific EIS, providing a discussion of the potential constraints and consequences of a proposed action(s) based on the analysis of a limited number of hypothetical scenarios.

Public Comment and Final GEIS

Under 6 NYCRR §617.9(a)(3), once a draft EIS is accepted as complete, the analysis must be made available to the public for review and comment for a minimum of 30 days. The lead agency must consider the comments submitted and prepare a final GEIS, taking into consideration the comments and information provided.

1.2 REFORMING THE ENERGY VISION[14]

Consistent with 6 NYCRR §617.9(b)(5)(1), this section provides a concise description of: (1) the purpose and need of the REV, and (2) the actions proposed to achieve REV goals. The framework and mechanisms under which the goals of the REV would be achieved are still under development. There are 259 parties engaged in the REV proceeding, with activities coordinated under the leadership of two Administrative Law Judges.[15] Accordingly, this section is not intended to be an exhaustive or definitive discussion of the REV, but rather a targeted discussion of the REV for the purposes of the GEIS, as required under SEQRA. Additional detail on the design of the REV and the policy issues under consideration are documented in DPS staff reports and proposals, working group findings, and public comments, all available on DPS's Document and Matter Management (DMM) System.[16]

REV Background, Need and Purpose[17]

In initiating the REV, DPS highlighted a number of challenges facing New York's energy system, including but not necessarily limited to:

- The State's electricity infrastructure is aging; capital investment needed in New York over the next ten years is estimated at $30 billion;[18,19]
- The modern economy is increasingly dependent on electricity; the power needs of the digital economy increase the need for reliability and resilience in the power supply. The economic costs of outages due to extreme weather events grow each day;
- Minimal load growth, projected to be 0.16 percent per year through 2024;

[14] DPS. Case 14-M-0101: Reforming The Energy Vision – NYS Department of Public Service Staff Report and Proposal. April 24, 2014.

[15] The procedural framework outlined here is subject to revision, at the discretion of the administrative law judge and/or the Secretary, consistent with the overarching goal of acting on the principal policy issues in a timely manner.

[16] NYSPSC. Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision. Document and Matter Management System. Accessed September 1, 2014 at: http://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterCaseNo=14-m-0101&submit=Search+by+Case+Number.

[17] DPS. Case 14-M-0101: Reforming The Energy Vision – NYS Department of Public Service Staff Report and Proposal. April 24, 2014. Also see DPS. Case 14-M-0101. Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision. Developing the REV Market in New York: DPS Staff Straw Proposal on Track One Issues. Filed August 22, 2014.

[18] For example, 14,000 MW of non-hydro generation facilities are over 40 years old.

[19] This estimated capital investment does not include NYPA and LIPA transmission and distribution infrastructure.

- Increasing peak loads growing at an estimated 0.83 percent per year, resulting in declining system efficiency as measured by load factors;[20]
- The sales base for utilities is relatively flat while peak demand continues to grow;
- Electric systems are vulnerable to both cyber and physical attacks;
- Technology developments in DER and information systems challenge incumbent systems;
- Heavy dependence on natural gas for electricity generation has increased system vulnerability and price volatility at peak times; and[21, 22]
- The need to reduce carbon emissions and the associated costs and threats to infrastructure posed by increasingly severe climate events.

In response to these challenges, in its order issued December 26, 2013 in Case 07-M-0548 (*Program Changes to the Energy Efficiency Portfolio Standard*), the PSC announced a fundamental reconsideration of New York State's regulatory paradigms and markets concerning the electric power system, calling for a re-examination of how the State's policy objectives are served both by clean energy programs and by the regulation of electric utilities. Immediately following the December 26, 2013 EEPS Order, on January 7, 2014, the New York State Energy Planning Board released a draft of the 2014 State Energy Plan. Among other initiatives, the draft 2014 State Energy Plan calls on the Commission to:

> "Enable and facilitate new energy business models for utilities, energy service companies, and customers to be compensated for activities that contribute to grid efficiency. Maximize the cost effective utilization of all behind the meter resources that can reduce the need for new infrastructure though expanded demand management, energy efficiency, clean distributed generation, and storage."

In response to, and building on Case 07-M-0548 and the draft 2014 State Energy Plan, the Commission initiated Case 14-M-0101, *Reforming the Energy Vision* (REV) on April 24, 2014. In the Order initiating this proceeding, the Commission identified six objectives for the REV initiative:

[20] Potomac Economics. 2013 State of the Market Report for the New York ISO Markets. May 2014. Accessed September 18, 2014 at: https://www.potomaceconomics.com/uploads/nyiso_reports/NYISO_2013_SOM_Report.pdf. See also: NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

[21] For example, natural gas generation increased by 96 percent between 2004 and 2012. See, NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

[22] For example, the extreme cold brought on by the Polar Vortex in 2014 illustrates the inherent risks in price volatility associated with increased dependence on natural gas. During this period, many residential customers with average usage levels saw their winter electric bills increase by over 80 percent. See, NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

- Enhanced customer knowledge and tools that will support effective management of their total energy bill;
- Market animation and leverage of ratepayer contributions;
- System-wide efficiency;
- Fuel and resource diversity;
- System reliability and resiliency; and,
- Reduction of carbon emissions.

More broadly, REV seeks to rethink two key principles that have governed energy over the last hundred years: that demand is inelastic and that centralized energy generation is the most economic approach for producing power due to economies of scale. These assumptions have created an energy system that is designed and driven by short periods of peak electricity demand (e.g., hours per year). In New York, peak demand tends to be approximately 75 percent higher than the average load. For that reason, much of New York's energy system is underutilized most of the time. Moreover, approximately nine percent of generated power is lost because it has to travel long distances over transmission and distribution lines. In New York, the total rate of system utilization is under 60 percent.[23]

Historically, this approach worked, but was in part a reflection of a lack of feasible technologies that would allow greater control and management of energy demand (e.g., telecommunications, industrial and building system controls, distributed generation, energy efficiency, large-scale energy storage, etc.). Today, significant advancements in energy-related technologies offer new opportunities for transforming the State's energy system. The REV is intended to capitalize on these technological advancements, and create a market-based, customer-oriented system that may in-turn drive the development of an increasingly efficient, clean, and reliable energy industry. If successful, the REV would shift the energy market from one characterized by large, discrete, slow supply resources with limited dispatch capability, to a market that values a large number of fast responding, smaller resources.

As a result of the efforts of the Commission, NYSERDA, the New York Independent System Operator, Inc. (NYISO), utilities, Energy Service Companies (ESCOs), and others, many distributed energy resources exist today. The development of these resources has been fostered by programs and tariffs including the RPS, the EEPS, various NYISO and utility demand response programs, and other State policies such as net metering. To fully achieve the goals of the REV initiative, however, additional resources and better utilization of existing resources is needed.

The ideas introduced through the EEPS, State Energy Plan and REV, are not unique to New York, nor are they driven exclusively by the Commission's initiatives. Consideration of new utility business models is occurring on a national basis, among a wide range of industry participants. New York may, however, be particularly well-situated to provide leadership; in recent years New York has undertaken a number of measures that lay the foundation for a new utility business model. Additionally, the NYISO operates in a single state, providing an

[23] By conventional standards in the utility industry, this is a normal system utilization rate, considered tolerable and required in order to meet the State's highest peak demand anticipated.

organizational framework that positions the State to more easily integrate DER with the State's traditional wholesale markets.

REV Proposed Actions

For the purposes of this GEIS, the REV seeks to achieve the following three outcomes:

- Increased penetration of distributed energy generation technologies including solar, wind, fuel cells, hydroelectric, and various combustion technologies (including natural gas) to address peak load demand on New York's electric system;
- Increased penetration of energy efficiency technologies and demand management measures to address peak load demand on New York's electric system; and,
- Modifications in regulatory practices that best promote the goals and objectives of the REV and CEF proceedings.[24]

The following sections provide an overview of key actions contemplated under the REV, organized across three key areas, which include:

- Distributed System Platform;[25]
- Customer Participation; and,
- Regulatory Reform.

Distributed System Platform

A central pillar of the REV is a new business model in which DER becomes a primary tool in energy planning and operations, empowering customers to optimize their priorities based on reliability, cost, and sustainability.[26] Key to achieving this model is the concept of a DSP. In the July 2014 DPS Staff Report, the DSP is described as a flexible platform where a Distributed System Platform Provider (DSPP) actively manages and coordinates with customers, bulk markets, and regulators in order to:

- Foster the development of new energy products and services;
- Improve overall system efficiency;
- Increase the use and coordination of DER; and,
- Allow customers to manage their usage and reduce energy bills.

REV Working Group 2 developed a working definition of the DSPP as one that:

> "[O]perates an intelligent network platform that will provide safe, reliable and efficient electric services by integrating diverse resources to meet customers' and society's evolving needs. The DSPP fosters broad market activity by enabling

[24] NYSERDA RFQ 2561. NYSERDA/DPS. Request for Task Order Work Plan. July 2, 2014.

[25] Throughout this report, DSP is intended to refer to both the platform function and the platform entity (i.e., the Distributed System Platform Provider, or DSPP).

[26] Throughout this document DER is used to describe the array of DER, including end-use energy efficiency, demand response, distributed storage, and distributed generation (e.g., solar, wind, combined heat and power).

> active customer and third party engagement that is aligned with the wholesale market and bulk power system."[27]

As the entities that planned, designed, built, and operate existing distribution systems, incumbent utilities have the institutional knowledge and experience required to perform the proposed DSPP functions and tasks. Under the DSP model, the REV intends to expand the role of distribution utilities from one of physical delivery to the manager of a complex system. Areas of responsibility envisioned for the DSPP include:

- **DER Integration**. Accommodate and integrate a variety of DER, including customer sited generation, intermittent generation resources, energy storage technologies, and demand response resources, to address load growth, bolster system-wide resiliency during widespread outages, as well as improve local reliability in currently grid-constrained areas.

  Under the REV, the use of energy efficiency would be modified. Rather than a specific program funded through a system surcharge, efficiency would be used as one of the DER tools at a utility's disposal, and efficiency expenditures would be treated like any other part of the utility's revenue requirement.

- **Advanced Distribution Management Systems**. The REV envisions that DSPPs would balance demand and supply at the distribution system level. To facilitate this load balancing, DSPPs would need to procure and employ advanced distribution management systems that will enable them to analyze and forecast load and then dispatch resources to meet customer needs and balance distribution networks in real time.

  Advanced management of distribution systems would be utility-specific, reflect current conditions, anticipated or planned system upgrades, customer needs, as well as the regulatory and policy environment within which these changes would take place.

- **Communication Infrastructure**. Develop energy delivery communications systems that are scalable, interoperable, and upgradable. DSPPs would need to interface with multiple existing distribution utility systems, as well as external customer-based systems such as building management systems. Such systems must have the ability to handle vast amounts of data collected from distribution systems and customer-sited DER. To achieve such interoperability, distribution systems would also need to be modernized through the use of "smart grid" technologies, such as remote sensors and remote monitoring and control devices.

- **Products and Services**. Create opportunities for new products and services that benefit the grid and can be transacted within the grid. REV Working Group 1 viewed products and services from two perspectives: (1) products or services the DSPP would procure to benefit the distribution system and/or achieve public policy requirements or objectives; and, (2) products or services that would be procured by and among energy customers,

[27] DPS. Reforming the Energy Vision (REV) Working Group 2. Platform Technology Working Group. June 4, 2014. DSPP Framework (working draft). Accessed September 18, 2014 at: http://www3.dps.ny.gov/W/PSCWeb.nsf/All/C2E08D286B89876185257CDF005C90C2?OpenDocument.

DER providers, ESCOs and other third parties.[28, 29] A host of products and services are already available to customers from DER providers, ESCOs, and others. Many of the products and services focus on the needs and desires of commercial and industrial customers, such as energy efficiency, load management, demand response, behind the meter generation, and micro-grid applications. Some of these products and services are also available to other types of customers, but with lesser penetration. Most of these products and services, and as well as others identified by Committee members, could be sold to customers, either by the DSPP, DER providers, ESCOs, third party providers, and possibly other customers, under the appropriate circumstances.

Attachment 3 to the Market Committee's final report dated July 8, 2014 includes a matrix of products and services, their potential benefits, and examples of the technologies capable of providing each product or service.[30] Specifically, the Market Committee identified four categories of products and services:

(a) Products that affect the base load or delivery of energy;

(b) Products that affect peak loads or capacity;

(c) Grid services that affect the operation of the distribution grid; and,

(d) Products and services for emergency situations and planning purposes.

Attachment 4 to the same report summarizes the various potential products and services and identifies the nature of the potential transactions, the potential parties who would be engaged in providing the product or service, and the parties who may be interested in purchasing the product or service. Potential products and services are categorized as delivery services, pricing/billing transaction services, metering/information services, DER services, and energy storage (e.g., thermal/ice storage and batteries).

Over time, other products and services, not yet identifiable, may be developed based on customer needs and wants (similar to the evolution of products and services in the telecommunications industry).

- **Pricing**. Establish a framework (e.g., markets, tariffs, and operational systems) that defines the benefits and costs of products and services in ways that would support monetization (or pricing). Prices should reflect the various benefits provided by products and services, such as system reliability and resilience, economic benefits, public policy, and other benefits.

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[28] With respect to the second perspective of products and services, the REV Working Group 1 notes that not all transactions would necessarily involve the DSPP or be solely for the benefit of the distribution system.

[29] While ESCOs already provide a number of value added services to large majority of large, non-residential customers, such as demand response and load management; little evidence exists that ESCOs offer the same array of energy-related value-added services to small commercial or residential customers. The REV, in coordination with Case 12-M-0476, is intended to create opportunities for ESCOs to expand their services beyond reselling energy commodities and instead offer a wider range of energy-related value-added services to all customers.

[30] Technology examples include distributed generation, energy storage, energy efficiency, smart inverters, capacitor banks, remote sensing, meters, flexible AC transmission systems (FACTS), EV Charging Stations, microgrids, and energy monitoring and management.

Customer Participation

Trends driving the REV initiative offer a new perspective on customers as active partners in addressing the challenges and opportunities of a modern electric grid. To achieve widespread deployment of DER, customer interests must align with and complement the roles of utilities and other market participants.

A strategy for engaging customers would consist of three components: products, information, and enabling technology. DSPPs and other market participants must offer products to customers, the values of which would include both price and non-price factors. Customer awareness is a key ingredient that lays the foundation for increased utilization of these resources. Customers currently lack access to information on the factors that contribute to energy consumption. Customers need to be informed on the various elements of their energy consumption and how, and to what extent, they can control costs by managing consumption. This information needs to be in a usable format, providing customers with an understanding of the value of the information and access to goods, services, and technologies that empower (or enable) customers to extract value from the data provided. Enabling technology must further make customer participation both convenient and financially transparent.

Expanded access to customer-specific energy usage data is of particular importance in designing innovative energy management services. A tremendous amount of data will be generated through the modernized grid in addition to the types of customer data that already exist. The recently initiated phase of Case 12-M-0476 will explore best practices related to data ownership, data interchange, and rules for third-party data access, incorporating appropriate consumer privacy protections, as well as whether and how statewide policies should be developed.[31]

Regulatory Reform

Designing a new DSPP model for utilities necessitates reconsidering the regulatory and ratemaking practices under which such utilities operate and the incentives and disincentives implicit in the existing regulatory construct. The December 2013 EEPS Order stated,

> "the time has arrived for a fundamental refocus of, not only the system benefit programs, but also comprehensive consideration of how our regulatory paradigm and the retail and wholesale market designs either effectuate or impede progress of our policy objectives underlying these programs."[32]

The Order specifically requested that the scope of the new proceeding address changes regarding the current regulatory, tariff, and market design and incentive structures with the goal of aligning such frameworks with the State's energy policy objectives.[33] The EEPS Order further recognized that "all regulation is incentive regulation" and ratemaking approaches "reward some patterns of behavior and deter others." The current regulatory framework does not provide proper and

[31] DPS. Case 12-M-0476. Proceeding on Motion of the Commission to Assess Certain Aspects of the Residential and Small Non-residential Retail Energy Markets in New York State.

[32] DPS. Case 07-M-0548 – Proceeding on Motion of the Commission Regarding and Energy Efficiency Portfolio Standard. Order Approving EEPS Changes. State of New York Public Service Commission. Issued and Effective December 26, 2013.

[33] *Ibid.*

sufficient price signals to motivate and empower market participants and customers, and lacks incentives for utilities to improve performance. As part of the REV, the Commission will need to consider regulatory reforms across the State's energy industry that will promote and facilitate the REV policy goals.

Traditional electric rate design is based on the embedded cost to serve each customer class with the assumption that the peak demands of the class drive the costs. Rate design changes would be necessary to allow for new pricing models and new methods of cost allocation for the products and services to be bought and sold by electric utilities. New approaches to rate design would need to recognize the two-way transactive grid envisioned under REV.

The DSPPs would be purchasers, aggregators, and sellers of products and services. For each product or service, it is necessary to determine the best basis used to determine the price – market, tariff, or contract. That determination will affect the rate design to be employed. Rates should provide dynamic price signals that reflect system needs and costs over short and long term horizons. This approach will allow customers to align investments in DER in the most economic and efficient manner. Certain products and services can be provided competitively and their prices should be market-based with revenues accruing, at least in part, to utility earnings. Other products and services that are natural monopolies should be tariff-based.

Additional examples of contemplated changes to the State's regulatory and ratemaking framework include:

- Changes in time-varying retail rate designs to provide effective and appropriate price signals;
- Time of use rates (voluntary for smaller customers) to encourage off-peak usage;
- Rates and tariffs to recognize and provide for the value that innovative technology and business models can provide to the grid and its customers;
- Implementation of long-term rate plans to incentivize better planning, more certainty, and fewer rate cases;
- Outcome-based ratemaking which shifts the focus of regulation from the reasonableness of historically incurred costs to the pursuit of long-term customer value;
- Ratemaking that includes symmetrical incentives that would reward utilities with additional earnings if the utility achieves superior results in areas such as innovation and customer service;
- Ratemaking approaches to encourage and reward efficient allocations between capital and operating expenses;
- Alignment of wholesale and retail market rules relating to demand response aggregation, program eligibility, product valuation, payment protocols, communications technology and procedures, and measurement and verification methodologies;
- Policies and procedures that protect against risks of double payments, inconsistent incentives for peak load reduction, and programmatic inefficiencies caused by conflicting policy objectives and market rules;
- Rate designs to reflect: the value of grid service to consumers with DER, the value of grid service to consumers without DER, and the value that DER can provide to the grid; and,

- Payment structures for DER to reflect the value based on timing, location, flexibility, predictability and controllability of the resource.

1.3 CLEAN ENERGY FUND[34]

Consistent with 6 NYCRR §617.9(b)(5)(1), this section provides a concise description of: (1) the need and purpose of the CEF, and (2) the actions proposed to achieve CEF goals.

CEF Background, Need and Purpose

In this section we provide a brief history of New York's clean energy programs and the State's recent efforts to shift its clean energy programs from one funded by customer surcharges to a program which aligns with the market outcomes envisioned through the REV proceeding.

History of New York's Surcharge-Funded Clean Energy Programs

Following the opening of electricity markets to greater competition, the Commission enacted a public benefits program, including a System Benefits Charge (SBC), in 1996. Under the SBC, funds collected through a surcharge on customer's bills are used to fund and promote a number of clean energy initiatives, including energy efficiency, education and outreach, and research and development (R&D) of energy efficient and renewable technologies. Since its creation, the SBC has gone through several iterations. The first three authorizations extended the overall program through the end of 2011. In October 2011, the Commission extended the SBC for an additional five years through December 31, 2016; this renewed authorization is known as SBC IV.

During this same period, the Commission has initiated additional policies and programs in support of the State's clean energy goals. For example, in September 2004, the Commission adopted a RPS, which set an initial renewable energy target of 25 percent of State electricity consumption by 2013. Following a comprehensive mid-course review, the Commission expanded the RPS target in January 2010, increasing the target for renewable electricity used by consumers from 25 percent to 30 percent and extending the terminal year of the program from 2013 to 2015.[35] The RPS includes two "tiers" of renewable energy: Main-Tier, which targets larger utility scale resources; and CST, which targets smaller, behind the meter resources. Through December 31, 2013, NYSERDA's progress at achieving the Main Tier and CST 2015 targets was 48 percent and 57 percent of their renewable energy goals, respectively.[36]

New York is a founding member of the Regional Greenhouse Gas Initiative (RGGI), a regional program in which nine states in the Northeast are currently participating. Under RGGI, a cap for total CO_2 emissions from electric generation facilities is set for the region and then gradually reduced each year. The CO_2 emissions regional cap started at 165 million short tons in 2005; the regional cap in 2014 is set at 91 million short tons. Large electric power plants in the RGGI states are then required to hold one tradable emissions allowance for each ton of CO_2 they emit

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[34] NYSERDA. 2014. Clean Energy Fund Proposal. September 23; and DPS. Case 14-M-0094: Proceeding on Motion of the Commission to Consider a Clean Energy Fund. Issued May 8, 2014.

[35] DPS. Case 03-E-0188: Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio Standard, Order Establishing New RPS Goal and Resolving Main Tier Issues. Issued January 8, 2010.

[36] NYSERDA. 2014. New York State Renewable Portfolio Standard. Annual Performance Reports. Accessed September 18, 2014 at: https://www.nyserda.ny.gov/Publications/Program-Planning-Status-and-Evaluation-Reports/Renewable-Portfolio-Standard-Reports.aspx.

over a three year compliance period. Power plants acquire emission allowances through quarterly auctions that are jointly sponsored by the participating states, or by purchase from other allowance or offset allowance holders. Proceeds from the quarterly CO_2 emission allowance auctions are then invested by RGGI states into consumer benefit programs with emphasis on end-use energy efficiency, renewable energy deployment, and greenhouse gas abatement technology development. New York has received $691 million in RGGI auction proceeds between the first auction in September 2008 and the most recent auction in September 2014, which is roughly the amount that was received by NYSERDA from SBC fees over the same period.[37,38] New York has invested most of its RGGI proceeds in energy audits, energy efficiency measures, and cleaner energy sources for residential, commercial, and industrial buildings.[39]

In May 2007, the Commission initiated a proceeding to develop a State EEPS. The EEPS set a goal of reducing electricity usage in New York by 15 percent from projected electricity usage in 2015, which corresponds to a reduction of approximately 26,900 gigawatt-hours (GWh). Under the EEPS, NYSERDA and the six large investor-owned electric utilities, and gas utilities serving more than 14,000 customers were required to submit electric energy efficiency program proposals to the Commission. The program is funded through surcharges on retail sales of electricity and natural gas, with collections from electricity customers administered as an addition to the SBC. After five years, in December 2013, the EEPS electric and gas programs were at 55 percent and 59 percent, respectively of their 2015 goals.[40] Renewable resources supplied approximately 32,226 gigawatt hours of New York's electricity in 2013, representing approximately 23 percent of the State's electric generation.[41]

On October 24, 2011, the Commission issued an order approving the Technology and Market Development (T&MD) Portfolio, proposed by NYSERDA, for the five-year period of January 1, 2012 through December 31, 2016. This order approved an extension of the SBC program for an additional five and a half years, but split SBC funding into the existing EEPS portfolio and a new T&MD portfolio. Approximately $98 million was allocated annually to the programs under EEPS, and $82 million to the T&MD portfolio. The T&MD portfolio consists of a collection of programs designed to accelerate energy innovation by testing, developing, and introducing new technologies, strategies, and practices that build statewide market infrastructure to reliably deliver clean energy to New Yorkers. The primary objectives of the T&MD Portfolio are to:

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[37] Regional Greenhouse Gas Initiative. CO2 Auctions; Auction Results: Cumulative Allowances & Proceeds (by State). Accessed September 22, 2014 at: http://www.rggi.org/market/co2_auctions/results.

[38] SBC revenues were $175 million per year for the five-year period between July 2006 and June 2011, and are valued at $469 million over the subsequent five-year SBC program (January 2011 to December 2016). See NYSPSC. System Benefits Charge. Accessed September 22, 2014 at: http://www3.dps.ny.gov/W/PSCWeb.nsf/All/58290EDB9AE5A89085257687006F38D1?OpenDocument.

[39] NYSDEC. "The Regional Greenhouse Gas Initiative: Carbon Dioxide Budget Trading Program." Accessed July 24, 2014 at: http://www.dec.ny.gov/energy/rggi.html.

[40] DPS. Case 14-M-0094: Proceeding on Motion of the Commission to Consider a Clean Energy Fund: Order Commencing Proceeding. Issued May 8, 2014.

[41] NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

- Move new/underused technologies and services into marketplace to serve as a "feeder" to help achieve EEPS and RPS goals;
- Validate emerging energy efficiency, renewable, and smart grid technologies/strategies and accelerate market readiness in New York;
- Stimulate technology and business innovation to provide more clean energy solutions and lower cost solutions, while growing New York's clean energy economy; and,
- Spur actions and investment to achieve results distinct from incentive-based programs.[42]

In November and December 2012, the Commission ordered subsequent additions and revisions to the NYSERDA T&MD Program Operating Plan. The most recent update to the Operating Plan in February 2013 allocates $523 million of SBC funds to nine T&MD initiatives over five years with an average annual budget of $104.7 million.[43]

Shifting to Market-Based Clean Energy Programs

As a result of these various efforts, New York has made progress building a cleaner energy industry and setting a foundation for the deployment of clean energy and transportation options.[44] However, the effectiveness of these programs to achieve the State's energy goals is uncertain. For example, at the end of 2013, the RPS was at 49 percent of its combined 2015 goal and EEPS electric and gas programs were at 55 percent and 59 percent, respectively, of their 2015 goals.[45] While the progress towards RPS and EEPS energy goals has been limited, these programs have generated positive economic impacts. For example, a 2013 study estimates that every dollar spent on the acquisition of RPS Attributes for the current portfolio of Main Tier RPS projects, New York State captures approximately three dollars, on a net present value basis, in direct investment over a project's lifetime.[46]

In the time since the SBC's founding, the State's retail and wholesale markets have aged and evolved, as has the Commission's understanding of the legal, policy, and political barriers that are preventing energy efficiency and clean energy resources from achieving their full potential.[47]

[42] IEc. 2014. Comprehensive Evaluation Plan: Technology and Market Development, Clean Air Interstate Rule and Selected Regional Greenhouse Gas Initiative Programs. Final Working Version. Prepared for NYSERDA under Contract 32883. March.

[43] NYSERDA. 2013. Operating Plan for Technology and Market Development Programs (2012-2016): Systems Benefit Charge. Originally submitted December 22, 2011. First Revision November 13, 2012. Second Revision February 15, 2013. Available at: https://www.nyserda.ny.gov/Energy-Data-and-Prices-Planning-and-Policy/Program-Planning/System-Benefits-Charge.aspx.

[44] The NY State Energy Plan notes that carbon-free sources of energy continue to increase as a share of total energy produced in New York and that the residential solar PV market on Long Island is one of the fastest-growing in the U.S. See, New York State Energy Planning Board. 2014. Shaping the Future of Energy – 2014 Draft York State Energy Plan. Volume 1. Page 6. Accessed September 17, 2014 at: http://energyplan.ny.gov/Plans/2014.aspx.

[45] DPS. Case 14-M-0094: Proceeding on Motion of the Commission to Consider a Clean Energy Fund: Order Commencing Proceeding. Issued May 8, 2014.

[46] NYSERDA. 2013. Renewable Portfolio Standard Main Tier 2013 Program Review, Direct Investments in New York State. Final Report. September 5, 2013.

[47] For purposes of this GEIS, the term 'clean energy' is broadly defined to include the full breadth of energy-related technologies, programs and solutions that New York State may use to achieve its energy policy objectives including, but not necessarily limited to main-tier and customer-sited renewable energy sources (e.g., hydro, solar, wind and

The Commission and other policy makers have come to recognize that DER can no longer be viewed as peripheral elements of the electric system that require continuous government support. Instead, these customer-based technologies should be managed as a core source of value to the electricity system and its customers.[48]

Toward this end, the Commission, in cooperation with NYSERDA, has started the process of updating the State's current suite of clean energy programs, as well as initiating new, more market-based, efforts for supporting clean energy development. For example, through the NY-Sun initiative, NYSERDA designed and has begun to implement a "MW Block" program design.[49,50] When coupled with a multi-year commitment to the solar PV program, this approach is expected to achieve a greater scale of solar PV deployment and facilitate a transition away from the current surcharge-funded, pure incentive program, towards a sustainable market-based approach.

Similarly, in recent orders, the Commission authorized the implementation by NYSERDA of the State's Green Bank initiative.[51] The New York Green Bank (NYGB) is designed to enhance the opportunities for private resources to strengthen the marketplace viability of many different commercially proven clean energy technologies. Specifically, the NYGB is designed to partner with ESCOs, regional banks, larger multinational banks, specialty finance companies, and other investors and lenders to support economically viable clean energy projects. NYGB's ideal partners are entities that are achieving success in clean energy markets but whose success is limited by lack of available financing. The Commission has approved an initial NYGB capitalization of approximately $218.5 million. Through this capitalization and its partnerships with private sector parties, NYGB seeks to deploy commercially proven technologies and projects in the areas of energy efficiency and clean energy generation.[52]

As previously discussed, reconsideration of the effectiveness of surcharge- (or rate-payer) funded clean energy program has continued over the last year, with the establishment of the EEPS Order on December 26, 2013, the January 7, 2004 draft State Energy Plan, and the REV proceeding issued on April 25, 2014. Case 14-M-0094 builds on these past efforts, directing NYSERDA to consider the development of a single, comprehensive CEF.

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other carbon-free solutions), energy efficiency, energy storage, smart grid, demand response, distributed generation, and low carbon technologies (e.g., CHP and co-generation).

[48] DPS. Case 07-M-0548: Proceeding on Motion of the Commission Regarding an Energy Efficiency Portfolio Standard, Order Approving EEPS Program Changes. Issued December 26, 2013.

[49] DPS. Case 03-E-0188: Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio Standard, Order Authorizing Funding and Implementation of the Solar Photovoltaic MW Block Programs. Issued April 24, 2014.

[50] The "MW block" program divides New York into nine "blocks," composed of three regions – Long Island, ConEdison territory, and Upstate and three sectors: residential systems up to 25 kW, nonresidential systems up to 200 kw and then nonresidential systems greater than 200 kW. Incentive levels are defined separately for each block and sector. (Source: The NY-Sun initiative. NY-Sun Initiative Frequently asked Questions. Accessed October 3, 2014 at: http://ny-sun.ny.gov/About/NY-Sun-FAQ.aspx.)

[51] DPS. Case 13-M-0412. Initial Capitalization for the New York Green Bank, Order Establishing New York Green Bank and Providing Initial Capitalization. Issued December 19, 2013.

[52] *Ibid.*

CEF Proposed Actions

In meeting the objectives of Case 14-M-0094, the Commission directed NYSERDA to develop and submit for approval a proposal for a single, comprehensive Clean Energy Fund.[53] In the Order authorizing Case 14-M-0094, the Commission discussed overarching goals that NYSERDA should consider in the development of a CEF proposal, including, but not necessarily limited to:

- Ensuring continuity of the State's clean energy programs;
- Providing flexibility to allocate funds among a portfolio of clean energy programs in response to evolving circumstances;
- Fostering a more rapid, significant, and sustainable increase in the adoption of clean energy services and technologies;
- Enhancing program efficiency and leverage;
- Providing access to clean energy for low-income customers who may not otherwise benefit from the new markets that develop; and,
- Managing the transition from ratepayer surcharges to more sustainable market-based clean energy activities.

On September 24, 2014, NYSERDA filed their proposal for the CEF. In the following sections, we briefly summarize key aspects of NYSEDA's CEF proposal. This section is not intended to be an exhaustive or definitive discussion of NYSERDA's proposal. For a more complete description of the CEF, please see NYSERDA's CEF Proposal, dated September 23, 2014.[54]

Program Direction and Funding Objectives

To achieve the objectives established by the Commission in its May 8, 2014 Order, NYSERDA proposed a program framework configured around four program portfolios, designed to complement and align with the long-term energy objectives established by the REV and State Energy Plan policies:

- **Market Development**, which will align with REV to reduce barriers, animate consumer demand for clean energy, and enable the private markets to provide the new products and services sought by an animated consumer market;
- **Technology and Business Innovation**, which will catalyze the development of innovative clean energy solutions, while growing New York's cleantech sector and accelerating the development and introduction of the new technologies that will be needed to foster increased levels of GHG reductions;
- **NYGB**, which, as previously discussed, seeks market transformation in the financial sector, leveraging public investments and reaching new markets for clean energy services; and

[53] In addition to developing a more efficient approach for supporting and stimulating clean energy innovation, the CEF is intended to also provide a bridge between New York State's existing surcharge-funded clean energy programs (e.g., RPS, EEPS and T&MD) and the more comprehensive regulatory reforms envisioned under the REV.

[54] NYSERDA. 2014. Case 14-M-0094 – Proceeding on the Motion of the Commission to Consider a Clean Energy Fund. Clean Energy Fund Proposal. Issued September 23, 2014. Available at: http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={DABF6A8A-17A5-441F-AC44-48587105CF6D}.

- **NY-Sun**, which, as previously discussed, seeks to create a robust and self-sustaining solar market in New York for solar PV technologies, and build a program approach for other clean technologies.

Taken together, the CEF's four program portfolio will accelerate and expand investment in clean energy technologies. To ensure that the CEF is able to respond to evolving market needs and conditions, NYSERDA requested flexibility to move funds within each of the CEF portfolios, as well as between the Technology and Business Innovation, and the Market Development Portfolios.

In order to achieve the long-term GHG emission reductions envisioned under the CEF portfolio, NYSERDA recommends a fuel-neutral investment strategy. NYSERDA's research:

> "… demonstrates that energy consumers approach solutions to their energy needs holistically, looking for bill reductions and clean energy options that meet both electricity and on-site fuel uses, whether natural gas, heating oil, other fuels or combinations of fuels. … A fuel neutral approach, crediting all public CEF dollars with achieving the portfolio's emissions reductions progress, would better maximize the GHG emissions reduction productivity of public dollars spent on clean energy initiatives."

Budget and Funding

Under its May 8, 2014 Order, the Commission instructed NYSERDA to develop a framework for funding that establishes a transparent upper limit on contributions from ratepayers. The Commission also requested recommendations from NYSERDA on annual ratepayer collection levels for each year of the 2016-2020 program cycle and beyond. The Commission indicated that proposed annual collection levels should ideally be below the authorized 2015 total annual collection levels for the RPS, EEPS, SBC, and T&MD programs, which totaled $925 million in 2015. For the first three years (2016-2018), NYSERDA proposed a total annual funding amount of $648 million (i.e., total of $1.944 billion over three years). As requested by the Commission, annual funding levels decline thereafter over time, falling to $453 million, $428 million and $308 million per year in 2019, 2021 and 2025, respectively. Total funding requested for the CEF through 2025 is approximately $5 billion.

NYSEDA's September 23, 2014 proposal breaks down CEF funding into two five-year cycles. Under the first five-year cycle (2016-2020), CEF will operate within a period of transition, during which older programs are phased out and new programs are launched. Funding allocations and decision-making during the second five-year cycle (2021-2025) will be informed, in part, by the experience gained during the first funding cycle. NYSERDA will conduct reviews every three year review cycle to measure performance and adjust program parameters, as necessary and appropriate to improve performance and/or adapt to new information or emerging market conditions.

Program Success

To track progress and measure success, the CEF incorporates an evaluation component under which metrics and benchmarks are defined. According to NYSERDA, CEF's success will be apparent in the appearance of:

"(1) A more dynamic "supply side" of clean energy service providers, including energy service companies, financing institutions, product suppliers, and contractors/installers who develop new models for providing energy services and solutions to consumers,

(2) A better informed "demand side" customer base that seeks innovative energy services and effective energy solutions, and

(3) A flourishing clean energy market leading to clean energy investments at greater scale and impact."

1.4 PUBLIC BENEFITS OF REV AND CEF

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 REV and CEF proceedings, respectively. The public benefits of pursuing the REV vision, supported by the CEF, should be considered in comparison to the cost of the "business as usual" scenario in which current programs are maintained and the electricity system develops in reasonably anticipated ways. As previously discussed, the electric industry environment in New York in which the REV and CEF are being developed is characterized by numerous conditions that indicate a need for systematic change.

There is a general consensus that the overarching goal of the REV and CEF is to modernize New York's energy industry by: decreasing the State's dependence on the centralized generation and distribution structure that currently exists; and moving to a more decentralized system driven by market-based approaches that treats customers as active market participants, rather than distribution end points. If successful, the REV and CEF programs will generate a wide array of public benefits. Major categories of such public benefits include, but are not limited to:

- Increased customer choice and opportunity;
- Increased system efficiency and therefore cost reduction, calculated both in terms of load duration curve and in terms of overall heat rate;
- Improved fuel diversity, reduced fossil fuel dependence, and improved management of price volatility;
- Deferral or avoidance of transmission and distribution (T&D) infrastructure investment;
- Reduced line losses;
- Increased penetration of clean distributed generation;
- Reduction in carbon and other pollutant emissions, beyond what can be achieved through ratepayer funded programs;
- Increased value of energy efficiency investments resulting from targeting programs to system needs;
- Reduced average customer bills;
- Increased grid resilience and security, including avoided restoration and outage costs;
- Increased reliance on markets with resulting innovation in DER products and benefits, and the ability to effectively integrate new innovations into the system;
- Added levels of responsive demand and system flexibility that enable long-term development and integration of variable renewables;

- Increased non-energy benefits to customers and society including, for example, reduced health impacts or increased employee productivity; and,
- Securing the long-term viability of universal affordable service.

While some of these public benefits are quantifiable, others can be more difficult to quantify. Regardless, it is premature to develop precise benefits figures given the ongoing development of REV and CEF programs. On August 22, 2014, DPS issued a Straw Proposal on the feasibility of a DSPP Market, which includes illustrative examples of potential savings and avoidable costs anticipated under the REV. For example, increasing fuel diversity can reduce price volatility; the estimated total cost to New York customers from the gas-driven price spikes during the winter of 2013-2014 was over $1.0 billion.[55] **Exhibit 1-2** presents additional examples of societal benefits anticipated assuming successful achievement of the goals and objectives identified for the REV program.

1.5 LOCATION OF ACTION

The REV and CEF programs are intended to transform the ways in which energy is valued, generated, distributed, managed, and used across the entire energy industry. 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.

[55] DPS. Case 14-M-0101 Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision. Ruling Modifying Process for Filing Comments on Track one Staff Straw Proposal. Issued August 25, 2014.

EXHIBIT 1-2 SUMMARY OF POTENTIAL BENEFITS FOR THE REV PROGRAM

BENEFIT CATEGORY	PERSPECTIVE		
	RATE IMPACT MEASURES (RATES)	UTILITY COST (BILL)	SOCIETAL
BULK SYSTEM			
Avoided Generation Capacity (Installed Capacity Market (ICAP)) Costs, including Installed Reserves and Losses	✓	✓	✓
Avoided Energy (Location-based marginal price (LBMP)) Costs, including Losses	✓	✓	✓
Avoided Ancillary Services (e.g. operating reserves, regulation, etc.)	✓	✓	✓
Wholesale Market Price Impacts	✓	✓	
DISTRIBUTION SYSTEM			
Avoided T&D Capacity Costs	✓	✓	✓
Avoided O&M Costs	✓	✓	✓
Avoided Distribution Losses	✓	✓	✓
RELIABILITY/RESILIENCY			
Avoided Restoration Costs	✓	✓	✓
Avoided Outage Costs*			✓
EXTERNAL (NET)*			
Avoided GHG*			✓
Avoided Criteria Air Pollutants*			✓
Water*			✓
Land*			✓
Non-Energy Benefits (e.g. health impacts, employee productivity, property values)			✓

*Note: only the portion not already included above, net of any added external costs.
Source: DPS. 2014. Case 14-M-0101 – Proceeding on the Motion of the Commission in Regard to Reforming the Energy Vision. Developing the REV Market in New York: DPS Staff Straw Proposal on Track One Issues. August 22, 2014. Page 46.

1.6 RELATIONSHIPS TO OTHER PLANS AND PROGRAMS

In **Sections 1.2 and 1.3**, we discussed the relevance of the NY-Sun, NYGB, EEPS, RPS, T&MD, RGGI and the State Energy Plan to the REV and CEF proceedings. The REV and CEF may interact with a number of additional energy-related programs and plans. **Exhibit 1-3** provides a short description of other potentially-related energy initiatives.

EXHIBIT 1-3 OTHER RELATED ENERGY INITIATIVES

PROGRAM OR PLAN	TIMEFRAME	DESCRIPTION
Environmental Disclosure Program	Issued and Effective 1998, through Present.	The PSC requires electricity providers throughout the state to include "environmental disclosure labeling" information in electricity bills at least twice a year. The label included in each customer's bill provides information on the mix of fuels used to generate the electricity sold by their supplier over a 12-month period. Customers see the percentage of their electricity that is derived from each fuel source, as well as the air emissions (CO_2, SO_2, NO_x) relative to the State average. This information is intended to empower consumers to make informed choices about their energy sources. Environmental Disclosure may also encourage generators to consider providing more green power among their supply offerings.[56]
Standardized Interconnection Requirements (SIR)	Adopted in 1999. Amended in 2002, 2004, 2009, and 2013.	New York was the second state to adopt uniform interconnection standards for distributed generation (DG) systems. The Commission promulgated regulations requiring underground installation of new distribution facilities in residential subdivisions. The Commission originally adopted SIRs for systems up to 300 kW in capacity, but since then has amended its rules to increase the maximum capacity to 2 MW. The most recent amendments in 2013 are intended to simplify and expedite the interconnection application and review process, and to adopt changes made to the net metering law in 2012.[57,58]
Net Metering	Original net-metering law enacted in 1997. Law expanded in the years from 2002 - 2012.	The original net metering law applied only to residential photovoltaic systems up to 10 kW, and allowed customers to net meter their consumption and generation and receive compensation if production exceeds usage over a given time period. Updates to the program extend eligibility to non-residential photovoltaic, wind, biomass, fuel cells, CHP/Cogeneration, small hydroelectric, microturbines, and customers operating generating systems utilizing biogas produced by the anaerobic digestion of

[56] DPS. Final Generic Environmental Impact Statement in Case 03-E-0188 Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio Standard. Issued August 26, 2004. Accessed September 18, 2014 at: http://www.dps.ny.gov/NY_RPS_FEIS_8-26-04.pdf.

[57] NYPSC. 2014. New York State Standardized Interconnection Requirements and Application Process for New Distributed Generators 2 MW or Less Connected in Parallel with Utility Distribution Systems. February 2014. Accessed September 1, 2014 at: http://www3.dps.ny.gov/W/PSCWeb.nsf/96f0fec0b45a3c6485257688006a701a/dcf68efca391ad6085257687006f396b/$FILE/ATTP59JI.pdf/Final%20SIR%202-1-14.pdf.

[58] DOE. Da

tabase of State Incentives for Renewables & Efficiency. "New York Interconnection Standards." Accessed July 22, 2014 at: http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=NY02R&re=0&ee=0.

PROGRAM OR PLAN	TIMEFRAME	DESCRIPTION
		agricultural waste. PSL §66-j established limits on the amount of generation that is eligible for net metering for PV, farm waste, micro-CHP, micro-hydroelectric and fuel cell technologies; PSL §66-l established limits for small wind generators. On June 13, 2013, the Commission raised the net metering limits set under 66-j for major electric utilities under the Commission's jurisdiction. By increasing net metering limits, the Commission seeks to ensure sufficient net metering capacity to accommodate the statewide solar PV installation goals under the NY-Sun Initiative, which are currently incorporated into the RPS, as well as anticipated demand related to other eligible technologies.[59]
NY Prize	Announced on August 26, 2014.	NY Prize is a unique, first-in-the-nation initiative under which will $40 million of funding will be competed to support the development of community microgrids. The program's goals are to modernize the State's electric grid, protect communities from power outages, improve power quality and reliability, and enable a transition to cleaner and more efficient energy infrastructure.[60]
BUILD SMART NY State Building Initiative	Issued on December 28, 2012.	New York Governor Andrew M. Cuomo issued Executive Order (EO) 88 setting a goal of improving energy efficiency in State buildings 20 percent by 2020. Known as BUILD SMART NY, this initiative is benchmarking energy usage within state buildings and executing energy master plans at the most energy intensive campuses. Based on the findings of the benchmarking data and energy master plans, BUILD SMART NY will target retrofits in the largest and most inefficient buildings, accelerating efforts to improve the efficiency of state buildings. BUILD SMART NY will also implement best practices for building operations and maintenance to ensure efficiency improvements are sustained.[61]
State agency green procurement and sustainability	Issued April 24, 2008.	New York Governor Paterson issued EO 4, which directs state agencies and authorities to consider a broad range of environmental and health criteria when making purchasing decisions. EO 4 establishes an institutional framework – co-led by the Office of General Services

[59] DPS. Case 12-E-0485 to Case 12-E-0490. In the Matter of Order Raising Net Metering Limitations. Issued and Effective June 13, 2014. Accessed September 9, 2014 at: http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={000AA6DA-F23B-4644-A2EA-D8AE6BC26559}.

[60] NYSERDA. NY Prize. Powering a New Generation of Community Energy. 2014. Accessed December 30, 2014 at: http://www.nyserda.ny.gov/All-Programs/Programs/NY-Prize.

[61] Governor Andrew M. Cuomo. Executive Order 88: Directing State Agencies And Authorities to Improve The Energy Efficiency of State Buildings. Accessed September 9, 2014 at: http://www.governor.ny.gov/executiveorder/88; BUILD SMART NY. About BUILD SMART NY State Building Initiative. Accessed September 9, 2014 at: http://www.buildsmart.ny.gov/about/.

PROGRAM OR PLAN	TIMEFRAME	DESCRIPTION
		(OGS) and NYSDEC – to guide the state's sustainable purchasing prioritization, standard-setting and reporting activities. This interagency collaboration has created dozens of "green" specifications, which serve as a guide and resource for State of commodities, services and technology.[62]
80x50 State Greenhouse Gas Reduction Goal[63]	Issued on August 6, 2009.	New York Governor Paterson issued EO 24, which established a goal for the State of New York to reduce current greenhouse gas emissions from all sources within the State eighty percent (80 percent) below levels emitted in 1990 by the 2050. EO 24 further established a Climate Action Council, consisting of representatives from 15 state agencies, to prepare a draft Climate Action Plan to achieve the goals of EO 24.
Community Risk and Resiliency Act (CRRA)[64]	Passed by New York State Legislature on June 19, 2014; signed by Governor Cuomo on September 22, 2014. NYSDEC will adopt official sea level rise projections by January 1, 2016.	Recently signed into law by Governor Cuomo, the Community Risk and Resiliency Act will take effect in 2015 and will require State agencies to consider future climate risks caused by storm surges, sea level rise or flooding in certain permitting, funding and regulatory decisions. According to the legislative history, "[t]his legislation is intended to encourage advance planning for extreme weather events and to encourage the consideration of the effects of climate change. … It is appropriate and necessary for climate risk to be an eligible component of funding and permitting and also for applicants to demonstrate that they have considered climate change and extreme weather impacts on their proposed projects." The standards would apply to smart growth assessments, siting of wastewater treatment plants and hazardous waste transportation, storage and disposal facilities, design and construction regulations for petroleum and chemical bulk storage facilities and oil and gas drilling permits, as well as other projects. Additionally, NYSDEC will adopt and maintain official sea level rise projections for general use starting in 2016.

[62] Green Purchasing State Profile: State of New York. Accessed September 9, 2014 at: http://www.responsiblepurchasing.org/resources/state_profiles/new_york.pdf.

[63] NYSDEC. Executive Order No. 24, Establishing a Goal to Reduce Greenhouse Gas Emissions Eighty Percent by the Year 2050 and Preparing a Climate Action Plan. Accessed September 9, 2014 at: http://www.dec.ny.gov/energy/71394.html.

[64] New York State Assembly Bill A6558B. Accessed September 11, 2014 at: http://assembly.state.ny.us/leg/?default_fld=&bn=A06558&term=&Summary=Y&Memo=Y&Text=Y; Hull, R.G. "Environmental Law: Risk & resiliency: NY's plan to cope with climate change." August 17, 2014. Accessed September 11, 2014 at: http://nydailyrecord.com/blog/2014/08/17/environmental-law-risk-resiliency-nys-plan-to-cope-with-climate-change/; Governor's Press Office. "Governor Cuomo Signs Community Risk and Resiliency Act." September 22, 2014. Accessed September 24, 2014 at: http://www.governor.ny.gov/press/09222014-resiliencyact.

PROGRAM OR PLAN	TIMEFRAME	DESCRIPTION
Acid Deposition Reduction (ADR) Program National Atmospheric Deposition Program (NADP)	Original ADR Program established in 1985. Program was discontinued and combined with the NADP in 2012.	This program was established in response to the State Acid Deposition Control Act (SADCA) in 1985. The Program is designed to provide measurements of acid deposition and related quantities necessary to assess the effectiveness of sulfur control policy and other strategies aimed at reducing the effects of acid rain.[65] Updates to the program were intended to result in regulations that require New York's electric generation plants to reduce sulfur dioxide (SO_2) emissions by 50 percent below the levels required by the federal CAA Amendments of 1990. The program also had goals to implement year-round controls for nitrous oxides (NO_x) instead of the five-month summer ozone season controls.[66] At the end of 2012, the NYSDEC discontinued the program and transitioned seven monitoring locations to the National Atmospheric Deposition Program (NADP).[67] The NADP is a cooperative effort among federal, state, tribal and local governmental agencies, educational institutions, private companies, and non-governmental agencies to measure atmospheric deposition and study its effects on the environment.[68]
NO_x Set Aside Program	Pilot program in 1999. Updated allowance budget in 2003.	The energy efficiency and renewable set-aside component of the NO_x budget-trading program provides incentives to implement electric end-use energy efficiency and renewable generation projects by allocating three percent, or about 1,200 tons, of New York's ozone-season NO_x allowance budget to eligible projects, beginning in 2003. A pilot program under which 115 tons of NO_x allowances are available for end-use efficiency projects has been in place since 1999. Projects that can be bought and sold on the open market are certified as tradable emissions allowances. This program provides a viable model for the planned

[65] NYSDEC. "New York's Acid Deposition Monitoring Network". Accessed July 22, 2014 at: http://www.dec.ny.gov/chemical/8409.html

[66] DPS. Final Generic Environmental Impact Statement in Case 03-E-0188 Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio Standard. Issued August 26, 2004. Accessed September 18, 2014 at: http://www.dps.ny.gov/NY_RPS_FEIS_8-26-04.pdf.

[67] NYSDEC. New York's Acid Deposition Monitoring Network. Accessed September 1, 2014 at: http://www.dec.ny.gov/chemical/8409.html.

[68] For more information on the NADP, see: National Atmospheric Deposition Program. About NADP. Accessed September 29, 2014 at: http://nadp.sws.uiuc.edu/NADP/.

PROGRAM OR PLAN	TIMEFRAME	DESCRIPTION
		development of a carbon registry for early reduction credits and trading.[69]
Competitive Opportunities/Bypass Case (COB)	May 1996.	The PSC issued Opinion and Order in May 1996 which included the provision of a framework for the transition to competition of the commodity portion of electric service. The Order addressed topics relating to the value of retail and wholesale competition, the importance of maintaining system reliability, aspects of strandable costs and recovery of such costs, costs that may be required to be spent on public policy programs, market power issues and corporate structure, and the need for utilities to remain the provider of last resort to serve while also maintaining current customer protections. Retail access for customers for the commodity portion was phased in, with full access for all customers available in each utility service area by July 2001. The State's retail electric industry is fully open to customer choice and many ESCOs now operate in New York. Changes in the electric market allow utility customers in nearly all areas of the State to choose their supplier of electricity, while the delivery of electricity remains the function of the local utility. The transition toward retail competition had been evolving for several years, and it is expected that further evolution will occur.[70]

[69] DPS. Final Generic Environmental Impact Statement in Case 03-E-0188 Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio Standard. Issued August 26, 2004. Accessed September 18, 2014 at: http://www.dps.ny.gov/NY_RPS_FEIS_8-26-04.pdf.

[70] *Ibid*.

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 REV and CEF proceedings intend to transform. The background information presented in this chapter is intended to assist with understanding the impacts of the proposed REV and CEF actions.

Chapter 3 provides information on the environmental setting which serves as a baseline description of existing environmental conditions. The information presented in Chapters 2 and 3 provide a baseline against which the impacts of changes in the energy industry from the REV and CEF are evaluated and compared in Chapters 5 through 10.

This chapter is organized into five sections including:

- Section 2.1 provides a short overview of history of the electric industry in New York;
- Section 2.2 introduces the existing regulatory environment underlying New York's electricity industry;
- Section 2.3 discusses historical trends in electricity demand;
- Section 2.4 discusses historical trends in electricity prices; and,
- Section 2.5 describes the present (or current) electricity system, including the State's generation, transmission and distribution systems.

2.1 HISTORY OF THE ELECTRIC INDUSTRY[71]

For most of its history, the basic design of the electric grid has remained essentially the same. Electricity is generated at central stations, transmitted long distances via high-voltage lines, then stepped down in voltage and delivered to customers through local distribution systems. The system was built to serve the instantaneous demand of customers, with a large reserve margin to accommodate peak demand, plant outages and other contingencies. The generation of power was effectively a natural monopoly, under which utilities owned, operated, and coordinated power generation. Electric service was then "bundled" to retail customers in "franchise" areas through cost-based rates regulated by the New York Public Service Commission (PSC).[72] In the 1990s, New York's electricity industry was dominated by seven large Investor-Owned Utilities (IOUs), including Central Hudson Gas & Electric Company (CHG&E), Consolidated Edison Company of New York, Inc. (Con Edison), Long Island Lighting Company (LILCO), New York State Electric & Gas Company (NYSEG), Niagara Mohawk Power Corporation (NIMO), Orange & Rockland Company (O&R), and Rochester Gas & Electric Company (RG&E). Each of these companies

[71] DPS. 2014. Reforming the Energy Vision. Staff Report and Proposal. Case 14-M-0101. April 24.

[72] Tierney, Susan. 2010. The New York Independent System Operator. A Ten Year Review. Analysis Group. Boston, Massachusetts. April 12. Accessed August 25, 2014 at: http://www.analysisgroup.com/uploadedFiles/Publishing/Articles/Tierney_NYISO_10_Year_Review.pdf.

was vertically integrated, owning and operating power plants, transmission facilities, and distribution systems.

From the 1970s through the 1990s, a number of factors led to a restructuring of the vertically-integrated electric industry, including, but not limited to, the energy price shocks of the 1970s, cost overruns and safety issues with nuclear plants, and advancements in energy-related technologies. In response to these factors, New York State, along with 13 other states, initiated efforts in the 1990s to restructure the electricity industry, with the goal of increasing market competition and improving the operation of electricity industries to improve energy delivery, reliability, and safety.[73] For example, in 1998, LILCO's transmission and distribution system was acquired by the newly established state agency Long Island Power Authority (LIPA), which was created to control soaring energy prices in the wake of an abandoned investment in a nuclear power plant and soaring electricity bills in LILCO's service area.[74]

Following the issuance of Order 96-12 in Case 94-E-0952 (the Competitive Opportunities Bypass proceeding) in 1996, the IOUs agreed, in individual proceedings, to divest, or unbundle, their generation assets from transmission and distribution.[75] In so doing, IOUs no longer owned the exclusive right to sell electricity to the customers in their distribution area. While the IOUs retained the function of delivering energy (e.g., distribution), Order 96-12 effectively opened the State's energy commodity market, allowing Energy Service Companies (ESCOs) to sell energy directly to all groups of energy customers (i.e., industrial, commercial, and residential).[76] As a result of these regulatory reforms, New York electricity customers today can choose their energy supplier: an ESCO or their local IOU.[77]

To facilitate New York's electricity restructuring and respond to the Federal Energy Regulatory Commission's (FERC) mandate that states provide fair and open access to state electrical grids, the NYISO was created in 1999.[78] NYISO is a not-for-profit corporation governed by a ten member Board of Directors. Concurrent with its creation, NYISO assumed operational control of the State's bulk power transmission system and the dispatch of generation in 1999. In this manner, NYISO became the sole administrator for the State's wholesale electricity market. NYISO's main responsibilities include:

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[73] U.S. EIA. 2010. Status of Electricity Restructuring by State. Accessed August 25, 2014, at: http://www.eia.gov/electricity/policies/restructuring/.

[74] Office of the Comptroller, New York State. 2012. Public Authorities by the Numbers: Long Island Power Authority. October. Accessed September 12, 2014 at: http://www.osc.state.ny.us/reports/pubauth/lipa_by_the_numbers_10_2012.pdf.

[75] NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

[76] An ESCO is a company permitted by the New York State Department of Public Service to offer electricity and/or natural gas supply to customers in New York State; ESCOs do not own or operate the distribution and transmission systems.

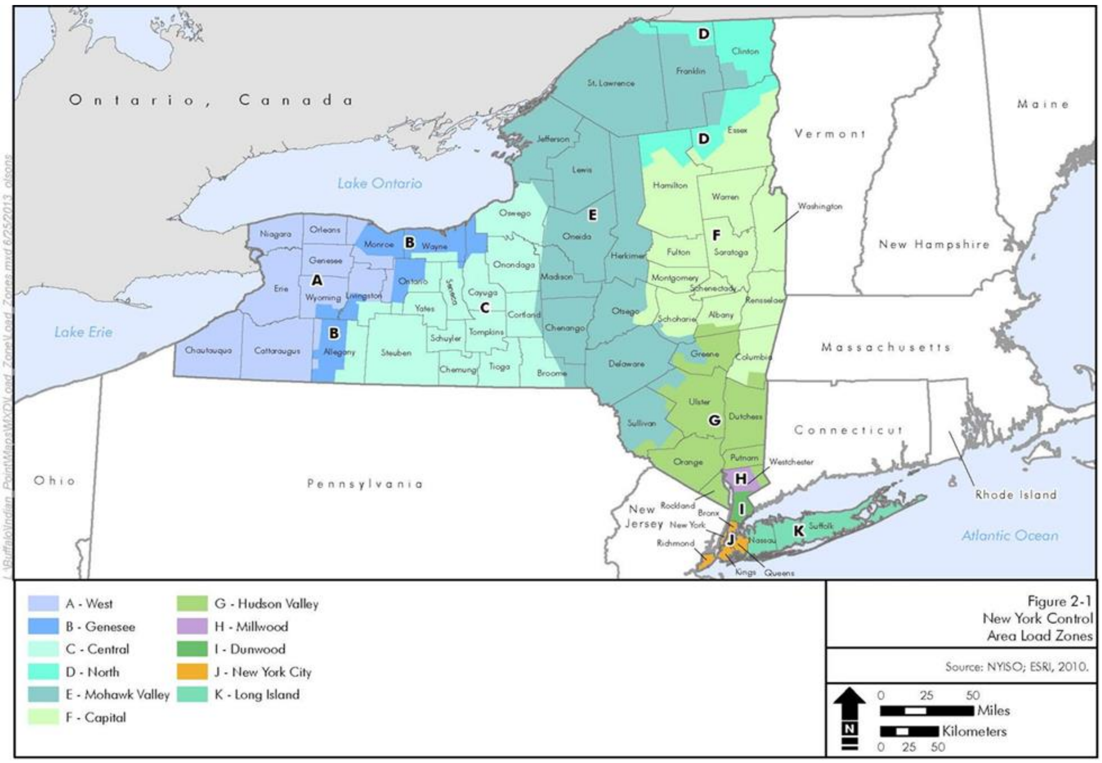
[77] NYSPSC. 2014. *Ask* PSC – The NYS Public Service Commission's Consumer Web Site. Accessed August 18, 2014 at: http://www.askpsc.com/askpsc/page/?PageAction=renderPageById&PageId=7f285010bbcba4320235157257b2dc82.

[78] NYISO. 2014. NYISO Website page "Our History." Accessed August 18, 2014 at: http://www.nyiso.com/public/about_nyiso/nyisoataglance/history/index.jsp.

- Maintaining the safe and reliable operation of New York's bulk power system;
- Operating fair, non-discriminatory and effective wholesale electric markets; and
- Planning for the reliability, economic, and public policy needs of New York State's bulk power system.[79]

For purposes of pricing, load, and supply assessment, and reliability criteria, NYISO manages the State's energy markets through 11 subdivisions or zones (**Exhibit 2-1**).

EXHIBIT 2-1 NEW YORK CONTROL AREA LOAD ZONES



Source: New York State Department of Public Service and Ecology and Environment Inc. 2013. Indian Point Contingency Plan Final Generic Environmental Impact Statement. Prepared for New York State Public Service Commission. September 2013.

To ensure a reliable and efficient bulk power system, the NYISO also established a number of products and services to support the wholesale market, including a capacity market, demand response programs, ancillary services markets, and transmission congestion contracts. The capacity market, in particular, is an important mechanism designed to ensure that sufficient resources are available to meet the State's projected load.[80]

[79] New York State Energy Planning Board. 2012. New York State Transmission and Distribution Systems Reliability Study and Report. August. Accessed September 17, 2014 at: http://nyssmartgrid.com/wp-content/uploads/2012/09/reliability-study.pdf.

[80] NYISO. NYISO Markets – New York's Marketplace for Wholesale Electricity. Accessed August 19, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Other_Reports/Other_Reports/NYISO%20Markets%20-%20New%20Yorks%20Marketplace%20for%20Wholesale%20Electricity.pdf.

Specifically, NYISO ensures compliance with criteria established by the Northeast Power Coordinating Council (NPCC) and the New York State Reliability Council (NYSRC) to maintain adequate resources to serve all forecasted loads plus a reserve margin. To meet this goal, the NYISO administers a capacity market that ensures Load-Serving Entities, such as the IOUs, purchase sufficient capacity and compensate capacity suppliers based on an administratively-determined "Demand Curve." Because of the constrained nature of the transmission system, the capacity market has locational features, which reflect system reliability requirements that require certain percentages of New York City, Lower Hudson Valley, and Long Island capacity be physically located in those areas.

Across the competitive wholesale electricity market landscape, capacity markets are undergoing significant analysis and modification to address emerging reliability needs. Capacity markets are continually evolving in order to enhance system predictability, responsiveness, and transparency, and to maintain reliability by encourage private investment in new resources and upgrades of existing resources.

2.2 REGULATORY ENVIRONMENT

New York's electricity industry is regulated by a collection of federal and State statutes and authorities. Authorized under the Federal Power Act and major amendments thereafter, FERC regulates the transmission and wholesale sale of electricity (and of natural gas for resale) in interstate commerce. FERC also reviews proposals to build liquefied natural gas (LNG) terminals and interstate natural gas pipelines as well as licensing hydropower projects.[81]

Within the State, primary oversight of the electricity industry is maintained by the PSC. Founded in 1907, the PSC regulates the State's electric, gas, steam, telecommunications, and water utilities, and is charged by law with responsibility for setting just and reasonable rates and ensuring the provision of safe and adequate service by the utilities it regulates.[82] As part of this responsibility, the PSC also enforces the Home Energy Fair Practices Act (HEFPA), which provides residential energy customers with comprehensive protections in areas such as applications for service, customer billing, and payment and complaint procedures.[83] Subsequent to the electricity restructuring, the New York State Legislature enacted the Energy Consumer Protection Act in 2002, which amended HEFPA to include ESCOs and any other entity that provides gas and electric service to residential customers.

New York Energy Law refers to a section of statutory code in the Consolidated Laws of New York. It is commonly referred to as "energy law." Originally enacted on July 26, 1976, the New York Energy Law has been amended several times since 1976, expanding or revising authorized areas of scope. Of particular relevance is §6.104, which requires the State Energy Planning Board ("the Board") to develop and adopt a state energy plan every four years, or more frequently

[81] FERC. What FERC Does. Last Updated June 24, 2014. Accessed August 13, 2014 at: http://www.ferc.gov/about/ferc-does.asp.

[82] New York State Energy Planning Board. 2012. New York State Transmission and Distribution Systems Reliability Study and Report. August. Accessed September 17, 2014 at: http://nyssmartgrid.com/wp-content/uploads/2012/09/reliability-study.pdf.

[83] NYSPSC. Home Energy Fair Practices Act webpage. Accessed August 18, 2014 at: http://www3.dps.ny.gov/W/PSCWeb.nsf/All/BFBBC5F20C80A1C685257687006F3A5C?OpenDocument.

if required. The Board initiated development of the State's first energy plan in March 2001 and since then has issued a state energy plan in 2002 and 2009. The Board is currently developing the State's 2014 energy plan. The Draft 2014 State Energy Plan covers a ten-year planning period organized around the following long-term goals:[84]

- Improve the reliability of the state's energy systems;
- Insulate consumers from volatility in market prices;
- Reduce the overall cost of energy in the state;
- Minimize public health and environmental impacts, particularly those related to climate change; and,
- Identify policies and programs designed to maximize cost-effective energy efficiency and conservation activities to meet projected demand growth.

The Draft 2014 Plan envisions "[r]eformed regulations, new roles for utilities, and new strategies based on customer priorities [that] will result in an energy system that is innovative, sustainable, and reliable."[85] The public comment period for the 2014 Draft State Energy Plan closed on May 30, 2014, and the Planning Board is currently developing the Final 2014 State Energy Plan.

New York's regulated power plants are also required to comply with the Regional Greenhouse Gas Initiative (RGGI), a mandatory market-based emissions reduction program using a cap-and-trade approach. RGGI is a cooperative effort including New York and eight other Northeastern states – Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, Rhode Island, and Vermont. Under RGGI, fossil fuel-fired power plants with capacity of 25 MW or over are required to possess allowances to emit carbon dioxide.[86] The market for these allowances is planned and coordinated by RGGI, while New York State oversees implementation and compliance.[87]

System Reliability

In the wake of the 2003 blackout, which occurred across parts of the Midwest and the Northeast United States (U.S.) and Ontario, Canada, the U.S. Congress passed a number of major industry changes through the Energy Policy Act of 2005 (EPAct). Of particular relevance, the EPAct expanded FERC's authority to include ensuring the reliability of high voltage interstate transmission systems through mandatory reliability standards.[88] Under the EPAct, regional, state and local reliability standards must be as stringent as the federal standards, which are proposed by the North American Electric Reliability Corporation and adopted by FERC, as warranted. In

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[84] New York State Energy Planning Board. 2014. Shaping the Future of Energy - 2014 Draft York State Energy Plan. Volume 1. Accessed September 17, 2014 at: http://energyplan.ny.gov/Plans/2014.aspx .

[85] *Ibid*. Page 20.

[86] Regional Greenhouse Gas Initiative. Regulated Sources. Accessed September 14, 2104 at: http://www.rggi.org/design/overview/regulated_sources.

[87] Regional Greenhouse Gas Initiative. The RGGI CO_2 Cap. Accessed September 14, 2104 at: http://www.rggi.org/design/overview/cap.

[88] FERC. FERC & EPAct 2005 Meeting Milestones. Accessed September 17, 2014 at: http://www.ferc.gov/legal/fed-sta/ferc-and-epact-2005.pdf.

New York, reliability rules are established by several regulatory entities, including the NYSRC and the NPCC, and are reviewed and adopted, as appropriate, by the PSC.

2.3 TRENDS IN ELECTRICITY DEMAND

The EIA defines energy consumption as simply "the use of energy as a source of heat or power or as a raw material input to a manufacturing process."[89] Peak demand is one measure of consumption, defined as "the maximum load during a specified period of time."[90] Peak demand takes into account the rate of consumption, or the time period over which a certain amount of power is consumed. For example, 1kWh of consumption could result from using one 100 Watt bulb for ten hours, or ten 100 Watt bulbs for one hour. While these represent the same level of energy consumption, the peak demand is different (i.e., 100 Watts versus 1,000 Watts), with the latter requiring ten times more system capacity. According to NYISO, peak demand, also known as peak load, is usually measured hourly. Peak demand is an important factor because reliability standards, such as reserve requirements, are based on projected peak demand.

In looking at trends in energy consumption, the U.S., electricity demand fell for the third consecutive year, dropping by 0.1 percent between 2012 and 2013.[91] **Exhibit 2-2** below presents historical trends in electric energy demand in New York State. As shown, electricity demand in New York increased slightly in 2013, however, this year-to-year comparison is distorted, slightly, by the extended outages that occurred in 2012 as a result of Hurricane Sandy. Over the past ten years, New York's electric energy demand grew by an average annual rate of 0.23 percent.[92] It is interesting to note that 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.[93]

According to the EIA, in 2010, New York State is the eighth largest energy consumer in the U.S. The State, however, had the second lowest energy consumption per capita in 2011 and 2012 after Rhode Island, due in part to widely-used mass transportation systems, influencing energy use in the transportation sector.[94]

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[89] EIA. 2014. EIA Glossary. Accessed on September 12, 2014 at: http://www.eia.gov/tools/glossary/index.cfm?id=E.

[90] EIA. 2014. EIA Glossary. Accessed on September 12, 2014 at: http://www.eia.gov/tools/glossary/index.cfm?id=P. Also, NYISO indicates that peak demand, also known as peak load, is usually measured hourly. See also: NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

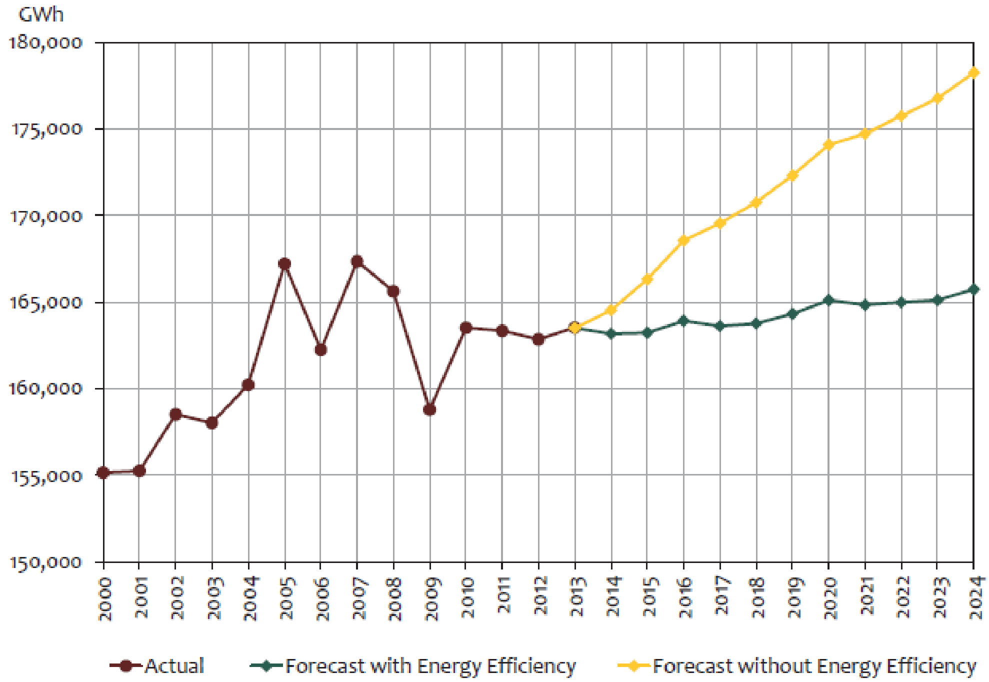
[91] NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

[92] *Ibid.*

[93] 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.

[94] EIA. State Energy Data System. Last Updated: March 27, 2014. Accessed August 21, 2014 at: http://www.eia.gov/state/?sid=NY.

EXHIBIT 2-2 NEW YORK STATE ELECTRIC ENERGY DEMAND TRENDS, ACTUAL AND FORECAST



Source: NYISO. 2014. Power Trends 2014: Evolution of the Grid. Page 16.

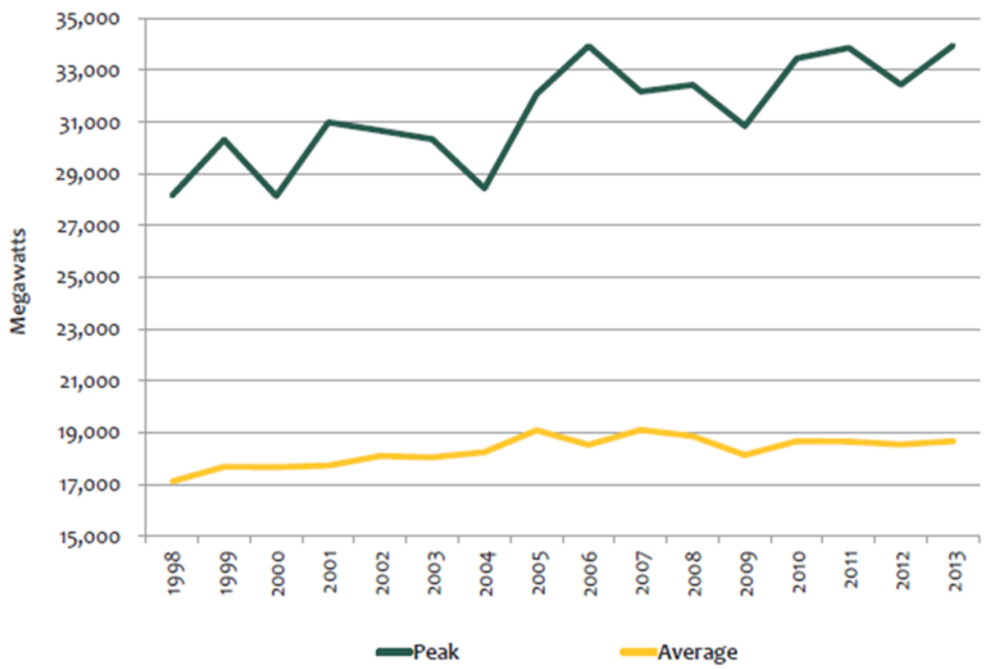
Demand for electricity tends to rise with population increases, economic growth, and the expansion of electric-powered technologies. In New York State and across the U.S., the economic recession that began in 2008 changed historical patterns of population and economic growth. Furthermore, fundamental changes in the use of electricity serve as a secondary driver of changes in energy consumption. Such changes include energy efficiency and emerging alternatives to grid-supplied power, such as customer-sited solar photovoltaic systems.[95]

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. During the past decade, the average annual growth rate for peak demand in New York was roughly two percent.[96] As illustrated in **Exhibit 2-3**, peak demand is increasing as average demand remains relatively constant.

[95] NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

[96] *Ibid*.

EXHIBIT 2-3 PEAK VERSUS AVERAGE DEMAND IN NEW YORK STATE: 1998-2013



Source: NYISO. 2014. Power Trends 2014: Evolution of the Grid. p. 16.

As an example, when comparing 1998 to 2013, the new peak set in 2013 is nearly 5,800 megawatts (MW) higher, whereas average demand increased by a much smaller 1,500 MW during the same period. Within a span of six months in 2013, New York State set two, new seasonal records for peak electric demand; an all-time record peak of 33,956 MW set during a summer heat wave in July 2013 and a record winter peak of 25,738 MW set during the extreme cold that accompanied the January 2014 "polar vortex."[97]

During both of these record setting demand events, New York's electric system maintained reliability without resorting to emergency measures that reduce or curtail electric service to customers; however, these events underscored the unique challenge associated with peak electricity demand. To meet peak demands under New York's current centralized generation system, New York utilizes a variety of mechanisms. For example to address the address the summer peak demand in 2013, New York State used demand response programs and imported electricity from the Ontario and PJM International Connection LLC (PJM) regions. To address to 2013/2014 winter record peak demand, New York imported natural gas from New England and began using oil for generation, as the relative cost of oil-fired generation fell below natural gas-fired generation[98]

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[97] *Ibid.*

[98] NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

Geographical Distribution of Electricity Demand

As shown in **Exhibit 2-4**, electricity consumption and demand in New York State varies significantly between upstate and downstate areas. In 2013, downstate areas, including New York Control Area (NYCA) load zones H-K, represented more than half of the State's electricity usage. Additionally, 2013 peak summer demand in New York City and Long Island exceeded that of the rest of the State.

EXHIBIT 2-4 2013 ELECTRICITY DEMAND, BY NEW YORK CONTROL AREA LOAD ZONE

STATE SUB-AREA	NYCA LOAD ZONE	2013 ANNUAL ENERGY USAGE (GWh)	PEAK DEMAND (MW)	
			SUMMER	WINTER
Upstate	A (West)	15,790	2,549	2,358
	B (Genesee)	9,981	2,030	1,645
	C (Central)	16,368	2,921	2,781
	D (North)	6,448	819	848
	E (Mohawk Valley)	8,312	1,540	1,415
	F (Capital)	12,030	2,392	1,989
	G (Hudson Valley)	9,965	2,358	1,700
Downstate	H (Millwood)	2,986	721	625
	I (Dunwoodie)	6,204	1,517	974
	J (New York City)	53,316	11,456	7,810
	K (Long Island)	22,114	5,653	3,594
Upstate Subtotal		78,894	14,609	12,736
Downstate Subtotal		84,620	21,705	14,703
TOTAL		163,514	33,956	25,738

Source: NYISO, 2014 Load & Capacity Data "Gold Book." Page 21.

Electricity Demand Forecast

Overall electric energy use is forecast to grow at an average annual rate of 0.16 percent over the next decade. As a result of the generation, transmission, and demand-side resources developed since 2000, in the near-term, the ability of New York's electric system to meet demand remains positive and the existing array of resources continues to provide a surplus of supply.[99] Peak demand, however, is forecast to grow at an annual average rate of 0.83 percent from 2014 through 2024; that is, current forecasts expect that the amount of power used during periods with the highest electricity demand will increase at a faster rate than the amount of power used on a day-to-day basis.[100] Additional discussion of mechanisms to meet peak demand is included below in the section on Generation Reliability.

2.4 ELECTRICITY PRICES

As of May 2014, New York State had the second highest average retail residential electricity prices in the U.S., at 20.62 cents/kWh, as compared to 12.84 cents/kWh on average for the U.S.

[99] *Ibid.*

[100] *Ibid.*

overall.[101] Between July of 2013 and July of 2014, the average New York State electricity rates ranged from a low of 18.8 cents/kWh in October to a high of 23.2 cents/kWh in January .[102] **Exhibit 2-5** shows monthly retail electricity prices for New York State, as compared to the nationwide average from 2001 to 2013. **Exhibit 2-5** also shows monthly retail electricity prices for the New York City metropolitan area for the same period. Residential prices have increased by an annual average of 3.8 percent and 4.8 percent for New York State and the New York City metropolitan area, respectively; over the same time period, national residential prices grew by approximately 3.5 percent. Overall, New York State's residential prices have been higher than the nationwide average by over 60 percent since 2001.

EXHIBIT 2-5 HISTORICAL RESIDENTIAL RETAIL ELECTRICITY PRICES, 2000-2013

Source: U.S. Energy Information Administration, *Electric Power Monthly*, Table 5.6.A, "Average Retail Price of Electricity to Ultimate Customers by End-Use Sector, by State," and U.S. Department of Labor, Bureau of Labor Statistics, *Consumer Price Index - Average Price Data*, *New York-Northern Jew Jersey-Long Island, Electricity per KWH, 2001-2014*, Series APUA10172610.

New York's electricity rates are influenced by a number of factors, including the wholesale energy market, which, as previously discussed, is administered by NYISO and overseen by FERC. According to the NYISO, New York's wholesale electricity markets involve "approximately 400 market participants in daily and hourly auctions that match the buyers and sellers of power" with

[101] EIA. New York State Profile and Energy Estimates: Rankings: Average Retail Price of Electricity to Residential Sector, June 2014. Accessed August 7, 2014 at: http://www.eia.gov/state/rankings/?sid=NY#/series/31.

[102] U.S. Bureau of Labor Statistics. Average Energy Prices, New York-Northern New Jersey-Long Island – July 2014. Accessed December 1, 2014 at : http://www.bls.gov/regions/new-york-new-jersey/news-release/pdf/averageenergyprices_newyorkarea.pdf

transactions averaging $7.5 billion annually.[103] New York's electricity rates are also driven by the cost of transmission, taxes and surcharges, and other factors.

Although much of New York's electric energy has historically been generated by base-load hydroelectric, coal, and nuclear units, currently the units that set the market clearing prices are usually natural gas units.[104] Generation owners bid their marginal costs of production, and since most of those costs are fuel costs, the price of fuel directly affects the price of electricity. The NYISO dispatches generators in the region starting from the lowest-priced bids to higher-priced bids. The bid price of the last generator used to satisfy the total demand for electricity therefore determines the wholesale price of electricity. The average wholesale electric energy price in 2013 was $59.13 per megawatt-hour (MWh), a 30 percent increase from the 2012 record-low of $45.28 per MWh.[105]

Wholesale and retail electricity prices are directly influenced by the cost of the fuels used by power plants to meet the demand for electricity. Power plants fueled primarily by natural gas account for more than half of the electric generating capacity in New York State, making the market sensitive to natural gas supply and price volatility. Natural gas prices for utilities are particularly volatile due to the structure of contracts used. Utilities typically buy natural gas for peak demand periods on interruptible contracts, which are designed to reflect scarcity and the actual costs of supply, and are designed to be lower priority than firm contracts, where price and supply are set up front. In addition, while recent pipeline expansions have eased constraints on pipeline capacity, the downstream New York City metro area remains more vulnerable to disruptions of pipeline capacity than other upstream market areas, especially during periods of high demand.[106] In 2013, and the winter of 2014, dramatic increases in the demand for natural gas for heating and limitations on gas transmission for electricity generation produced spikes in electricity prices. During 2013, the average price for natural gas in New York experienced a 58 percent increase over the historically low prices of 2012. **Exhibit 2-6** illustrates the close correlation between the average cost of wholesale electricity and the price of natural gas in New York.[107]

In addition to reflecting the cost of fuels used to produce power, wholesale electricity prices also rise and fall with power demands. Lower demand for electricity allows a larger proportion of

[103] NYISO. NYISO Fact Sheet. Accessed August 21, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Fact_Sheets/NYISO_Fact_Sheets/about%20the%20nyiso_factsheet%20apr7.pdf.

[104] Potomac Economics. 2013 State of the Market Report for the New York ISO Markets. May 2014. Page 5. Accessed September 18, 2014 at: https://www.potomaceconomics.com/uploads/nyiso_reports/NYISO_2013_SOM_Report.pdf.

[105] NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

[106] U.S DOE: Office of Electricity Delivery and Energy Reliability. 2013. Assessment of the Adequacy of Natural Gas Pipeline Capacity in the Northeast United States. http://energy.gov/oe/articles/assessment-adequacy-natural-gas-pipeline-capacity-northeast-united-states-report-now.

[107] NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

electricity to be generated by more efficient and less-costly facilities, resulting in lower prices.[108] The cost of electricity in New York State is high compared with neighboring states and varies throughout the state's load zones, primarily due to physical limitations of the transmission systems to move power to downstate regions of New York State with the highest demand.[109] While there is some capacity for importing power from other regions these sources are often more expensive.

EXHIBIT 2-6 NEW YORK NATURAL GAS COSTS AND ELECTRICITY ENERGY PRICES 2000-2013[110]

Source: NYISO. 2014. Power Trends 2014: Evolution of the Grid. Page 33.

As DER has become more prevalent, electricity providers in New York State have modified their pricing schemes to account for increased volatility, both in wholesale electric use, and in electric demand. For example, electric utilities may assess standby fees to recover costs of transmission infrastructure for users who typically get their electricity from DER, but may need electricity from the grid at times. In New York, customers with loads of over 300 kWh or greater for two out of 12 months by default are served by mandatory hourly pricing, although many companies offer other pricing schemes. For example, one company provides customers with an algorithm that allows them to automatically purchase more electricity when prices are lower.[111]

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[108] *Ibid*.

[109] U.S. Bureau of Labor Statistics. 2013. BLS News Release. Average Energy Prices New York-Northern New Jersey-Long Island May 2013. Accessed June 21, 2014 at: http://www.bls.gov/ro2/avgengny.pdf. (As cited in Indian Point Contingency Plan Final Generic Environmental Impact Statement. July 2013)

[110] NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

[111] NYISO. 2014. A Review of Distributed Energy Resources. Accessed September 27, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Other_Reports/Other_Reports/A_Review_of_Distributed_Energy_Resources_September_2014.pdf.

2.5 THE PRESENT ELECTRIC SYSTEM

This section provides information on each of the components of the electrical system in New York State: generation, transmission and distribution.

- **Generation** consists of the many generating units scattered throughout the State and the associated facilities typically located at a generating station, such as step-up transformers, controls, generation leads, switch gear, emissions control technologies (for example, selective catalytic reduction technologies, flue-gas desulfurization technologies, fabric filers, electrostatic precipitators), etc.
- **Transmission** includes the facilities that transport electricity at high voltage levels from the generation facilities (including those located outside the state) to the distribution system. It includes the transmission (and the subtransmission) wires, poles, cables, substations and switching stations, underground transmission equipment, etc.
- **Distribution** operates at lower voltage levels, carrying electricity delivered by the transmission system to customer end-users. It is primarily composed of distribution wires, cables, poles, substations, regulators, meters, and capacitor banks.

While some loads can be served directly from the generation facilities, and others served from the transmission system, for most services the entire system serves as an integrated unit.

Generation System

This section provides an overview of the existing electricity generation system serving New York State, including an overview of existing power plants and capacity, as well as an overview of planned generation projects and projected capacity. The section continues with a discussion of New York's generation system reliability and imports and exports.

Existing Power Plants and Capacity

Generators sell electricity to wholesale customers through bilateral contracts or the wholesale markets operated by NYISO.[112] Following electricity restructuring, the majority of former utility-owned generation capacity is now owned by more than two dozen independent power producers (IPP). In addition, the New York Power Authority (NYPA), the country's largest state public power organization, supplies up to one-quarter of New York State's total electricity demand. NYPA operates 16 generating facilities, including two of the State's major hydroelectric facilities (the Niagara Power Project and the St. Lawrence-FDR Power Project), and over 1,400 circuit-miles of transmission lines.[113]

As of 2012, there were more than 700 operational electric generating units in New York State.[114] For the summer of 2014, power resources available to serve New York State totaled 41,298

[112] DPS and Ecology and Environment Inc. 2013. Indian Point Contingency Plan Final Generic Environmental Impact Statement. Prepared for New York State Public Service Commission. July 2013. Accessed September 17, 2014 at: http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7B4FEE54FA-74C8-4954-B76F-ECDEEEC16266%7D.

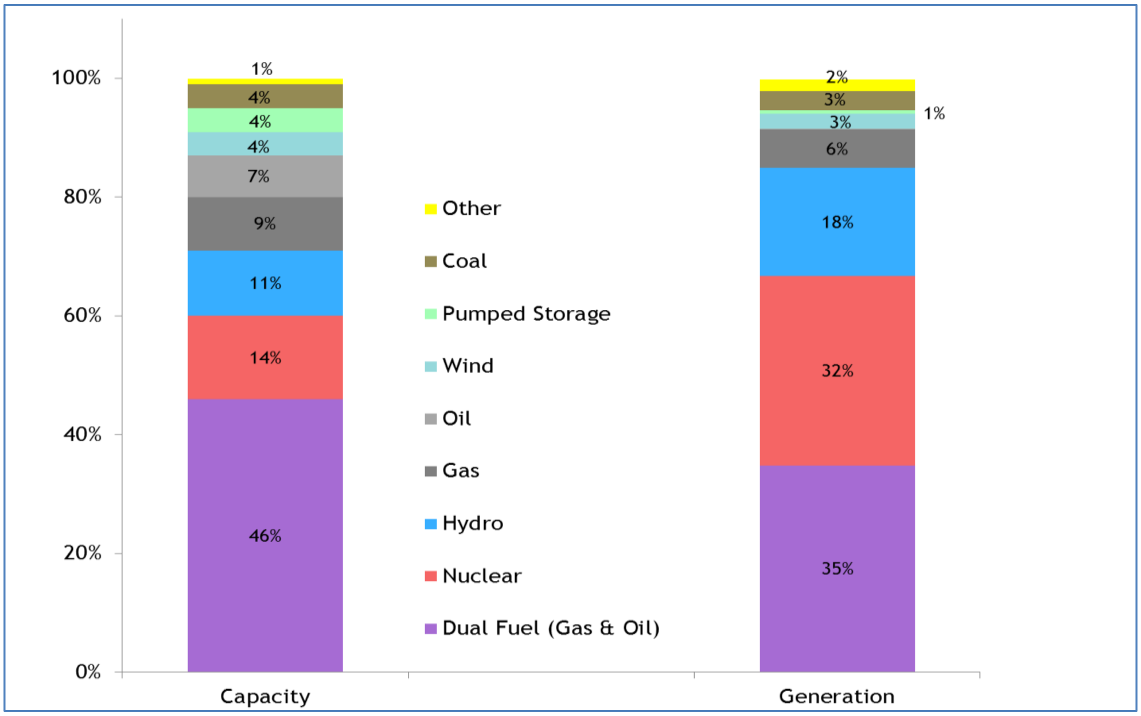
[113] New York Power Authority. NYPA website, "About NYPA." Accessed August 18, 2014 at: http://www.nypa.gov/about.html and http://www.nypa.gov/Generation/default.htm.

[114] New York State Energy Planning Board. 2012. New York State Transmission and Distribution Systems Reliability Study and Report." August. Accessed September 17, 2014 at: http://nyssmartgrid.com/wp-content/uploads/2012/09/reliability-study.pdf.

MW.[115] While the total is 154 MW lower than the previous year, the summer 2014 capacity remained above the projected peak demand of 33,666 MW, with sufficient excess to meet reserve requirements.[116] As of April 2014, New York State ranked ninth in the country for total net electricity generation with a total of 9,658 MWh.[117]

Exhibit 2-7 details New York State's power generation and capacity by fuel type. In 2013, over a third of the state's electric generation came from dual-fuel (gas and oil) facilities. Nuclear generation accounted for just under a third, and hydropower followed at 18 percent of total State generation. Wind facilities produced three percent of total electricity generation in 2013.[118]

EXHIBIT 2-7 NEW YORK CAPACITY AND GENERATION BY FUEL TYPE



Source: NYISO. 2014 Load & Capacity Data 'Gold Book.' April 2014. Pages 56-57.

Note: Percentages represent 2014 NYCA summer capability and 2013 NYCA generation.

[115] NYISO. 2014. Power Trends 2014: Evolution of the Grid. Page 24. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf. Includes installed generating capacity of 37,978 MW from in-state power projects, projected levels of demand response participation totaling 1,189 MW, and power available for imports from neighboring electric systems of 2,130 MW.

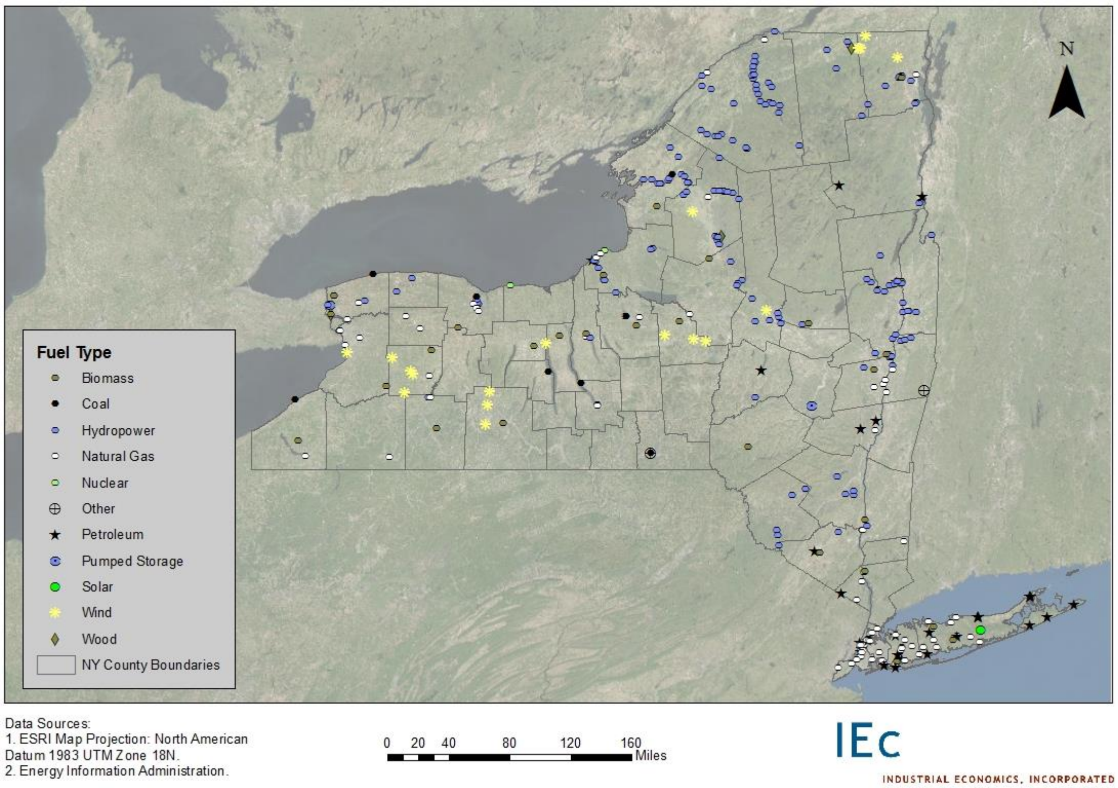
[116] NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

[117] EIA. New York State Profile and Energy Estimates: Rankings: Total Net Electricity Generation April 2014. Accessed August 7, 2014 at: http://www.eia.gov/state/rankings/?sid=NY#series/51.

[118] NYISO. 2014 Load & Capacity Data 'Gold Book'. April 2014. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/markets_operations/services/planning/Documents_and_Resources/Planning_Data_and_Reference_Docs/Data_and_Reference_Docs/2012_GoldBook_V3.pdf.

While New York State has a relatively diverse mix of generation resources, supply is less diverse when viewed at the regional level (see **Exhibit 2-8**). For example, a majority of the State's electric demand is situated downstate, whereas most of the state's power supplies (and particularly the sources with historically lower operating costs, such as hydroelectricity and nuclear power) are located upstate. This geographical variation in supply coupled with stringent air quality regulations, transmission limitations, and reliability standards means natural gas is used to meet the high levels of electricity demand generated in the downstate region (New York City and Long Island).[119,120]

EXHIBIT 2-8 LOCATION OF GENERATION BY FUEL TYPE, 2012-2013



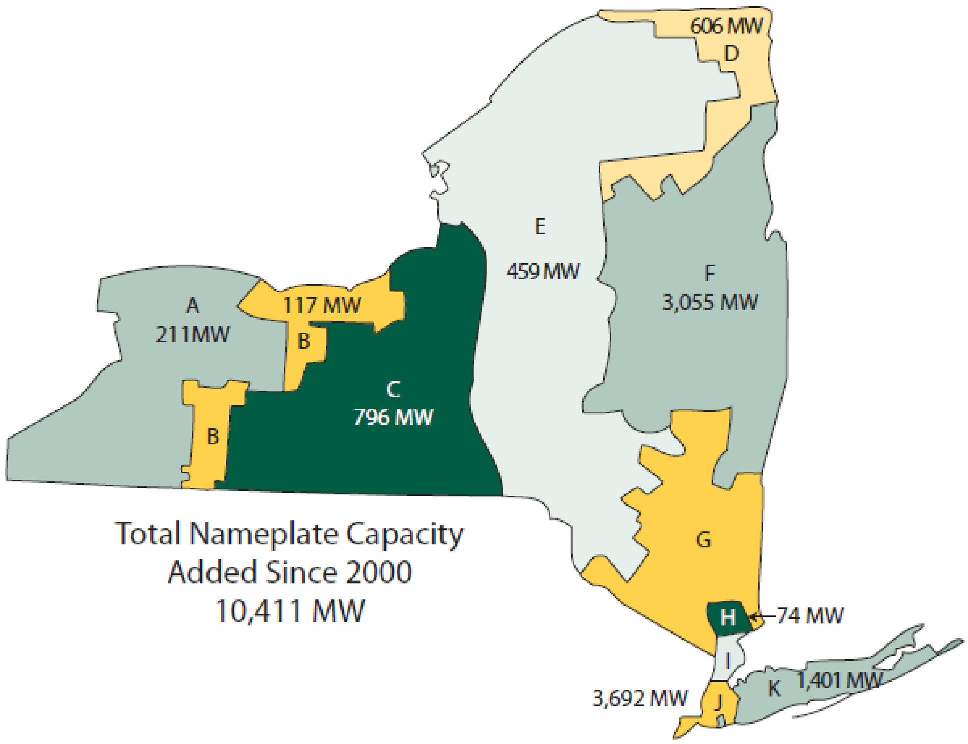
Since 2000, private power producers and public power authorities have added more than 10,400 MW of generating capacity in New York State, while total power plant retirements reached nearly 6,000 MW (based on summer capability periods). Added generation primarily came from wind-powered and gas-fueled facilities, while power plant retirements primarily came from New York's coal generation fleet. Over 80 percent of the new generation is located in New York City, on Long Island, and in the Lower Hudson Valley – the regions of New York State where power demand is greatest. Location-based pricing and regional capacity requirements of New York's

[119] NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

[120] However, many of these units are also capable of using oil when necessary, which affords some level of fuel diversity and reliability benefits to the system.

wholesale electricity markets encourage investments in areas where the demand for electricity is highest.[121] **Exhibit 2-9** shows the distribution of new generation in the state since 2000.

EXHIBIT 2-9 NEW GENERATION IN NEW YORK STATE: 2000-2013



Source: NYISO. 2014. Power Trends 2014: Evolution of the Grid.

Various factors can affect the mix of fuels used to generate electricity. For example, renewable portfolio standards adopted by the PSC set specific targets for a portion of renewable energy sources, while policy goals or environmental regulations may require power plants burning fossil fuels to meet certain emissions standards by limiting production and/or installing pollution controls. New York has experienced several changes in the mix of fuels over the past decade, including increases in generation fueled by natural gas and the emergence of wind-powered generation. In particular, the portion of New York State's generating capacity from gas and dual-fuel (gas and oil) facilities grew from 47 percent in 2000 to 55 percent in 2014, while the segment of generating capability from power plants fueled solely by oil dropped from 11 percent in 2000 to seven percent in 2014. The expansion of dual-fuel generation may be driven in part by the volatility of natural gas prices, as discussed earlier. In addition, dual-fuel plants play a role in meeting reliability requirements. During periods of high electricity usage, reliability rules require many of these plants to switch to burning oil. Outside of peak times, generators can choose to run on whichever fuel is less expensive.[122]

[121] NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

[122] *Ibid*.

Virtually non-existent in 2000, wind power currently (2014) accounts for approximately four percent of the State's generating capability. In contrast, generation from power plants using coal declined from 11 percent in 2000 to four percent in 2014. Generation from nuclear power plants and hydroelectric facilities, however, have remained relatively constant since 2000, each accounting for approximately 15 percent of total capacity over the years.[123] **Exhibit 2-7**, (above) illustrates the State's 2014 generating capacity by fuel source (based on 2014 summer capability).

Exhibits 2-10 and 2-11 provide details on the amount and location of generation capacity. As shown in **Exhibit 2-11**, while several of the largest generators are located in the New York City/Long Island region, a significant amount of generating capacity is located upstate, outside of the capacity zones responsible for the State's largest demand loads in New York City and Long Island.

Planned Generation Projects and Projected Capacity

New York's generation fleet is shifting as older facilities are retired and new renewable sources are developed. Nearly 60 percent of the generating capacity in New York State is at least 30 years old. Steam turbines fueled by natural gas and/or oil have an average age of more than 40 years, while combined cycle units fueled by natural gas have an average age of little more than a decade.[124] New York's hydropower facilities average age is over 50 years; however, NYPA recently modernized several major hydropower projects.[125] Renewable power projects such as wind and solar units are among New York's newest facilities. In addition, there are ongoing efforts to harness the potential of offshore wind as evidenced by the lease request by the Long Island-New York City Offshore Wind Collaborative for a 350 to 700 MW offshore wind project off the coast of Long Island.[126]

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[123] *Ibid*.

[124] *Ibid*.

[125] New York Power Authority. NYPA website, "Generation." Accessed August 20, 2014 at: http://www.nypa.gov/Generation/default.htm.

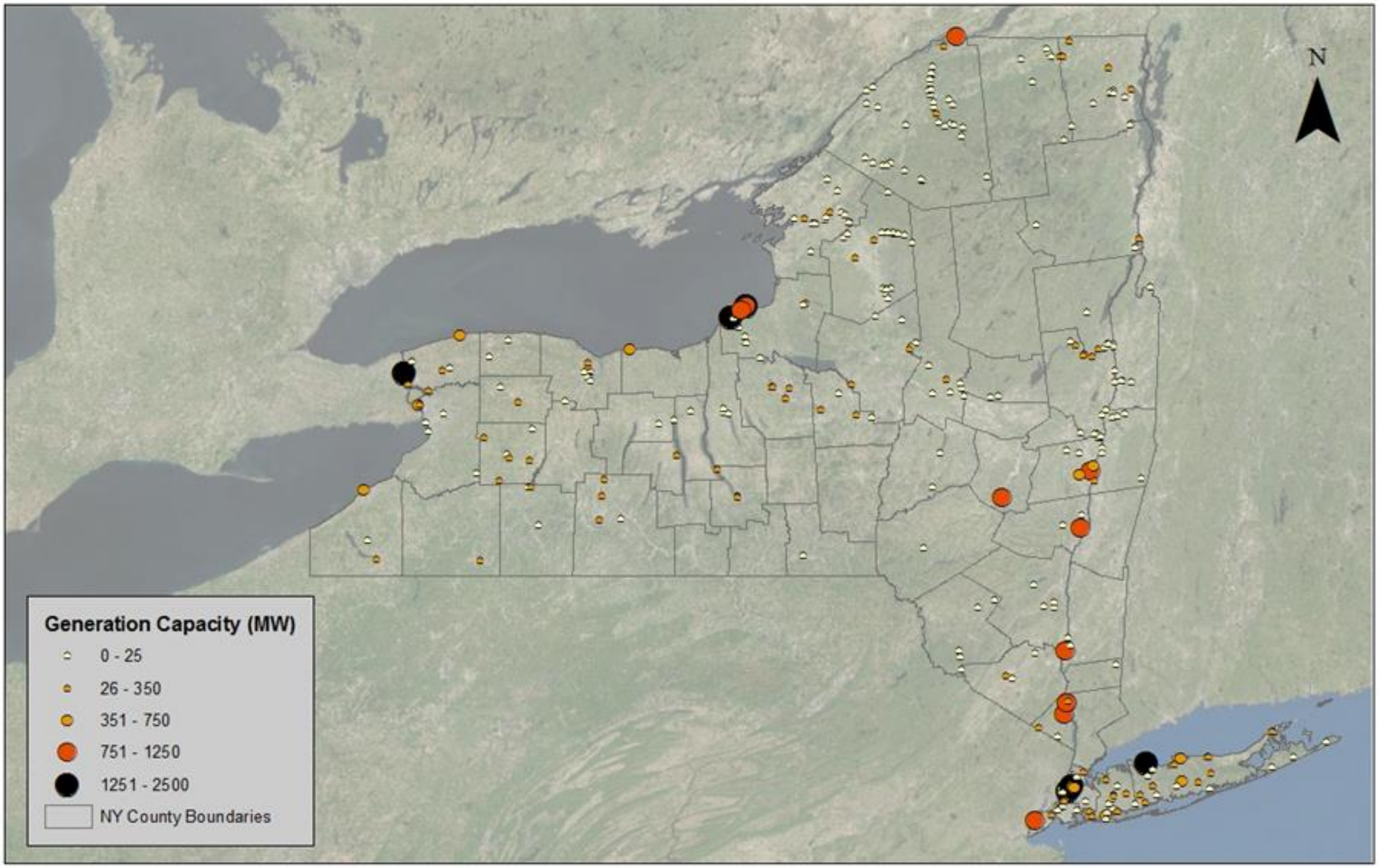
[126] Long Island-New York City Offshore Wind Project. Project website. Accessed August 20, 2014 at: http://www.linycoffshorewind.com/.

EXHIBIT 2-10 2014 INSTALLED GENERATION CAPACITY BY NYCA LOAD ZONE

STATE SUB-AREA	NYCA LOAD ZONE	INSTALLED CAPACITY (MW)	
		SUMMER	WINTER
Upstate	A (West)	4,491	4,548
	B (Genesee)	766	775
	C (Central)	6,546	6,883
	D (North)	1,609	1,636
	E (Mohawk Valley)	1,085	1,110
	F (Capital)	4,433	4,944
	G (Hudson Valley)	2,175	2,211
Downstate	H (Millwood)	2,115	2,131
	I (Dunwoodie)	-	-
	J (New York City)	9,458	10,228
	K (Long Island)	5,300	5,755
	Upstate Subtotal	21,105	22,107
	Downstate Subtotal	16,873	18,114
	TOTAL	**37,978**	**40,221**

Source: NYISO. 2014 Load & Capacity Data "Gold Book." p. 54, 55. Accessed September 18, 2014 at: http://www.nyiso.com/public/webdocs/markets_operations/services/planning/Documents_and_Resources/Planning_Data_and_Reference_Docs/Data_and_Reference_Docs/2014_GoldBook_Final.pdf

EXHIBIT 2-11 LOCATIONS OF GENERATING CAPACITY IN NEW YORK STATE



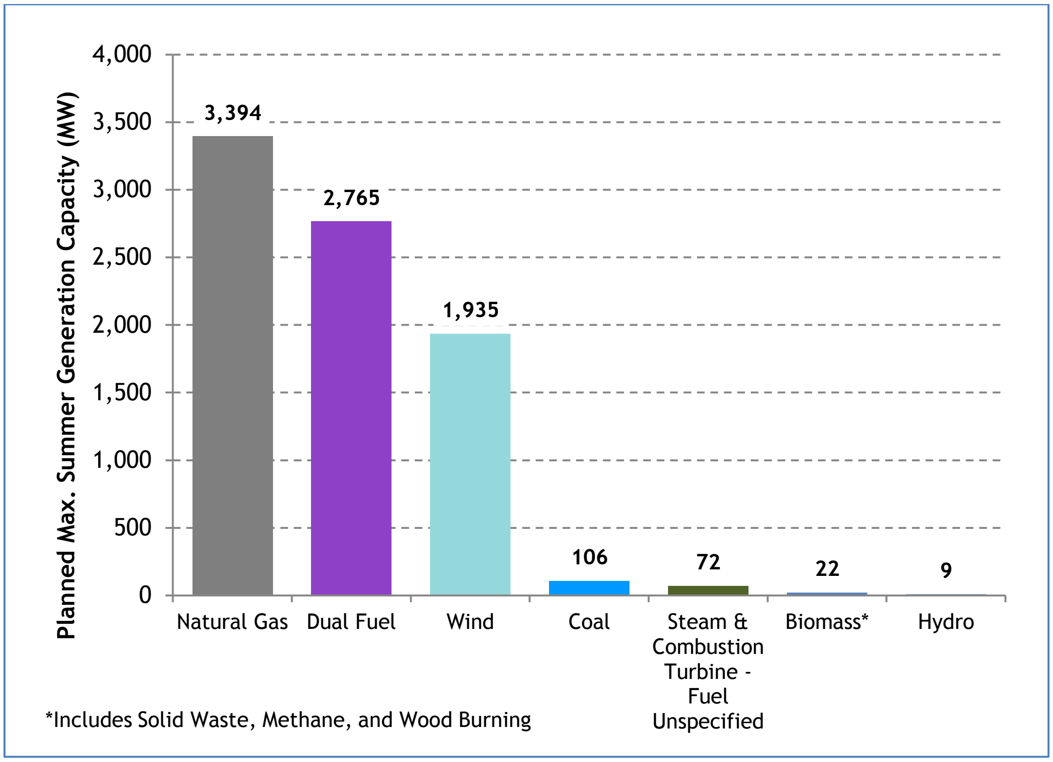
Data Sources:
1. ESRI Map Projection: North American Datum 1983 UTM Zone 18N.
2. Energy Information Administration.

0 20 40 80 120 160 Miles

IEc
INDUSTRIAL ECONOMICS, INCORPORATED

Between 1997 and 2012, the use of natural gas for electricity generation in the U.S. increased an average of six percent annually, or a total of 137 percent. While the nationwide share of electricity generated by natural gas fell slightly from 31 percent in 2012, to 28 percent in 2013, generation remained well above the 22 percent share held in 2007.[127] In New York State, electricity generated by natural gas grew from about 27,000 GWh in 2004, to 53,000 GWh in 2012.[128] Moreover, natural gas has become the predominant fuel for new generation. As illustrated in **Exhibit 2-12**, as of September 2014, 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 make up another large segment, accounting for nearly one-quarter of all proposed generating capacity.[129]

EXHIBIT 2-12 PROPOSED GENERATION BY FUEL TYPE (2014)



Source: NYISO.2014. Interconnection Queue. Accessed September 9, 2014 at: http://www.nyiso.com/public/markets_operations/services/planning/planning_resources/index.jsp.

[127] NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

[128] *Ibid.*

[129] NYISO Interconnection Queue. Accessed September 9, 2014 at: http://www.nyiso.com/public/markets_operations/services/planning/planning_resources/index.jsp. See also: NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

Generation Reliability

Published in August 2012, the New York State Transmission and Distribution Systems Reliability Study and Report provides an update on New York's transmission and generation systems, describing system reliability and establishing standards and criteria for measuring reliability.[130] The cumulative impacts of generator retirements is being evaluated by the NYISO in its 2014 Reliability Needs Assessment; a report which will also discuss potential needs for market-based and/or regulatory solutions to maintain reliability. Meanwhile, the NYISO and stakeholders continue to examine capacity market structures to encourage investment where needed to bolster power resources.

In addition, it is important to understand the State's use of natural gas when assessing system reliability. Because power plants rely on instantaneous delivery of natural gas, any disruption to power plants' natural gas supplies can affect the ability of a given plant to produce power. As such, the value of dual-fuel capability to electric system reliability is becoming increasingly apparent. For example, reliability rules for New York's electric system include "minimum oil burn" requirements for summer peak electricity loads in New York City and Long Island. At certain load levels, dual-fuel power plants are required to burn oil to guard against the possibility of a gas supply disruption causing electricity supply shortages. As it moves to address issues of market design, grid operations, and system planning perspectives, the NYISO is evaluating the impact of fuel storage capability, fuel inventories at generation facilities, and fuel availability/delivery issues.[131]

Imports and Exports

To meet its electricity load demand, New York State has historically imported electricity into the State. In 2013, approximately 17 percent of New York's electric consumption was imported.[132]

Exhibit 2-13 shows the transfer capabilities for the four main sources of imports coming into New York: Hydro-Québec, Ontario Hydro, New England, and PJM. The fuel types used by each generation source vary. For example, Hydro-Québec provides energy produced almost entirely from hydropower, while electricity from PJM is primarily from non-renewable resources.[133]

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[130] New York State Energy Planning Board. 2012. New York State Transmission and Distribution Systems Reliability Study and Report. August. Accessed September 18, 2014 at: http://nyssmartgrid.com/wp-content/uploads/2012/09/reliability-study.pdf.

[131] NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

[132] NYISO. 2013 CARIS Benchmark Results: Preliminary. Presentation dated June 14, 2013. Accessed August 20, 2014 at: http://www.nyiso.com/public/webdocs/markets_operations/committees/bic_espwg/meeting_materials/2013-06-14/ESPWG%20Benchmark%20Results%2061413%20revised.pdf.

[133] Hydro-Québec. 2014. "Hydro-Quebec at a Glance." Accessed August 25, 2014 at: http://www.hydroquebec.com/about-hydro-quebec/who-are-we/hydro-quebec-glance.html. Also, see, PJM. 2014. Renewable Energy dashboard. PJM Queued Generation Active and Under Construction. Accessed August 25, 2014 at: http://www.pjm.com/Home/about-pjm/renewable-dashboard.aspx.

EXHIBIT 2-13 TRANSFER CAPABILITIES FROM NEIGHBORS INTO NEW YORK CONTROL AREA

LOCATION	IMPORT TO NEW YORK (MW)
Ontario	1,725
Quebec	1,500
New England	2,025
PJM	3,400
Source: New York State Energy Planning Board. 2012. New York State Transmission and Distribution Systems Reliability Study and Report." August. Page 13. Note: Transfer capability from New York to neighbors would be different.	

In addition to the four primary interfaces with adjacent regions, 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. The controllable lines collectively import nearly 2.2 GW directly to downstate areas. The total transfer capability between New York and the adjacent regions is substantial relative to the total power. **Exhibit 2-14** 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 2012 and 2013.[134] As shown, the vast majority of the State's imports come from Canada, with almost 60 percent of New York's net imports during peak hours provided solely by Hydro-Québec.

EXHIBIT 2-14 AVERAGE NET IMPORTS (MW) FROM NEIGHBORING AREAS DURING PEAK HOURS

YEAR	HYDRO QUEBEC	ONTARIO	PJM	NEW ENGLAND	CSC	NEPTUNE	1385	VFT	HTP	TOTAL
2012	1,294	666	572	-239	268	267	120	64	0	**3,012**
2013	1,296	808	489	-463	245	371	99	124	46	**3,016**
Source: Potomac Economics. 2013 State of the Market Report For the New York ISO Markets. May 2014. Accessed September 18, 2014 at: https://www.potomaceconomics.com/uploads/nyiso_reports/NYISO_2013_SOM_Report.pdf										

Power flows continuously between New York and its surrounding areas depending on system needs, physical constraints, and market conditions. While more power generally flows into New York State for consumption than is exported, New York State exports some electricity to support the New England and PJM systems at peak times and during emergency situations.[135] In 2013, such regional support resulted in the export of approximately two percent of the energy generated in New York State.[136]

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[134] Potomac Economics. 2013 State of the Market Report for the New York ISO Markets. May 2014. Accessed September 18, 2014 at: https://www.potomaceconomics.com/uploads/nyiso_reports/NYISO_2013_SOM_Report.pdf.

[135] DPS and Ecology and Environment Inc. 2013. Indian Point Contingency Plan Final Generic Environmental Impact Statement. Prepared for New York State Public Service Commission. July 2013. Accessed September 17, 2014 at: http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7B4FEE54FA-74C8-4954-B76F-ECDEEEC16266%7D.

[136] NYISO. 2013 CARIS Benchmark Results: Preliminary. Presentation dated June 14, 2013. Accessed August 20, 2014 at: http://www.nyiso.com/public/webdocs/markets_operations/committees/bic_espwg/meeting_materials/2013-06-14/ESPWG%20Benchmark%20Results%2061413%20revised.pdf.

While interconnected, the power grids and wholesale electricity markets serving various regions of the U.S. and Canada were developed separately and reflect differences in geography, climate, reliability requirements, and available power resources. Such differences can lead to inter-regional market and operational inefficiencies. As noted in NYISO's Power Trends 2014: Evolution of the Grid report,

> "[r]emoving barriers to the efficient flow of power between electric systems is an important component of enhanced operational flexibility. The electric system has a long tradition of interconnected operations to bolster reliable operations across utility and regional boundaries, as well as mutual aid among utilities when recovering from major disasters. The changing dynamics of power resources will require increased operational flexibility to sustain reliability, as:
>
> - Renewable resources with variable output become an increasingly larger share of generating capacity;
> - Distributed energy resources expand and require more sophisticated integration with the centralized grid; and,
> - The need to enhance system resilience grows in the face of extreme weather conditions."[137]

In an effort to enhance the utilization of existing resources and reduce costs for power consumers, NYISO is participating in the Broader Regional Markets initiative along with PJM Interconnection, Independent System Operator (ISO) New England, Midcontinent ISO, Ontario's Independent Electricity System Operator, and Hydro-Québec. The initiative is intended to allow faster responses to changing conditions by reducing the need to use more expensive local power if less costly power is available from a neighboring grid operator. Launched in 2013, the Market-to-Market Congestion Relief Coordination (MMCR) is designed to enable joint management of transmission limits that occur near the borders of the NYISO and PJM control areas (**Exhibit 2-15**). During 2013, the first year of MMCR's implementation, NYISO estimates savings of $4.7 million from increased management efficiencies and market-to-market coordination with PJM.[138]

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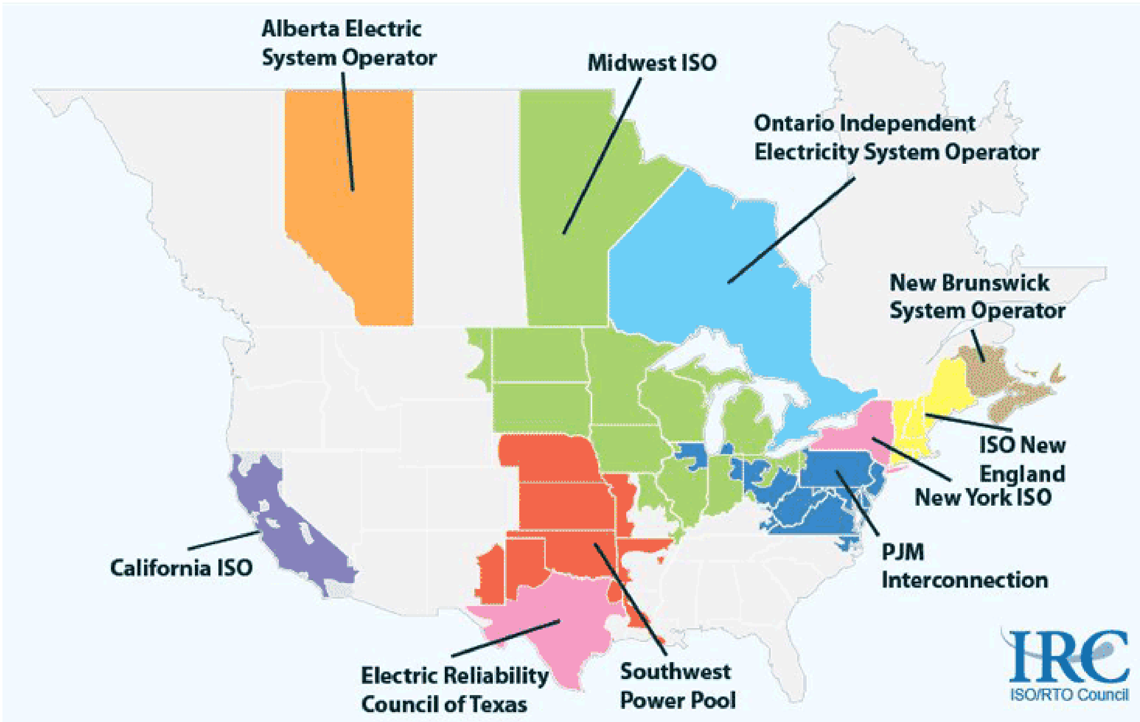
[137] NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

[138] *Ibid*. Page 10.

EXHIBIT 2-15 ISO/REGIONAL TRANSMISSION ORGANIZATIONS COUNCIL MEMBERSHIP



Source: NYISO. "ISO/RTO Council." Accessed on August 25, 2014 at: http://www.nyiso.com/public/markets_operations/services/planning/iso_rto/index.jsp.

Transmission System

This section provides an overview of the State's exiting transmission system as well as plans for new transmission capacity. In addition, this section discusses issues affecting transmission reliability, and advancements in smart grid technology in New York State.

Existing Transmission System

From the 1970s until 1999, the New York bulk transmission system (high-voltage transmission lines) was centrally operated by the New York Power Pool. As part of electricity restructuring, NYISO assumed operational control over the State's bulk transmission facilities in 1999. The main characteristic of bulk facilities is their ability to move power across the state as well as into adjoining states and Canada. As detailed in **Exhibit 2-16**, transmission facilities range in capacity from 115 kV to 765 kV. The majority of the 115 kV system (area transmission) remains under the operational control of the IOUs. Overall, the statewide transmission system includes more than 10,260 miles of high voltage overhead transmission lines, 790 underground circuit miles, and interties with neighboring states and Canada.[139]

[139] NYISO. 2014 Load & Capacity Data 'Gold Book.' April 2014. Accessed September 18, 2014 at: http://www.nyiso.com/public/webdocs/markets_operations/services/planning/Documents_and_Resources/Planning_Data_and_Reference_Docs/Data_and_Reference_Docs/2014_GoldBook_Final.pdf.

EXHIBIT 2-16 APPROXIMATE NEW YORK TRANSMISSION LINE MILEAGES

TRANSMISSION LINE TYPE	LINE MILEAGE BY FACILITY SIZE							
	115 kV	138 kV	150 kV DC	230 kV	345 kV	500 kV	500 kV DC	765 kV
Overhead	6,079	353	0	1,070	2,604	5	0	155
Underground	66	373	24	20	241	0	66	0
Total	6,145	626	24	1,090	2,845	5	66	155

Source: NYISO. 2014 Load & Capacity Data 'Gold Book'. April 2014. Page 113.

New York State's electric transmission system is predominantly owned by six IOUs (CHG&E, Con Edison, O&R, NIMO d/b/a National Grid, RG&E, and NYSEG), as well as by the LIPA and NYPA, who are collectively known as transmission owners (TOs). With certain exceptions, such as the siting of major transmission and generation facilities, LIPA and NYPA are not regulated by the PSC, while the six IOUs are.

Relying on the instantaneous exchange of scheduling information, the NYISO coordinates the operation of the New York State Power System in conjunction with each TO's Control Center.[140] While NYISO controls and coordinates activities across the State's Secured Transmission System, the TOs are responsible for physically maintaining and operating facilities.[141]

Since 2000, New York added more than 2,300 MW of transmission capability, primarily to facilitate the interstate transmission of power to southeastern New York from neighboring electricity markets.[142] **Exhibit 2-17** provides a historical view of New York's existing and new transmission lines since 2000.

In addition to the transmission lines, substations, switching stations, riser stations, and other such ancillary facilities are located throughout the system. Lower voltage, sub-transmission facilities (generally in the 34.5 kV to 69 kV range) traverse most parts of the State, further dispersing bulk electricity supplies to distribution systems that then carry electricity to electricity end-users (even though some customers take service at the transmission and sub-transmission levels). The transmission system, including the sub-transmission and substation facilities, occupies a total land area on the order of 250,000 acres or more.[143]

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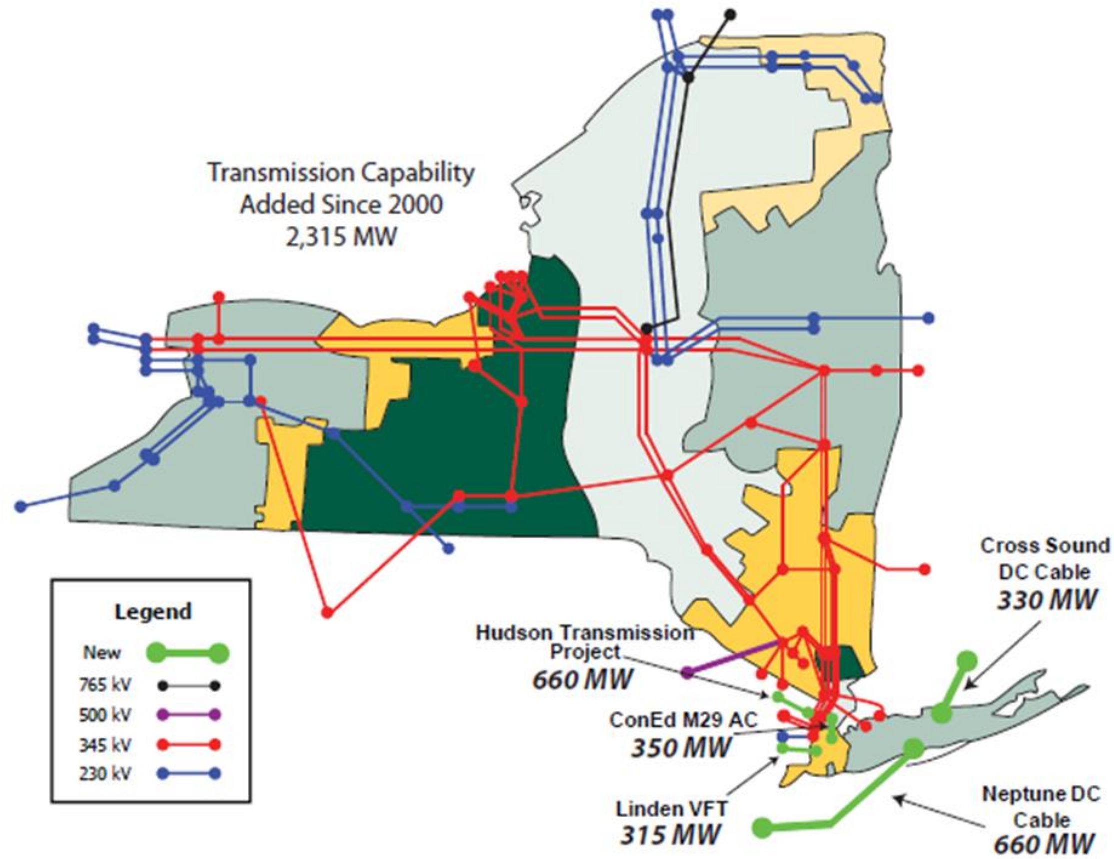
[140] NYISO. 2012. Transmission and Dispatching Operations Manual. October. Accessed August 21, 2014 at: http://www.nyiso.com/public/webdocs/markets_operations/documents/Manuals_and_Guides/Manuals/Operations/trans_disp.pdf.

[141] New York State Energy Planning Board. 2012. New York State Transmission and Distribution Systems Reliability Study and Report. August. Accessed September 18, 2014 at: http://nyssmartgrid.com/wp-content/uploads/2012/09/reliability-study.pdf.

[142] NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

[143] DPS. Final Generic Environmental Impact Statement in Case 03-E-0188 Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio Standard. Issued August 26, 2004. Accessed September 18, 2014 at: http://www.dps.ny.gov/NY_RPS_FEIS_8-26-04.pdf.

EXHIBIT 2-17 NEW TRANSMISSION IN NEW YORK STATE: 2000-2013



Source: NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

As noted in NYISO's Power Trends 2014: Evolution of the Grid report,

> "[p]hysical transmission constraints limit the economically efficient dispatch of electricity and can cause 'congestion' on the system that requires more local and more expensive generation to be operated to meet customers' needs." [144]

As previously discussed, while the southeastern region of New York State (Long Island, New York City, and the Lower Hudson Valley) accounts for approximately 65 percent of the State's electricity demand, only half of the State's generating capacity is located in that region.[145] As a result, surplus generation from other regions is transmitted to southeastern New York to meet demand. The most recent Congestion Assessment and Resource Integration Studies (CARIS) report, approved in November 2013, identified the most congested parts of the New York State bulk power system based upon historic data, as well as estimates of future congestion. **Exhibit 2-**

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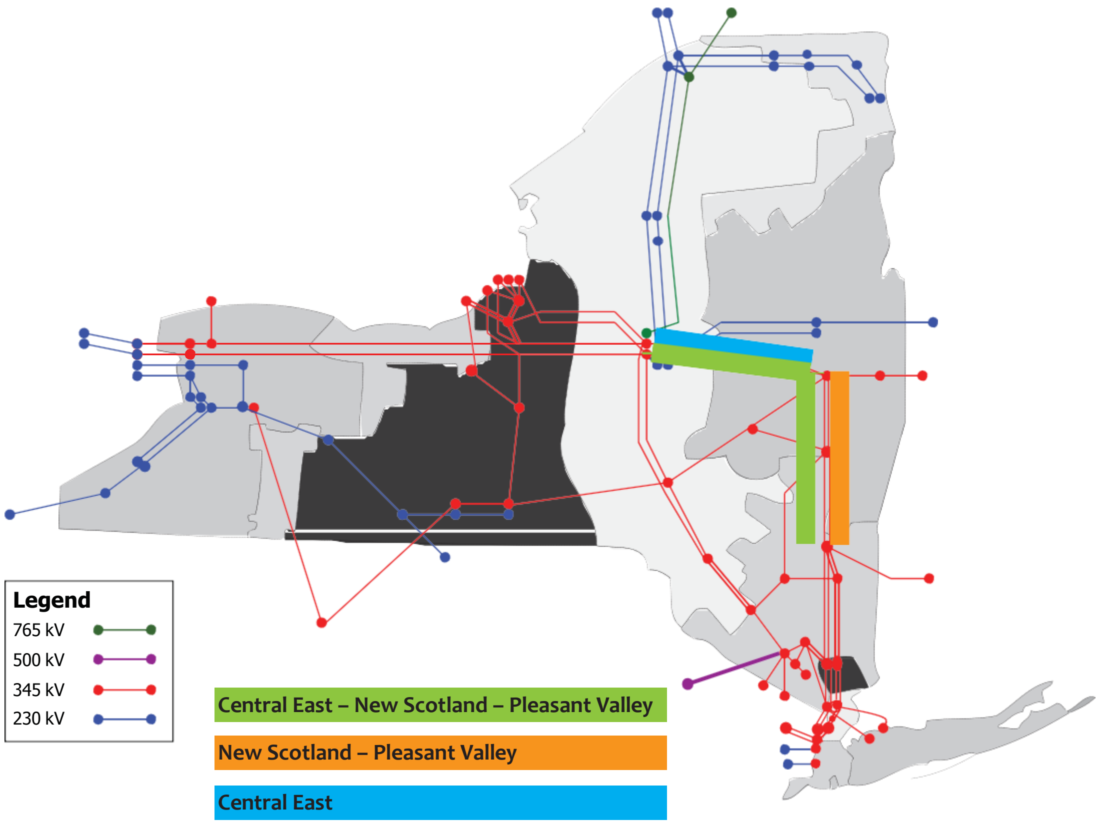
[144] NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

[145] *Ibid*. Page 27.

18 shows the three primary transmission congestion corridors identified in this report, including all or parts of the high-voltage transmission path from Oneida County through the Capital Region and south to the Lower Hudson Valley.

EXHIBIT 2-18 TRANSMISSION CONGESTION CORRIDORS IN NEW YORK STATE



Source: NYISO. 2013 Congestion Assessment and Resource Integration Study. CARIS – Phase I. November 19, 2013.

Planning/Licensing of New Transmission Capacity

More than 80 percent of New York's high-voltage transmission lines went into service before 1980. Of the State's more than 11,000 circuit-miles of transmission lines, nearly 4,700 circuit-miles will require replacement within the next 30 years, at an estimated cost of $25 billion.[146] New and upgraded transmission facilities will help address congestion, deliver renewable power resources from upstate locations, and diversify the State's fuel sources. To further these goals, various efforts are underway to upgrade and enhance New York's transmission system, most notably:

- Updated in April 2013, the New York Energy Highway Blueprint outlines plans for the development of 3,200 MW of new generation and transmission funded by public/private investment of up to $5.7 billion to transport surplus power supplies in upstate New York and north of the border in Quebec to high-demand regions in downstate New York. This includes over 1,000 MW of additional alternating current transmission capacity through currently congested areas of the Mohawk Valley Region, Capital region, and the Lower

[146] *Ibid*. Page 29.

Hudson Valley.[147] Transmission projects collectively named the Transmission Owner Transmission Solutions (TOTS), which were approved as part of the Indian Point contingency proceeding in November 2013.[148]

- An expedited siting process, proposed by Governor Cuomo in the 2014 State of the State Address, was developed by the PSC. The process is aimed at streamlining the process for the siting of transmission projects built on existing rights-of-way.[149]

There have also been several regulatory developments related to improving transmission systems. In 2011, FERC issued Order No. 1000, which expands upon previous orders related to transmission planning and cost allocation. Specifically, the order is designed to reduce barriers to transmission system investment. Among its components, the order required that planning processes consider transmission needs driven by public policy requirements. In August 2014, the PSC adopted procedures to guide the identification of such transmission needs and therefore warrant referral to the NYISO. Such procedures do not, however, supplant any applicable state and local approvals for siting, construction, and operation, which transmission developers would still be required to obtain.[150]

Transmission Reliability

The New York State Legislature, pursuant to Article 6 of the New York State Energy Law (Section 6-108), established and authorized the Energy Planning Board to undertake a study of the overall reliability of the State's electric transmission and distribution systems. Published in August 2012, the New York State Transmission and Distribution Systems Reliability Study and Report provides an update on New York State's transmission and generation systems, describing system reliability of the system, and the standards and criteria for measuring reliability.[151] According to this study,

> "[s]ince most of eastern North America (including New York State) is comprised of a single synchronous interconnection or "grid," each regional or local system can be adversely affected by the planning and operations of its neighbors. In

[147] New York Energy Highway Task Force. 2013. New York Energy Highway Blueprint Update. April. Accessed August 21, 2014 at: http://www.nyenergyhighway.com/PDFs/BluePrint/EHBPPT/Blueprint_Update_April%202013.pdf. Also see, NYPSC. Proceeding on Motion of the Commission to Examine Alternating Current Transmission Upgrades. Case No, 12-T-0502 Accessed September 12, 2014 at: http://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterCaseNo=12-t-0502; and NYPSC. In the Matter of Alternating Current Transmission Upgrades - Comparative Proceeding. Case No. 13-E-0488. Accessed September 12, 2014 at:

http://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterCaseNo=13-E-0488.

[148] NYISO. 2014. Power Trends 2014: Evolution of the Grid. Page 30. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

[149] *Ibid*. Page 30.

[150] DPS. Case 14-E-0068. Policy Statement on Transmission Planning for Public Policy Purposes. Issued and Effective August 15, 2014.

[151] New York State Energy Planning Board. 2012. New York State Transmission and Distribution Systems Reliability Study and Report. August. Accessed September 17, 2014 at: http://nyssmartgrid.com/wp-content/uploads/2012/09/reliability-study.pdf.

> other words, the reliability of every power system is dependent on the reliability of every other power system on the grid." [152]

The study continues by identifying two important concepts for assessing transmission system reliability:

1. **Transmission operational reliability/security,** which addresses the ability of a system to withstand disturbances such as electrical short circuits or unanticipated loss of system elements; and,
2. **Resource adequacy**, which addresses the ability of the system to meet customers demand at all times, taking into account scheduled outages of system elements.[153]

Key factors that have the potential to affect reliability of New York's transmission infrastructure are the aging infrastructure, the possibility of environmental regulatory initiatives that could force retirement of critical resources, and the potential for higher than expected load growth.[154] As discussed in a recent white paper,

> "The state's generation portfolio will change in response to a carbon-constrained future, retirement of older plants, and low natural gas prices. As new generating stations replace old ones, new transmission lines must be built to connect the new stations and move the power to load centers. Siting new transmission lines is extremely difficult, and some portions of New York's grid are reaching its operational limits and need to be replaced or upgraded. Many grid assets have been in operation for over 50 years and are reaching the end of their useful lives."[155]

Smart Grid[156]

Evolution of the electric system also includes deployment of advanced technology aimed at making the grid "smarter." The concept of "Smart Grid" encompasses a diverse set of technological solutions intended to enhance the operation of the transmission and distribution systems, and ultimately improve the ability of electricity consumers to manage their use of power. Efforts to expand smart grid technology build on a foundation of upgrading and modernizing key elements of the grid to enhance the precision with which grid operators manage the flow of electricity. Under provisions of the American Reinvestment and Recovery Act of 2009, the U.S. Department of Energy (DOE) Smart Grid Investment Grant (SGIG) program provided funding to system operators, transmission companies, and utilities across the U.S., resulting in the

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[152] *Ibid*.

[153] *Ibid*.

[154] *Ibid*.

[155] New York State Smart Grid Consortium. 2013. Powering New York State's Future Electricity Delivery System: Grid Modernization. January. Page 3. Accessed August 20, 2014 at: http://nyssmartgrid.com/wp-content/uploads/2013/01/NYSSGC_2013_WhitePaper_013013.pdf.

[156] NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 18, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

installation of more than 800 networked phasor measurement units (PMUs) to help avoid major electric system disturbances, like the 2003 blackout.[157]

In New York, the NYISO and New York's transmission-owning utilities and power authorities have completed power grid upgrades that are part of a statewide $75 million smart grid initiative, supported by $37.8 million in SGIG funds from DOE. The NYISO's partners in the statewide smart grid initiative include: Con Edison; National Grid; O&R; RG&E; CHG&E; NYSEG; NYPA; and LIPA. The project, completed in June 2013, deployed PMUs across the State to relay system electric conditions at a rate of 60 times per second—360 times faster than previously available. Connecting with networks in New England, the mid-Atlantic, and the Midwest will provide the NYISO grid operators with broader situational awareness of grid conditions throughout the eastern U.S. This regional interconnected PMU network will improve grid operators' ability to more quickly detect irregularities, predict problems, and take corrective action to maintain reliability. New York's SGIG project also deployed new capacitor banks to improve the efficiency of the bulk transmission system by reducing the amount of electricity that is lost when carried over long distances.[158]

Distribution System

Existing Distribution System

Existing distribution systems serve approximately 7.5 million customers across the State. Serving as the final step for most customers, the distribution system picks up where the transmission and sub-transmission systems leave off. Generally, electric distribution systems are designed for voltages from 34.5 kV down to 2.4 kV, with direct services to customers typically at 120/208 volts. The most common service voltage for electric distribution systems in New York State is 13 kV. Some customers are, however, able to take distribution service at higher voltage levels, in some cases even as high as transmission voltage levels. New York's distribution system includes both underground and overhead systems, with underground facilities generally found in newer installations and in highly congested areas such as New York City. There are over 300,000 miles of distribution lines throughout New York State, of which slightly more than half are overhead.

Operation and Control

The vast majority of distribution systems in New York State are operated and controlled by the six IOUs and LIPA. For example, Con Edison's distribution system makes up a large percentage of the underground facilities in the State.[159] In addition to the six IOUs and LIPA, there are 49 municipal utilities and four rural electric cooperatives that own and operate their own distribution facilities, serving over 150,000 customers.[160] In most cases, the municipal utilities and cooperatives are connected to the larger utilities (e.g., NYPA or LIPA) and, therefore, have a

[157] *Ibid*.

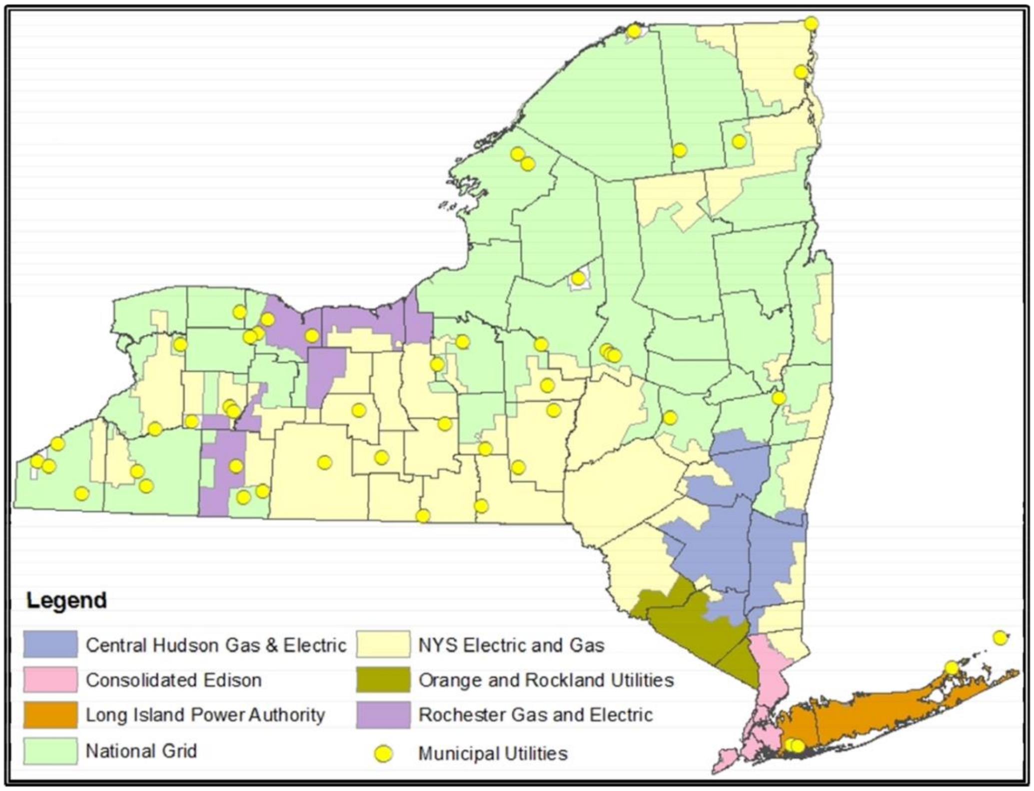
[158] *Ibid*.

[159] New York State Energy Planning Board. 2012. New York State Transmission and Distribution Systems Reliability Study and Report. August. Page 14. Accessed September 17, 2014 at: http://nyssmartgrid.com/wp-content/uploads/2012/09/reliability-study.pdf.

[160] DPS. Final Generic Environmental Impact Statement in Case 03-E-0188 Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio Standard. Issued August 26, 2004. Accessed September 18, 2014 at: http://www.dps.ny.gov/NY_RPS_FEIS_8-26-04.pdf.

relatively limited operating flexibility.[161] **Exhibit 2-19** illustrates the location of electric service territories and municipal utilities throughout New York.

EXHIBIT 2-19 LOCATION OF ELECTRIC SERVICE TERRITORIES AND MUNICIPAL UTILITIES THROUGHOUT NEW YORK STATE



Source: New York State Energy Planning Board. 2012. New York State Transmission and Distribution Systems Reliability Study and Report. August. Page 10.

Planning/Licensing of New Distribution Capacity

Local distribution companies are responsible for planning and licensing new distribution capacity/facilities. More specifically, local distribution companies are statutorily responsible to "distribute" power from energy suppliers to the end user (i.e., the customer). Licensing requirements for the siting of distribution facilities are normally governed by local jurisdictions and ordinances.[162]

The PSC requires the underground installation of new distribution facilities in residential subdivisions. The PSC also has rules governing the installation of small (up to 300 kVA) distributed generators to the distribution systems. These are referred to as Standardized Interconnection Requirements.[163]

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161 *Ibid*.

162 *Ibid*.

163 *Ibid*.

The IOUs and municipal utilities and cooperatives are further responsible for all aspects of customer services, including but not necessarily limited to, safety, reliability, metering, billing, and complaints. With respect to distribution, the PSC regulates the IOUs and many of the municipal utilities.

As new generation is increasingly made up of distributed energy resources, careful consideration will be needed to effectively integrate such resources into the State's larger electricity system. NYPSC recently issued updated guidance on interconnection requirements for new distributed generators 2 MW or less connected in parallel with utility distribution systems.[164] Net metering for grid-connected DG is available subject to technology, system and aggregate capacity limitations.[165]

Connecting and integrating distributed resources presents various challenges. To meet such challenges, the NYISO and other grid operators continue to modernize the electric system to integrate such resources, which will, in turn, help to reduce peak demand periods and provide increased operational flexibility.[166] For example, CHG&E currently operates a microgrid in Frost Valley, NY. CHG&E recently submitted a rate application to the PSC, which, if approved, would allow the utility to create a voluntary microgrid subscription program that could be developed in service areas with small populations and, in so doing, avoid the high costs associated with the construction of miles of infrastructure to reach remote areas.[167]

[164] NYPSC. 2014. New York State Standardized Interconnection Requirements and Application Process for New Distributed Generators 2 MW or Less Connected in Parallel with Utility Distribution Systems. February. Accessed September 13, 2014 at: http://www3.dps.ny.gov/W/PSCWeb.nsf/All/DCF68EFCA391AD6085257687006F396B?OpenDocument.

[165] For a summary of net metering in New York State, see: DOE. Database of State Incentives for Renewables and Efficiency (DSIRE). Accessed September 13, 2014 at: http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NY05R.

[166] NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 18, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

[167] Wood, Elisa. 2014. "*How microgrid subscriptions can strengthen the New York grid*." Accessed August 25, 2014 at: http://www.greenbiz.com/blog/2014/08/19/how-microgrid-subscriptions-can-revitalize-new-york-grid.

CHAPTER 3 | ENVIRONMENTAL SETTING

Consistent with 6 NYCRR §617.9(b)(5)(ii) of SEQRA, this chapter describes in detail the environmental setting of areas potentially impacted by the proposed REV and CEF actions, which include the entire State of New York in this case.

Chapter 1 describes the potentially wide-ranging actions currently envisioned through the REV and CEF proceedings. Chapter 2 describes the State's energy industry, which the REV and CEF proceedings intend to transform. Fundamental shifts in the way the State of New York generates, distributes, and uses electricity may, in turn, create different types of impacts on the State's array of environmental resources.

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 provided in this chapter will hereafter serve as a baseline description of existing environmental conditions against which the impacts of changes in the energy industry from the REV and CEF are evaluated and compared in Chapters 5 through 10.

This chapter is organized into 16 sections consistent with the following environmental resource areas:

- **Physical Geography** provides a brief description of the State's physiography, geology and soils;
- **Land Use** describes the different types of current land uses across the State, including agricultural and existing land uses associated with the electric industry;
- **Water Resources** describes the State's surface-water, groundwater, wetlands, ocean and beaches, water quality and water use and availability;
- **Climate and Air Quality** summarizes climatic conditions such as temperature and precipitation, air quality, and greenhouse gas emissions;
- **Forest Resources** summarizes New York's forestlands;
- **Critical Environmental Areas,** as defined by State and local governmental agencies;
- **Species Biodiversity** describes the State's plants and animals;
- **Scenic and Visual Resources** describes the State's scenic and visual resources in terms of vegetation, landscape, and unique natural views;
- **Open Space** summarizes the State's definition and recognition of the importance of open space;
- **Cultural and Historic Resources**, including the importance of those resources;

- **Waste Management** covers solid and hazardous waste generation and management practices, wastewater services, the types of waste from current activities, the means by which waste is disposed, and pollution prevention practices;
- **Noise and Odor Pollution**, including ambient noise and vibration levels, analytical techniques, and the identification of sensitive receptors;
- **Public Health** summarizes potentially relevant public health issues;
- **Growth and Community Character** describes the history of population growth in New York State and the factors that contribute to the development and maintenance of community character;
- **Transportation** briefly describes the transportation modes and facilities found throughout New York State; and
- **Socioeconomics and Environmental Justice** provides an overview of the State's socioeconomic characteristics, including employment, income and wages, housing, municipal revenues and a description of low-income and minority populations that could be subject to disproportionate and adverse environmental impacts.

3.1 PHYSICAL GEOGRAPHY

New York State is the 27th largest state in the U.S. by size, covering more than 47,000 square miles (30.1 million acres),[168] including approximately 1,600 square miles (1.0 million acres) of inland water bodies.[169] The topography of New York State is generally hilly or mountainous in all areas except Long Island and the relatively level areas adjacent to Lake Erie, Lake Ontario, and the St. Lawrence River. The highest topographic variations are found in the Catskill and Adirondack Mountains where elevations reach higher than 4,000 feet and variations between peaks and valleys of up to 2,500 feet. Approximately 40 percent of New York State has an elevation of more than 1,000 feet above sea level.[170] In the following sections, we briefly discuss additional features of New York's physical geography, including physiography, geology, and soils.[171]

Physiography

The U.S. is divided into eight physiographic regions. A physiographic region is one in which the shape of the land and surface is relatively constant and is different from surrounding or adjacent regions. As shown in **Exhibit 3-1**, New York overlaps three physiographic regions, with the majority of the State falling within the Eastern Appalachian Highlands region of North America, which extends from New England, south to Alabama and Georgia, and west to the continental interior plains.

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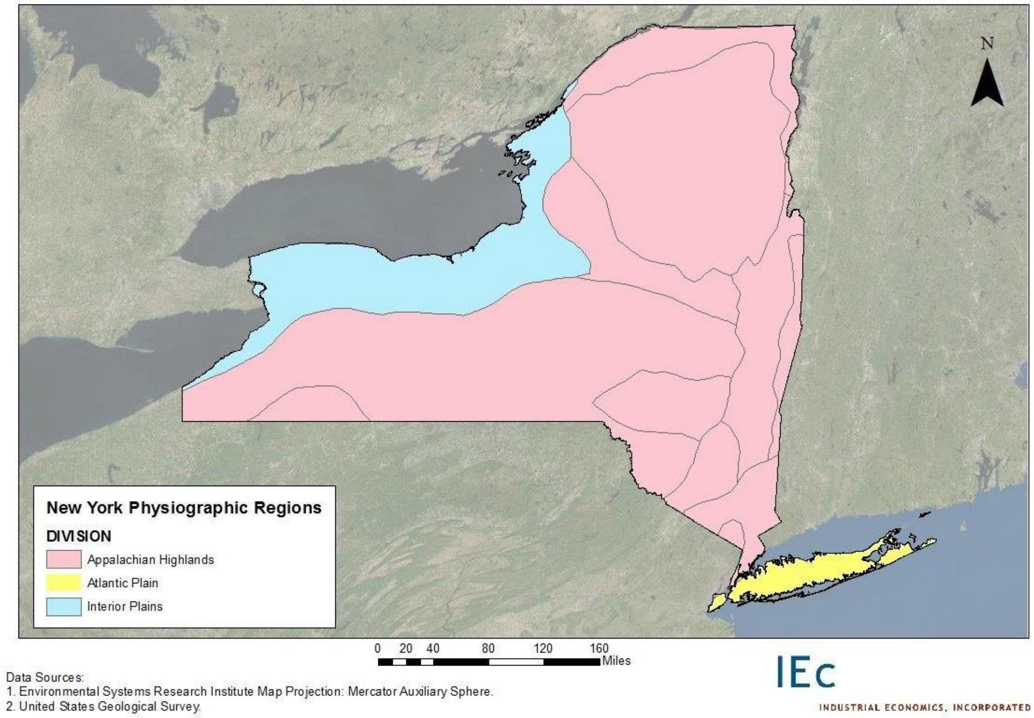
[168] U.S. Census Bureau. State & County Quick Facts – New York. Accessed August 14, 2014 at: http://quickfacts.census.gov/qfd/states/36000.html.

[169] Cornell University. The Climate of New York. Accessed September 29, 2014 at: http://archive.today/UGwJ.

[170] *Ibid*.

[171] Physiography is the study of the origin and evolution of landforms.

EXHIBIT 3-1 NEW YORK PHYSIOGRAPHIC REGIONS



Geology

New York State's electric industry is influenced by the State's geology. Geology determines the types and distribution of soils, water drainage, topography and ecosystems. In turn, these factors impact land use, development, and population distribution, thereby indirectly affecting the electric industry.

More directly, the buffering ability of bedrock geology, soils, and water can help limit the damage caused by acidic air pollutants released from sources such as electric generation, industrial activities, and transportation. The four types of geological features that provide pollution buffering in New York include: (1) shale and shale-sandstones, such as limestone; (2) granite; (3) sands and clays; and, (4) soils. The ability of certain geologic features to buffer air pollutants from surrounding soils and surface waters depends on the amount of calcium carbonate released by natural weather and erosion processes. Geologic features resistant to such processes, such as granite in the Adirondack Mountains and Hudson Highlands, provide minimal buffering capacity due, in part, to a lack of calcium carbonate.

Shale and shale-sandstones such as limestone provide the greatest buffering capacity. This bedrock dominates in the Appalachian Highlands, Hudson Valley, and the periphery of Tug Hill (in upstate New York).[172] Large areas of sandstone are found in narrow bands of bedrock along the northern edge of the Appalachian Highlands, the south shore of Lake Ontario, the St. Lawrence River plain, and the Catskill Mountains. Several long, narrow bands of limestone bedrock are also found in the periphery of the Adirondacks, and along the Lake Ontario plain, the St. Lawrence River plain, and

[172] As discussed in Chapter 2, for purposes of this GEIS, upstate New York is defined as areas that fall within NYCA Load Zones A-G and downstate as areas that fall within NYCA Load Zones H-K.

the escarpment located south of the Mohawk River and west of the lower Hudson River. Large areas of limestone bedrock also occur at both the northern edge of the Hudson Highlands and along the Taconic Mountains. Although sands and clays erode rapidly, these geologic features, underlying most of Long Island, are primarily composed of silicates, which do not generate a lot of calcium carbonate and therefore provide little buffer to acidic pollution.

Soils

Soils across New York differ substantially from the State's underlying bedrock strata because the State's soils formed approximately 8,000 to 10,000 years ago on glacial tills or during glacial retreat. Due to glacial scouring and the subsequent fluvial transport of deposited materials, many areas of the State are marked by relatively thin soil mantles, evidenced by bedrock outcroppings that are common in some areas of the State. Large areas of the Adirondacks, Catskills, and Hudson Highlands contain only thin or generally non-existent soils, with substantial areas of steep terrain dominated instead by rock outcroppings.

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. For example, the highlands of eastern New York form natural barriers to transportation and settlement. As such, most New Yorkers live in the lowland areas in between, including the Lake Champlain/ Hudson River Valleys, and south of the Hudson Highlands, where the topography slopes down to sea level in New York City and Long Island.

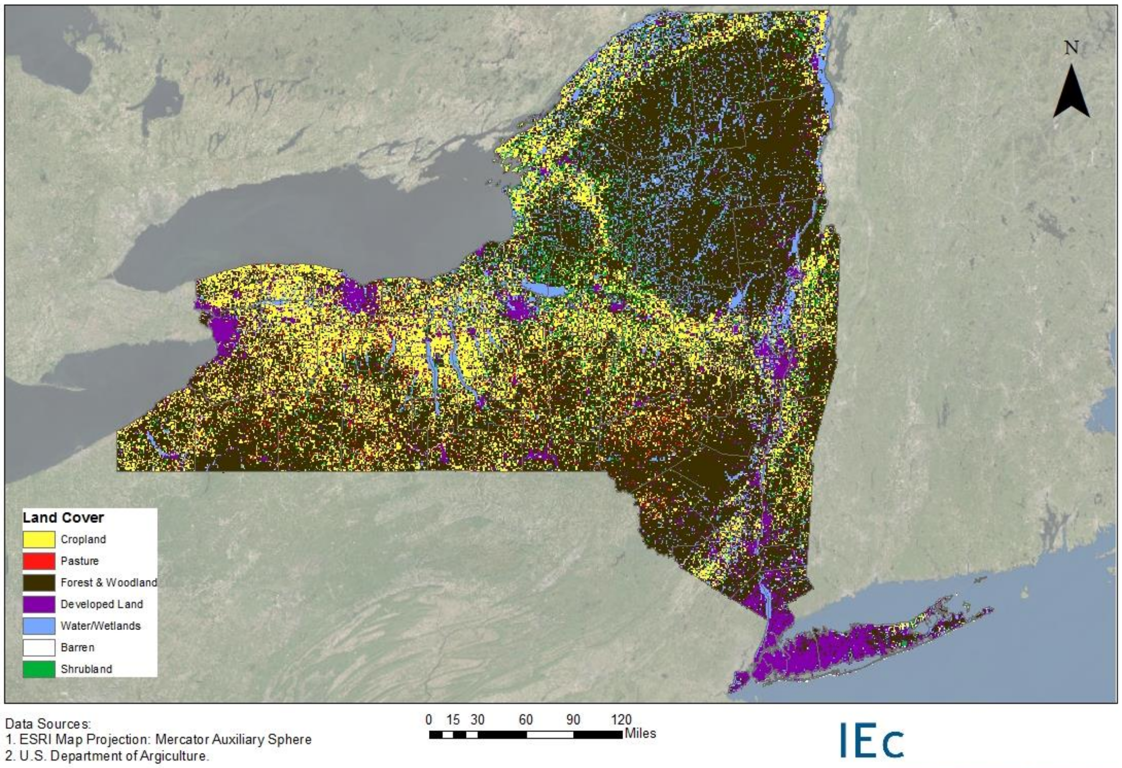
In addition to topography, land use is also influenced by such factors as proximity to developed areas and transportation networks, past uses of the land, and general societal and economic trends. The scope and scale of development across the State ranges from urban and suburban, to rural and natural areas. Because of topography, a variety of land uses are concentrated in a narrow corridor along the Hudson River. **Exhibits 3-2** and **3-3** 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 21 percent is active farmland. Developed areas, which consist primarily of residential, commercial, and industrial land uses, comprise approximately nine percent of the State.

EXHIBIT 3-2 NEW YORK STATE LAND USE SUMMARY

LAND TYPE	ACRES	PERCENT OF TOTAL
Cropland	5,812,586	19%
Pasture	577,821	2%
Forest & Woodland	17,491,240	56%
Developed Land	2,774,105	9%
Open Water	1,056,040	3%
Wetlands	1,987,096	6%
Barren	58,181	0%
Shrubland	1,343,420	4%
TOTAL	**31,100,489**	**100%**

Source: USDA. 2011. 2010 New York Cropland Data Layer. National Agricultural Statistics Service. Accessed August 21, 2014 at https://gis.ny.gov/gisdata/.

EXHIBIT 3-3 LAND USE ACROSS NEW YORK STATE



IEc INDUSTRIAL ECONOMICS, INCORPORATED

Local Land Use Planning

New York State constitutional "home rule" provisions mean that land use in New York State is primarily controlled at the municipal level. All cities in New York State and more than 70 percent of townships develop and adopt comprehensive land use plans, which address land use planning, conservation, zoning, and related regulatory requirements. Numerous statewide land use plans and resource management plans provide further guidance for local authorities on state-wide land use issues of importance (e.g., groundwater, coastal areas, etc.).

Agriculture[173]

In 2012, the value of New York's agricultural industry was over $5.4 billion, which includes agricultural production from approximately 35,500 farms operating on more than seven million acres of land. Farmland represents approximately 21 percent (6.4 million acres) of the State's total land area, of which approximately 5.8 million acres are arable land. The state's remaining farmland is composed of improved pasture, permanent pasture, woodland, and miscellaneous categories such as wetlands, excavations, and homestead sites.

Dairy represents the major agricultural commodity produced in New York. In 2013, approximately 615,000 milk cows produced nearly 13.5 billion pounds of milk, with a total value of nearly $3 billion on approximately 5,000 farms. A much smaller, but important, component of New York's agricultural industry is fruit and vegetable production, which occurs on approximately 241,000

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[173] New York State Department of Agriculture & Markets. Ag Facts. Accessed August 14, 2014 at: http://www.agriculture.ny.gov/agfacts.html.

acres. The total value of the State's field crops, fruits, and vegetables was approximately $2.7 billion in 2012. New York ranks first in production of cabbage and pumpkins, and third behind California and Washington in grape production. The value of New York's grape industry was estimated at $52.3 million in 2012. The majority (62 percent) of this value is from grapes utilized for juice, followed by grapes utilized for wine at 36 percent and the fresh market accounting for the remaining two percent of grapes' 2012 value. New York is also a leader in the production of maple syrup. In 2012, New York ranked second behind Vermont in both production and value, generating revenues of $15.7 million from 360,000 gallons of maple syrup.

EXHIBIT 3-4 SELECT CHARACTERISTICS OF THE NEW YORK STATE AGRICULTURAL INDUSTRY

STATISTIC	VALUE (2013)
Farmland	7,200,000 acres
Number of farms	35,500 farms
Average size of farm	203 acres
Average age of principal operator	57.1
Total sales (2012)	$5,415,125,000
Total net cash farm income	$1,216,800,000
Average per farm	$34,240

Source: USDA. 2012 and 2013. Census of Agriculture. Accessed August 14, 2014 at: http://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=NEW%20YORK and http://www.agcensus.usda.gov/Publications/2012/Online_Resources/Rankings_of_Market_Value/New_York/.

Agricultural lands and operations also play a role in the state's renewable energy industry. New York is the second leading state in operating anaerobic methane digesters that create electricity from manure waste. In 2013, New York had 23 operating digester sites and an additional three sites in the planning and implementation process.[174] Additionally, in 2012 New York State had 1015.14 MW of installed capacity of wind turbines on agricultural lands.[175]

Electric Industry Land Uses

Transmission and distribution lines account for the majority of the electric industry's direct use of land in New York. The statewide transmission system spans more than 180,000 acres plus a supporting network consisting of more than 10,000 overhead circuit miles and 600 underground circuit miles. [176] In addition, thousands of additional miles of local distribution lines convey electric power from utilities to customers.

[174] Newbold, E. 2013. "Anaerobic Digesters: an opportunity for farms to use manure for energy production, bedding and fertilizer." Cornell University. Accessed August 14, 2014 at: http://smallfarms.cornell.edu/2013/06/11/anaerobic-digesters/.

[175] IEc analysis of EIA. 2012. Annual Electric Generator Report. EIA-860. Washington, DC.; and EIA. 2012. Power Plant Operations Report. EIA-923. Washington, DC.

[176] DPS. Final Generic Environmental Impact Statement in Case 03-E-0188 Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio Standard. Issued August 26, 2004. Accessed September 18, 2014 at: http://www.dps.ny.gov/NY_RPS_FEIS_8-26-04.pdf.

3.3 WATER RESOURCES

This section describes New York's water resources beginning with the State's watersheds and then describing the State's lakes and rivers, wetlands, oceans and estuaries, groundwater, drinking water, water use, and water quality. This section ends with a brief discussion of the intersection of energy and water.

Watersheds

The primary classification of water resources is the watershed. A watershed (also referred to as a drainage basin or catchment) is an area of land that drains all water (including rainfall) to a common outlet such as the outflow of a reservoir, mouth of a bay, or point along a stream channel. Watersheds include networks of rivers, streams, and lakes, the land area surrounding them and the underlying groundwater. High elevation geographic features, such as mountains, ridges, and hills, separate watersheds and are referred to as drainage divides. The U.S. is divided into 21 primary drainage regions; New York State is within portions of two of these drainage regions: the Mid-Atlantic region and the Great Lakes region. Within New York State, waters are drained by five major watersheds, which include the Allegheny, Delaware, Great Lakes-St. Lawrence, Hudson, and Susquehanna. Watersheds within the State are further divided into 17 sub-regional watersheds, which are the watershed units at which the New York State Department of Environmental Conservation (NYSDEC) manages the State's water resources.

Watersheds are often a unit by which water resources are managed because water quality and stream flow are affected by activities occurring within the land area that defines a watershed. For example, under the 1974 Safe Drinking Water Act (SDWA), intensive development activities are restricted in watersheds that provide source water for drinking water supplies. The largest of such areas, known as Source Water Protection and Wellhead Protection Program areas, is the New York City watershed, which includes large areas of the Catskill and Delaware watersheds west of the Hudson River and parts of Westchester and Putnam counties, which feed the Croton water supply east of the Hudson River.

Lakes and Rivers

New York's 17 sub-regional watersheds include 7,600 freshwater lakes, ponds, and reservoirs, covering approximately 2.3 million surface acres and 356 shoreline miles at Lake Ontario, 373,760 surface acres and 83 shoreline miles at Lake Erie, and 97,024 surface acres and 190 shoreline miles at Lake Champlain. In addition, the State has more than 70,000 miles of rivers and streams, the most notable of which include:

- The Hudson River, designated an American Heritage River;
- The Susquehanna River, a large interstate river that empties into Chesapeake Bay;
- The Delaware River, designated a National Wild and Scenic River;
- The Saint Lawrence River, the gateway between the Great Lakes and the Atlantic Ocean; and
- The Niagara River, which connects New York's two Great Lakes, Lake Erie and Lake Ontario.

New York's diverse water resources provide habitat to a numerous and diverse group of aquatic species. Major water bodies, such as Lake Ontario, Lake George and the Finger Lakes, provide excellent habitat for numerous cold and warm water species. Other lakes, such as Oneida and

Chautauqua, are quite shallow, warm, rich in nutrients, and provide the habitat for a wide range of warm water fishes such as bass, walleye, muskellunge, and pan fishes. Streams range in size from tiny, spring-fed brooks holding native brook trout to large rivers such as the Hudson supporting many species of fish, including anadromous American shad and striped bass.[177]

Wetlands

Wetlands (swamps, marshes, bogs, and similar areas) are areas saturated by surface or ground water sufficient to support distinctive vegetation adapted for life in saturated soil conditions. There are many of different types of wetland, including marshes, hardwood, coniferous and shrub swamps, wet meadows, bogs, fens, and coastal marshes. Wetlands serve as natural habitat for a number of plant and animal species, including several species of wildlife that are rare or endangered in New York. Wetlands also provide a buffer for flooding and tidal erosion along the State's shoreline.

In New York State, public protection is afforded to two main types of wetland: tidal wetlands surrounding Long Island, New York City, and the Hudson River South of the Tappan Zee Bridge; and freshwater wetlands found throughout the state. The U.S. Geological Survey (USGS) estimates the total acreage of wetlands at approximately 2.4 million acres (or eight percent of the state's total land area), including over two million acres of freshwater wetlands and 25,000 acres of tidal wetlands. The largest percentage of wetlands occurs in the counties in the Adirondack Mountains and counties south and east of Lake Ontario.[178]

Oceans and Estuaries[179]

The southern part of New York State sits on the shore of the Northern Atlantic Ocean. New York includes nearly 1.2 million acres of salt and brackish water in the marine and coastal areas, and more than 2,800 miles of shoreline. The ocean current coming up the shoreline mixes with freshwater rivers and streams that drain into the ocean around New York City and Long Island. The intersection between these two types of waters creates several distinct estuaries that flourish with marine life, including five estuaries that exhibit unique characteristics, namely the Long Island Sound, the Peconic Estuary, the Long Island South Shore Estuary Reserve, the New York/New Jersey Harbor, and the Hudson River Estuary. These areas are managed cooperatively by NYSDEC, the U.S. Environmental Protection Agency (EPA), other state agencies, and local municipalities.

Drinking Water

Over ninety percent of all New Yorkers receive water from public water supply systems.[180] Public water supply systems vary in size. The largest engineered water system in the nation belongs to New York City, whose system serves more than nine million people. Mid-sized, privately-owned water supply companies serve municipalities while the smallest systems include small stores in

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[177] Anadromous fish are born in fresh water, spend most of their life in the sea, and then return to fresh water to spawn. Salmon, smelt, shad, striped bass, and sturgeon are common examples of anadromous fish.

[178] USGS. National Water Summary on Wetland Resources. State Summary Highlight. Water Supply Paper 2425. Accessed August 14, 2014 at: http://water.usgs.gov/nwsum/WSP2425/state_highlights_summary.html.

[179] NYSDEC. Oceans and Estuaries. Accessed August 14, 2014 at: http://www.dec.ny.gov/lands/207.html.

[180] USGS. 2005. Water Use in the United States. Accessed September 15, 2014 at: http://water.usgs.gov/watuse/data/2005/.

rural areas that serve customers water from their own wells. In total, there are over 9,300 public water supply systems in New York State.[181]

As shown in **Exhibit 3-5**, the majority of the State's population is served by surface water. For example, the nine million people served by the New York City water system rely on surface water associated with New York City's large up-state reservoir and distribution system.

EXHIBIT 3-5 SUMMARY OF NEW YORK DRINKING WATER SOURCES

TYPE OF DRINKING WATER SOURCE	NUMBER OF SYSTEMS	POPULATION SERVED	PERCENT OF POPULATION SERVED
Surface Water	588	12,505,823	58%
Ground Water	8,194	4,770,131	22%
Purchased Surface Water	458	3,996,600	19%
Purchased Ground Water	134	203,024	1%
TOTAL	**9,374**	**21,475,578***	**100%**

* This number includes the population served by the New York City Water System, which includes a transient sub-population of approximately 2.8 million people.

Source: New York State Department of Health. Drinking Water Program: Facts and Figures. Accessed August 14, 2014 at: https://www.health.ny.gov/environmental/water/drinking/facts_figures.htm.

Groundwater occurs across all parts of New York State.[182] Approximately one-quarter of New Yorkers rely on groundwater as a source of potable water.[183] Unconsolidated sediments (e.g., sand and/or gravel deposits) function as New York State's most productive aquifers. Groundwater in these aquifers occurs under water-table (unconfined) or artesian (confined) conditions. A number of municipalities, industries, and farms have built over many of these aquifers because they typically form flat areas that are suitable for development with an ample groundwater supply.[184] To enable better management of the State's groundwater resources, DEC works with the USGS to map the State's groundwater resources. **Exhibit 3-6** shows the general location of New York's "Principal" and "Primary" aquifers excluding Long Island. The blue areas identify "Primary Aquifers" capable of yielding a great deal of groundwater and, therefore, are also the State's more heavily utilized aquifers. The green areas show the remainder of the unconsolidated aquifers in New York, termed "Principal Aquifers." These aquifers are not heavily utilized, but are capable of providing 10 to 100 or more gallons per minute. Although other areas in upstate New York are capable of supplying groundwater, these delineated aquifer areas are the State's most reliable sources.[185]

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[181] New York State Department of Health. Drinking Water Program: Facts and Figures. Accessed August 14, 2014 at: https://www.health.ny.gov/environmental/water/drinking/facts_figures.htm.

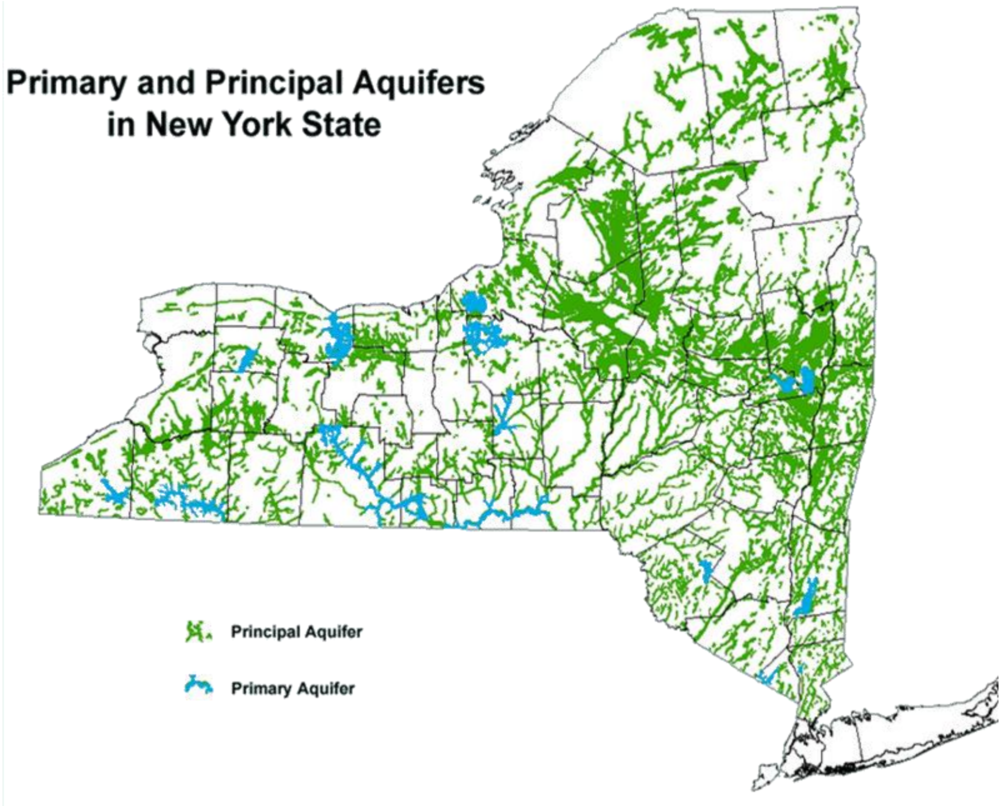
[182] Groundwater is the water located beneath the earth's surface in soil pore spaces and in the fractures of rock formations.

[183] NYSDEC. Groundwater. Accessed August 14, 2014 at: http://www.dec.ny.gov/lands/36064.html.

[184] NYSDEC. Groundwater Resource Mapping. Accessed August 14, 2014 at: http://www.dec.ny.gov/lands/36118.html.

[185] NYSDEC. Groundwater. Accessed August 14, 2014 at: http://www.dec.ny.gov/lands/36064.html.

EXHIBIT 3-6 NEW YORK STATE GROUNDWATER RESOURCES



Source: NYSDEC. Groundwater. Accessed August 14, 2014 at: http://www.dec.ny.gov/lands/36064.html.

Water Use

In 2005, the most recent year for which data are available, USGS estimated annual water withdrawals in New York State at approximately 15.2 billion gallons per day (bgd). Uses for such withdrawals include drinking water, irrigation, industrial, and thermoelectric power.[186] The vast majority (79 percent or 12.02 bgd)[187] of the State's total annual withdrawals (15.2 bgd) are for thermoelectric power.

On the following page, **Exhibit 3-7** shows the location of large (i.e., capable of withdrawing 100,000 gallons or more) surface water and groundwater withdrawals across the State. According to NYSDEC, there are approximately large 1,644 withdrawal points across the State, of which approximately 41 percent withdraw surface water (680 points), 40 percent withdraw groundwater (665 points), and the remaining 18 percent withdraw both surface- and groundwater (290 points).[188] In 2005, 1,865,391 households consumed self-supplied water.[189]

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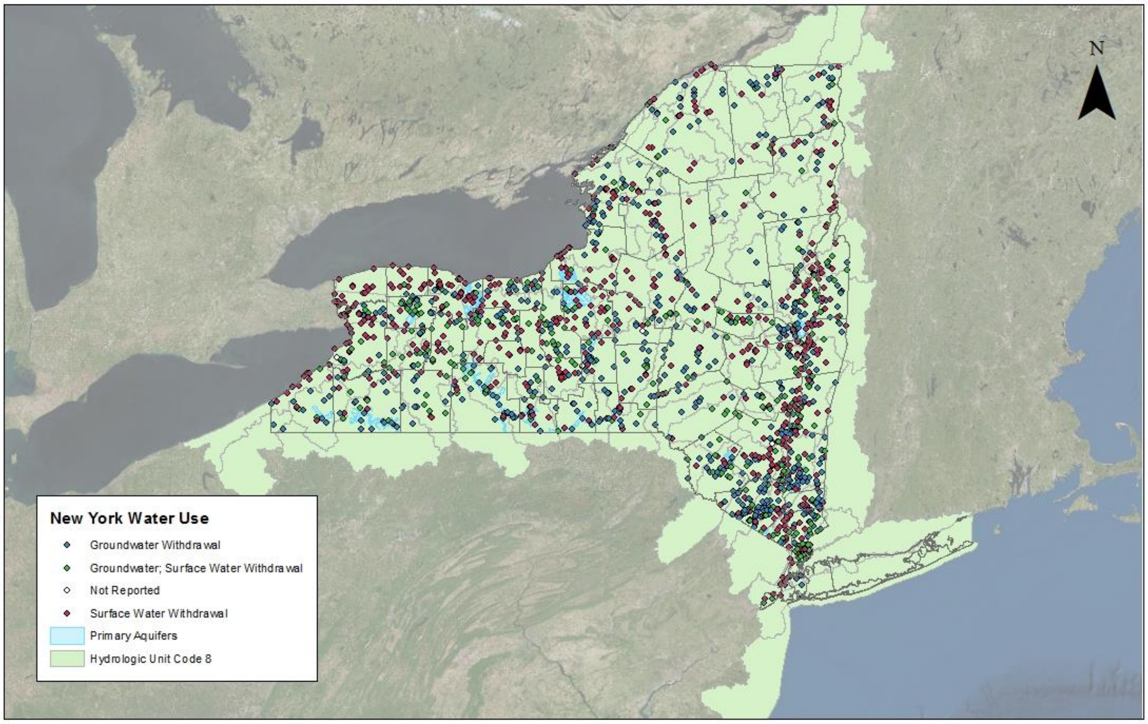
[186] USGS. 2005. Estimated Use of Water in the United States in 2005. Accessed August 14, 2014 at: http://pubs.usgs.gov/circ/1344/pdf/c1344.pdf.

[187] *Ibid*. USGS estimates that thermoelectric power in New York State withdraws 7.140 bgd of fresh surface water and 4.8 bgd of saline surface water.

[188] Withdrawal type is unavailable for nine points.

[189] USGS. 2005. Water Use in the United States. Accessed September 15, 2014 at: http://water.usgs.gov/watuse/data/2005/.

EXHIBIT 3-7 NEW YORK STATE WATER WITHDRAWALS



Data Sources:
1. Environmental Systems Research Institute Map Projection: Mercator Auxiliary Sphere.
2. United States Geological Survey.
3. New York State Geographic Information Systems Clearinghouse.

0 25 50 100 150 200 Miles

IEc INDUSTRIAL ECONOMICS, INCORPORATED

Energy and Water Resources

Water is used in many forms of electric power generation to spin turbines directly (hydropower) or indirectly (steam-electric power) or for cooling generation equipment. Consequently, most of the State's electric power plants are located adjacent to major lakes, rivers, estuaries or coastal areas. The majority of New York's electric power is generated using water to cool steam used to spin turbines. Most plants built in the U.S. before 1970 operate with an open-loop (or once-through) cooling system.[190] In these systems, large volumes of water are withdrawn by the facility from an adjacent water body and returned to the source at a higher temperature. Both the extraction and return of water can result in environmental impacts. To minimize the adverse environmental impacts of such operations, Congress included Section 316(b) in the Clean Water Act (CWA) and New York State promulgated regulations (6 NYCRR part 704.5), which placed greater restrictions on once-through cooling systems to minimize the adverse environmental impacts of cooling water intake processes.[191]

After 1970, cooling towers, or closed-loop systems became the more predominant cooling system for power generation. These systems operate by condensing generated turbine steam into hot water and then air-cooling the hot water in a tower – mechanically or by draft. The cooled water is collected and returned to the plant's boiler. Consumed water is evaporated in the cooling tower

[190] EIA. 2004. Steam Electric Plant Operation and Design Report. EIA-767. Washington, DC.

[191] DOE. 2006. Energy Demands on Water Resources. December. Accessed at: http://www.sandia.gov/energy-water/docs/121-RptToCongress-EWwEIAcomments-FINAL.pdf.

rather than being returned to the source watershed. Dry cooling mechanisms are also available as a technology and have been installed in several locations in New York over the last ten years. However, they require higher energy usage and are currently more expensive than wet cooling systems.

In New York State, thermoelectric water withdrawals are significant, accounting for approximately 79% (or 12 bgd) of total water withdrawals in 2005. As of 2005, all thermoelectric water withdrawals were from surface water sources, of which approximately 40 percent were from saline surface waters and 60 percent from fresh surface waters. [192] Net power generation associated with thermoelectric-power water withdrawals totaled 93,600 gigawatt hours in 2005, the most recent year for which data are available.[193] This translates to an average withdrawal rate of approximately 7.8 gallons of water to produce 1 kilowatt-hour of energy.

Hydropower serves as another intersection between energy and water resources. In 2013, New York was the largest hydroelectric power producer east of the Rocky Mountains, and the Robert Moses Niagara plant is the fourth largest hydroelectric plant in the nation. Hydroelectric plants are currently capable of supplying approximately 18 percent of the state's total electricity demand. **Exhibits 3-8** and **3-9** (on the following page) provide an overview of the State's hydropower capacity. New York's largest hydroelectric plants are located in Lewistown, NY, in the vicinity of Niagara Falls and on the St. Lawrence River.

3.4 CLIMATE AND AIR QUALITY[194]

The climate of New York State is broadly representative of the humid continental type, which prevails in the Northeast. Variation in climate across the State is driven by differences in latitude, topography, as well as proximity to large bodies of water. Due to its geographical position, New York State is subject to a variety of air masses. Regional climate is driven by two countervailing air masses: cold air from the northern interior of the continent and humid air from the Gulf of Mexico and adjacent subtropical waters. New York is also affected by a third air mass flowing inland from the North Atlantic Ocean, which can produce cool, cloudy, and damp weather conditions. This maritime influence is particularly dominant in the southeastern portion of the State.

[192] USGS. 2005. Estimated Use of Water in the United States in 2005. Accessed August 14, 2014 at: http://pubs.usgs.gov/circ/1344/pdf/c1344.pdf.

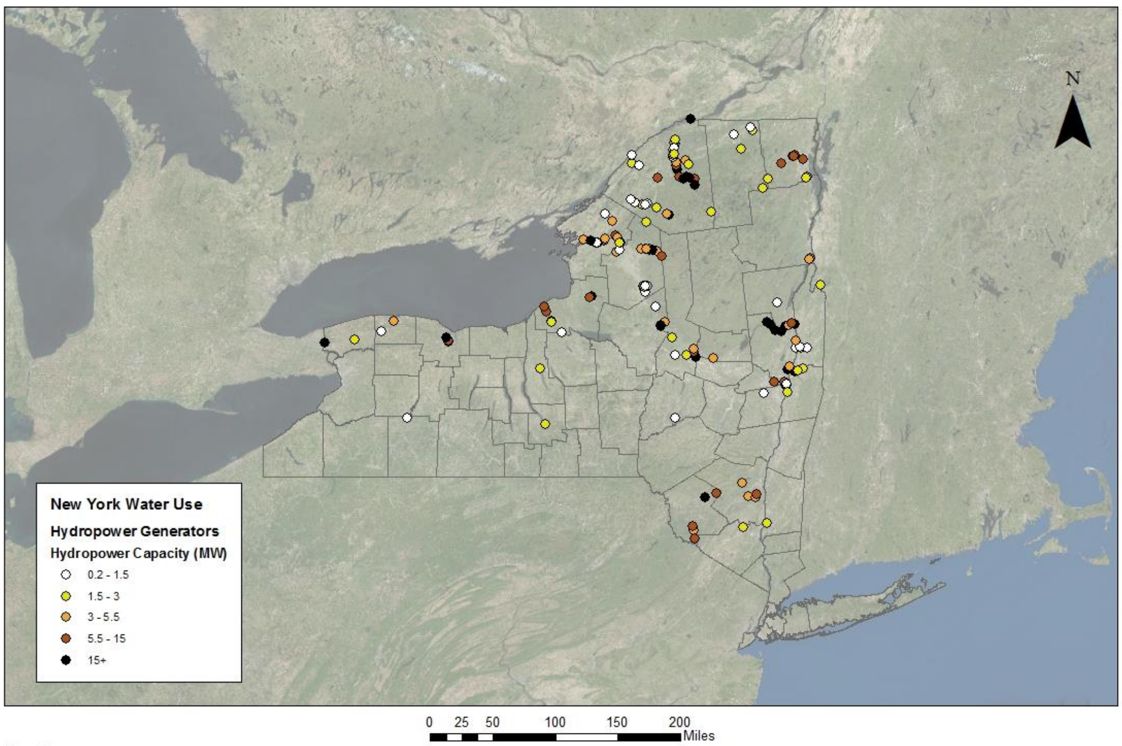
[193] According to USGS, an updated report on water use is expected in late 2014. To the extent new data becomes available, this GEIS will be updated accordingly.

[194] Cornell University. The Climate of New York. Accessed August 14, 2014 at: http://nysc.eas.cornell.edu/climate_of_ny.html.

EXHIBIT 3-8 SUMMARY OF NEW YORK HYDROPOWER GENERATION CAPACITY

FACILITY CAPACITY (MW)	NUMBER OF FACILITES	TOTAL MW CAPACITY	PERCENT OF TOTAL STATE-WIDE CAPACITY
0.2 to 1.49	29	26.2	0.6%
1.50 to 2.90	33	66.0	1.5%
3.0 to 5.49	36	142.7	3.3%
5.5 to 14.9	30	25.4	5.9%
15 and over	27	3,819.7	88.6%
TOTAL	**153**	**4,309.0**	**100%**
Source: EIA-860, Annual Electric Generator Report and EIA-923, Power Plant Operations Report. Data Period: 2012-2013.			

EXHIBIT 3-9 NEW YORK STATE HYDROPOWER PLANTS



Data Sources:
1. Envrionmental Systems Research Institute Map Projection: Mercator Auxiliary Sphere.
2. United States Energy Information Administration.

IEc INDUSTRIAL ECONOMICS, INCORPORATED

The average annual mean temperature ranges from about 40°F in the Adirondacks to near 55°F in the New York City area. The highest temperature of record in New York State is 108°F at Troy on July 22, 1926. The record coldest temperature is -52°F at Stillwater Reservoir (northern Herkimer County) on February 9, 1934 and also at Old Forge (also northern Herkimer County) on February 18, 1979. Temperatures of 90°F or higher occur from late May to mid-September in all but the normally cooler portions of the State.

Moisture for precipitation is transported primarily from the Gulf of Mexico and Atlantic Ocean through circulation patterns and storm systems. Nearly all storm and frontal systems moving eastward across the continent pass through, or in close proximity to, New York State. Storm systems that move northward along the Atlantic coast are of particular importance on the weather and climate of Long Island and the lower Hudson Valley. While statewide precipitation is distributed relatively evenly throughout the year (i.e., distinct dry or wet seasons are absent), the distribution of rainfall within the State varies based on local topography and proximity to the Great Lakes or Atlantic Ocean. Average annual rainfall in excess of 50 inches occur in the western Adirondacks, Tug Hill area, and the Catskills, while slightly less than that amount is noted in the higher elevations of the Western Plateau southeast of Lake Erie. Areas of least rainfall, with average accumulations of about 30 inches, occur near Lake Ontario in the extreme western counties, in the lower half of the Genesee River Valley, and in the vicinity of Lake Champlain.

New York State also receives an abundant amount of snowfall each year, the majority of which occurs in upstate New York. The State receives an average seasonal snowfall of approximately 40 inches or more, with average snowfall exceeding 70 inches in much (60 percent) of the State. Snowfall in New York City and Long Island are tempered significantly by the Atlantic Ocean, which reduces snow accumulation to approximately 25 to 35 inches pear year.

Air Pollutants

Air pollutants originate from many human activities. Pollutants come from industries that manufacture chemicals and other goods, from on- and off-road vehicles and power equipment, and from energy facilities that burn oil, gas or coal. Fossil-fueled electric generating plants release criteria pollutants such as nitrogen oxides (NO_x) and sulfur dioxide (SO_2), as well as hazardous air pollutants such as mercury. Air quality in New York has continued to improve since the promulgation of federal and State control requirements for stationary and area sources, complemented by on-going improvements in mobile source emissions and efficiency.[195] While control technologies are required for new generating facilities, and the use of natural gas as a primary energy source (instead of oil or coal) has lowered emissions per kilowatt-hour of generation, most of the largest individual emission sources in New York State continue to be electricity generation plants.[28] Most air quality control regions in New York are in attainment with national air quality standards, while ozone continues to be a priority for air quality planning purposes.[196]

Climate Change

Greenhouse gases such as carbon dioxide contribute to the trend of rising average global temperatures.[197] Over the last century, the atmospheric concentrations of carbon dioxide and other heat-trapping greenhouse gases have rapidly increased. Although the presence of some greenhouse

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[195] DPS and Ecology and Environment Inc. 2013. Indian Point Contingency Plan Final Generic Environmental Impact Statement. Prepared for New York State Public Service Commission. July 2013. Accessed September 17, 2014 at: http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7B4FEE54FA-74C8-4954-B76F-ECDEEEC16266%7D.

[196] EPA. Green Book. Current Nonattainment Counties for All Criteria Pollutants. July 2, 2014. Accessed September 26, 2014 at: http://www.epa.gov/oaqps001/greenbk/ancl.html.

[197] IPCC. 2013: Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

gases in the atmosphere is natural and essential, many human activities release additional greenhouse gases. Combustion of fossil fuels (coal, oil, and natural gas) to generate energy is the greatest contributor to atmospheric CO_2 levels. Agricultural and other industrial processes also emit other greenhouse gases such as methane, nitrous oxide and halocarbons. Compared with other states, New York emits relatively low amounts of greenhouse gases per capita (14.7 tons of CO_2e[198] per New Yorker in 2007).[199] This is due to a smaller proportion of New York's electric energy needs met by coal-fired power plants, and also to the widespread use of public transportation in the State's larger cities.[200]

As the concentration of greenhouse gases increases, more heat is trapped in the atmosphere, which causes an increase in temperatures. Over the last century, New York State has experienced rising annual average temperatures. The fastest increases in State average temperatures occurred over the last four decades (i.e., since 1970), with summer temperatures rising approximately 2.4 F and winter warming exceeding 4 F.[201] By mid-century, New York's winter temperatures are projected to rise by another 2.5º F to 4º F, and summer temperatures by 1.5º F to 3.5º F.[202]

Because carbon dioxide and other greenhouse gases remain in the atmosphere for decades or even centuries, climate change is expected to continue even in the face of declining emissions. In response, a number of initiative and policies exist across New York State public agencies and local communities to prepare for the significant risks that climate change poses to the State's communities and infrastructure.[203] In general, climate change is expected to make wet regions wetter and dry regions drier.[204] In the Northeast, rising air temperatures will intensify water cycles through increased evaporation and precipitation. In New York State, more intense water cycles leads to water impacts such as increases in localized flash and coastal flooding, increases in the 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.[205] Projections predict that sea level at The Battery in New York City may rise between 0.6 and 1.8 feet by 2050 and between 1.9 and 6.3 feet by 2100, relative to sea

[198] To report the total impact multiple greenhouse gases may have on climate, these figures are given in terms of carbon dioxide equivalent (CO_2e). The carbon dioxide equivalent for a gas expresses its climate-changing ability as a multiple of that of carbon dioxide. CO_2e is derived by multiplying the tons of the gas by its associated global warming potential, a measure of energy that the gas absorbs relative to carbon dioxide. (Source: EPA. Glossary of Climate Change Terms. Accessed September 27, 2014 at: http://www.epa.gov/climatechange/glossary.html).

[199] NYSDEC. Why the Climate is Changing. Accessed August 14, 2014 at: http://www.dec.ny.gov/energy/63848.html.

[200] *Ibid.*

[201] NYSDEC. Climate Change in New York. Accessed September 28, 2014 at: http://www.dec.ny.gov/energy/94702.html.

[202] *Ibid.*

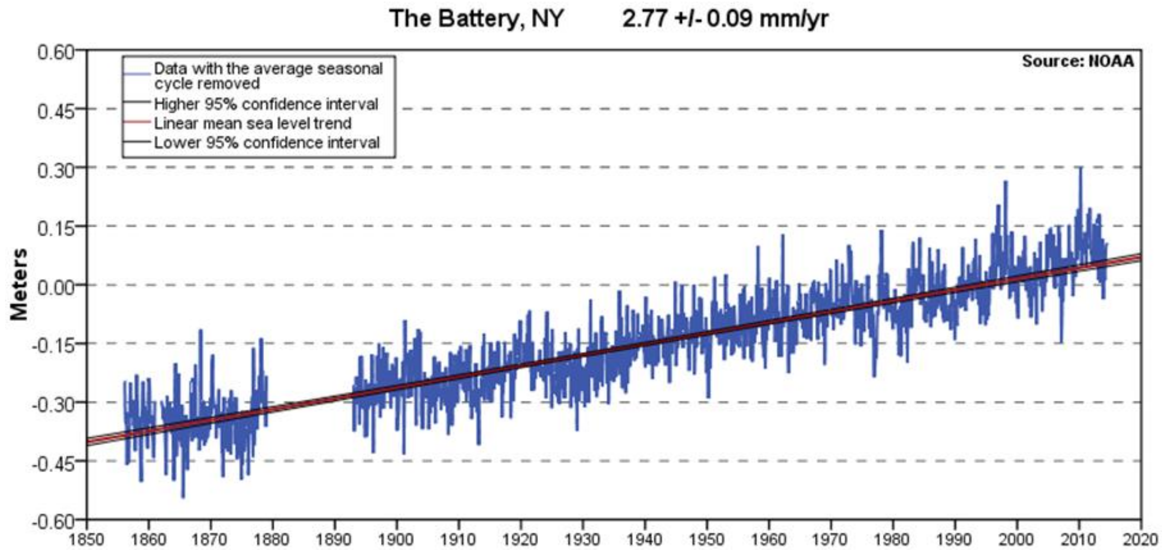
[203] City of New York. Climate Change. Accessed September 28, 2014 at: http://www.nyc.gov/html/planyc/html/sustainability/climate-change.shtml.

[204] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program, 841 pp. doi:10.7930/J0Z31WJ2.

[205] 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-synthesis-report.pdf.

levels in the 2012.[206] **Exhibit 3-10** illustrates historical rates of sea level rise at The Battery, New York.

EXHIBIT 3-10 OBSERVED SEA LEVEL RISE IN NEW YORK CITY



Source: NOAA. Tides & Currents. Mean Sea Level Trend 8518750 The Battery, New York. Accessed September 26, 2014 at: http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8518750.

Rising ocean temperatures also affect coastal areas of New York State through an increase in severe coastal storms and rising sea level. These two factors can alter sensitive coastal areas, increasing risk of property damage and harm to coastal residents, decreasing the diversity of coastal species, and move saltwater further north in the Hudson River , potentially contaminating water supplies in those areas. Extreme coastal floods are currently 50 percent more likely to occur in New York City as compared to 1900, and all coastal floods are more expansive due to higher sea levels.[207] Over 500,000 New Yorkers live within the 100-year coastal floodplain, and therefore face risks from severe storm events.[208] The impacts of climate changes are expected increase the vulnerability of the affected residents, especially those populations at the greatest economic and social disadvantages.[209]

[206] Strauss, B., C. Tebaldi, S. Kulp, S. Cutter, C. Emrich, D. Rizza, and D. Yawaitz. 2014. New York and The Surging Sea. A Vulnerability Assessment with Projections for Sea Level Rise and Coastal Flood Risk. Updated April 2014. Accessed on September 10, 2014 at: http://sealevel.climatecentral.org/uploads/ssrf/NY-Report.pdf.

[207] IPCC Working Group 1 (2013). Summary for Policy Makers. Accessed on September 10, 2014 at: http://www.climatechange2013.org/images/report/WG1AR5_SPM_FINAL.pdf.

[208] 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-synthesis-report.pdf.

[209] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program, 841 pp. doi:10.7930/J0Z31WJ2.

Changing climate conditions may impact the State's ecological resources. For example, water ecosystems and aquatic species may be vulnerable to changes in timing and intensity of precipitation and water temperature.[210] Climate change in New York State will also change the composition of the State's trees and other plants. Researchers expect spruce-fir forests, alpine tundra, and boreal plant communities to decrease in proliferation because of increased heat waves, droughts, and heavy downpours. In some areas, climate change will also increase less desirable species, including invasive plants such as kudzu that thrive in high carbon dioxide environments which benefits fast-growing plants.[211] Other species, including hardwood trees, may benefit to the extent that droughts do not limit their growth.[212]

Changing climate is also expected to generate both immediate direct and long-term impacts on the state's energy infrastructure. Extreme weather events, such as landslides, high winds, heavy precipitation, droughts, and wildfires, can inflict significant damage on the state's electricity generation, transmission, and distribution infrastructure. For example, Hurricane Sandy in 2012 left more than 8 million customers without power.[213] In colder climates, warming temperatures may cause thawing of permafrost, which may lead to the displacement of pipelines, railways, and pavement that are used for the transportation of energy fuel.[214]

Over longer timeframes, climate change is expected to decrease the efficiency of energy generation while increasing the demand for electricity, which may cause supply issues.[215] For example increased storm activity, higher temperatures and variable water availability can adversely affect natural gas and oil extraction, particularly in coastal areas. Warming temperatures can also adversely affect transmission efficiency and capacity. Renewable energy generation dependent on water resources, wind patterns, or solar radiation are also susceptible to changes in climate. **Exhibit 3-11** summarizes potentially negative impacts of climate change on different types of renewable energy resources.

[210] *Ibid*.

[211] *Ibid*.

[212] *Ibid*.

[213] United States Government Accountability Office. Report to Congressional Requesters. Climate Change – Energy Infrastructure Risks and Adaptation Efforts. January 2014. Accessed January 2, 2015 at: http://www.gao.gov/products/GAO-14-74.

[214] *Ibid*.

[215] *Ibid*.

EXHIBIT 3-11 POTENTIALLY NEGATIVE IMPACTS OF CLIMATE CHANGE ON RENEWABLE ENERGY RESOURCES

RENEWABLE ENERGY RESOURCE	POTENTIALLY NEGATIVE CLIMATE CHANGE EFFECT
Biofuels	Biofuel crops are susceptible to: • Drought, • Heavy rain, flooding • Extreme heat
Geothermal	• Warming temperature can reduce facility electricity generation efficiency • Drought
Hydropower	• Changes in precipitation • Increased temperature and evaporation
Solar	• Changes in haze, humidity, dust • Warmer temperatures effect effectiveness of PV electricity generation • Concentrating Solar Power may be negatively affected by droughts
Wind	• Extreme weather • Wind variability caused by changing weather patterns
United States Government Accountability Office. Report to Congressional Requesters. Climate Change - Energy Infrastructure Risks and Adaptation Efforts. January 2014. Accessed January 2, 2015 at: http://www.gao.gov/products/GAO-14-74.	

Agricultural production may also be negatively affected by rising summer temperatures. The effect of climate change on agriculture is complex. Fluctuations in ambient air temperatures and patterns of precipitation can change the distribution of and/or the productivity of key crops. As example, while longer growing seasons present opportunities for developing new crops and agricultural markets, longer growing seasons can also increase weed and pest pressures.[216]

New Yorkers may also face public health risks as the ambient environment changes. In particular, researchers expect heat-related deaths to increase at a faster rate than cold-related deaths. Rising temperatures and increased emissions will exacerbate existing air quality issues. Increased smog, larger and more frequent wildfires, and a greater volume of pollens and molds will serve to aggravate cardiovascular and respiratory illnesses, including asthma.[217]

3.5 FOREST RESOURCES

New York State is heavily forested, with more forestland than any other northeastern state. Approximately 63 percent (18.95 million acres) of the State is forested, equal to approximately one acre of forestland per resident.[218] Of this amount, approximately 76 percent (14.4 million acres) of the State's total forestland is privately owned across 687,000 landowners.[219]

[216] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program, 841 pp. doi:10.7930/J0Z31WJ2.

[217] *Ibid*.

[218] NYSDEC. Forests. Accessed August 14, 2014 at: http://www.dec.ny.gov/lands/309.html.

[219] *Ibid*.

Approximately 3.7 million acres of forestlands are publicly owned, including three million acres in the Adirondack Forest Preserve, 24,000 acres in the Catskill Forest Preserve; 330,000 acres in State Parks, 213,000 acres in Wildlife Management Areas, and 770,000 acres in State Forests, which includes Reforestation Areas, Multiple-Use Areas, Unique Areas, and State Nature and Historic Preserves.[220] The most common type of tree species is maple, beech, and birch, which collectively account for 54 percent of the State's forestland.

The Adirondack and Catskill Forest Preserves contain many small lakes on high mountain terrain and in the peripheral foothill areas, as well as rare aquatic and terrestrial ecosystems. Many clear, cool, well-oxygenated streams arise in these mountains and hills, providing critical habitat for a diverse aquatic invertebrate community. The ecological communities of these remote ponds and streams also constitute unique and irreplaceable gene pools that contribute to the ongoing genetic diversity of these areas.

New York's Forest Preserves also contain many representatives of terrestrial communities that are unique among ecological habitats in New York. These include, for example, alpine meadows found at higher elevations, mountain spruce-fir forests in the Adirondacks and Catskills, and large areas of swamp forests (red maple-tamarack, and black spruce-tamarack). Other notable ecological resources include the Appalachian hardwood forests contained in Allegheny State Park, the Atlantic and Great Lakes coastal plain habitats, and the Hudson and Mohawk watersheds. Jamaica Bay and Montezuma National Wildlife Refuges are wildlife and fisheries habitats of national significance, and the State Forest system and Wildlife Management Areas provide extensive wildlife habitat and recreational opportunities throughout the state.

Forests represent an important economic resource for the State. Cornell University estimates the forest industry employs 60,000 people and contributes approximately $4.6 billion to the State's economy each year.[221] For example, forestlands provide biomass fuel for wood-fired electric generation facilities in New York. In central New York, approximately 500 acres of biomass crops, primarily willow and hybrid poplar, supply fuel for biomass generation facilities.[222] Forests also provide an array of non-market services, including, but not necessarily limited to, wildlife habitat, watershed protection, soil stabilization, recreational opportunities, and ecological diversity.

3.6 CRITICAL ENVIRONMENTAL AREAS

Critical environmental areas (CEAs) are specific geographic areas, designated by local agencies and authorized by SEQRA, to preserve or protect critical environmental benefits or protect against a threat to human health. . The boundaries of each CEA are shown on individual maps, which reside with the designating agency as well as with NYSDEC. To assist state and local authorities with the SEQR environmental assessment process, NYSDEC also provides information on protected areas in an online mapping tool.[223] Any action by a governmental agency that could impact a designated

[220] NYSDEC. Lands and Waters. Accessed August 14, 2014 at: http://www.dec.ny.gov/61.html.

[221] NYSDEC. Forests. Accessed August 14, 2014 at: http://www.dec.ny.gov/lands/309.html.

[222] DPS. Final Generic Environmental Impact Statement in Case 03-E-0188 Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio Standard. Issued August 26, 2004. Accessed September 18, 2014 at: http://www.dps.ny.gov/NY_RPS_FEIS_8-26-04.pdf.

[223] NYSDEC. EAF Mapper Tool. Accessed Septepmber 22, 2014 at: http://www.dec.ny.gov/eafmapper/.

CEA must be evaluated with special attention to the environmental characteristics for which it was designated. The most common reasons for designating a CEA are to protect drinking water, wetlands, or significant coastal habitats. To be designated as a CEA, an area must have an exceptional or unique character with respect to one or more of the following:

- A benefit or threat to human health;
- A natural setting (e.g., fish and wildlife habitat, forest and vegetation, open space and areas of important aesthetic or scenic quality);
- Agricultural, social, cultural, historic, archaeological, recreational, or educational values; or
- An inherent ecological, geological, or hydrological sensitivity to change that may be adversely affected by any change.

There are approximately 206 CEAs designated by local agencies across 31 counties in the State.[224] Many CEAs specify a single park, reservoir, or creek, but many designations encompass numerous locations or an entire resource type. For example, Kings, Queens, and Nassau counties on Long Island each designated Jamaica Bay as a CEA within their respective boundaries. Suffolk County, with 76 CEAs, has the highest total number of CEAs in the State. CEAs in Suffolk County include single sites such as wetlands, creeks, and inlets, while other CEAs encompass multiple locations, such as the water recharge area associated with the town of East Hampton.[225]

Through the Coastal and Inland Waterways Program, New York's Department of State (NYSDOS) also identifies and recommends coastal landscapes for designation as Scenic Areas of Statewide Significance (SASS), which must be considered in state and local reviews of funding or permitting actions.[226] Upon the recommendation of NYSDEC, NYSDOS also designates Significant Coastal Fish and Wildlife Habitats (SCFWH). To date, NYSDOS has identified 15 SASS in the Hudson River Valley coastal region and Long Island, as well as over 250 sites as SCFWHs.[227,228]

3.7 SPECIES BIODIVERSITY

The biodiversity of New York includes all different species of animals, plants, fungi, microorganisms, and bacteria. The total number of species in New York is uncertain, but tens of thousands plants and animal species have been identified to date.[229] The New York Natural Heritage Program (NYNHP) maintains the most comprehensive database on the status and location of rare species and natural communities. The NYNHP currently monitors 179 natural community types, 802 rare plant species, and 466 rare animal species throughout New York State, including

[224] NYSDEC. Critical Environmental Areas. Accessed August 22, 2014 at: http://www.dec.ny.gov/permits/6184.html.

[225] *Ibid.*

[226] **Chapter 6** discusses relevant regulatory and permitting requirements, including the Coastal and Inland Waterways Program's consistency determinations.

[227] NYDOS, Office of Planning and Development. Scenic Areas of Statewide Significance. Accessed September 12, 2014 at: http://www.dos.ny.gov/opd/programs/consistency/scenicass.html.

[228] NYSDOS, Office of Planning and Development. Significant Coastal Fish & Wildlife Habitats. Accessed September 12, 2014 at: http://www.dos.ny.gov/opd/programs/consistency/scfwhabitats.html.

[229] 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.

mollusks, fish, insects, mammals, amphibians, reptiles, and birds.[230] Of protected animal species, 53 are state-listed as endangered, 34 are state-listed as threatened, and 58 are state-listed as species of special concern (i.e., any native species for which a welfare concern or risk of endangerment has been documented in New York State).[231,232] Of the rare plant species, 349 are state-listed as endangered, 155 state-listed as threatened, 86 state-listed as rare, and 153 are state-listed as vulnerable.[233] According to the U.S. Fish and Wildlife Service (USFWS) seven federally-listed threatened and endangered plant species are present in New York State. Of the seven federally-listed plant species, two species are endangered and five species are threatened.[234] According to the USFWS database, the State has 18 federally-listed threatened and endangered animal species, of which 13 species are endangered and five species are threatened. [235]

Wildlife-Related Recreation

New York's fish and wildlife resources provide recreational opportunities and economic benefits for a variety of people. Nearly 10 million people participate annually in some form of wildlife-related recreation in New York, including consumptive uses such as hunting, fishing, and trapping, and non-consumptive uses associated with tourism and observation.[236] The economic value of freshwater sport fishing and wildlife-related recreation in New York is estimated to be more than $9.2 billion annually. Of that total, trip-related expenditures were $2.5 billion and equipment expenditures totaled $5.1 billion. The remaining $1.5 billion was spent on licenses, contributions, land ownership and leasing, and other items. According to the Outdoor Industry Association, in New York State, outdoor recreation generates $33.8 billion in consumer spending, 305,000 direct New York jobs, $12.5 billion in wages and salaries, and $2.8 billion in state and local tax revenue.[237]

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[230] NYSDEC. New York Natural Heritage Program. Accessed September 12, 2014 at: http://www.dec.ny.gov/animals/29338.html.

[231] NYSDEC. Part 182: Endangered and Threatened Species of Fish and Wildlife; Species of Special Concern; Incidental Take Permits. Accessed on September 15, 2014 at: http://www.dec.ny.gov/regs/3932.html.

[232] NYSDEC. 2014. New York Natural Heritage Program. Accessed September 12, 2014 at: http://www.dec.ny.gov/animals/29338.html

[233] DPS and Ecology and Environment Inc. 2013. Indian Point Contingency Plan Final Generic Environmental Impact Statement. Prepared for New York State Public Service Commission. July 2013. Accessed September 17, 2014 at: http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7B4FEE54FA-74C8-4954-B76F-ECDEEEC16266%7D.

[234] NYSDEC. 6 NYCRR Subpart 193.3 Protected Native Plants. Accessed September 15, 2014 at: http://www.dec.ny.gov/regs/15522.html.

[235] U.S. Fish and Wildlife Service. Endangered Species of New York State, Listings and Occurrences for New York. Accessed August 20, 2014 at: http://ecos.fws.gov/tess_public/pub/stateListingAndOccurrenceIndividual.jsp?state=NY&s8fid=112761032792&s8fid=112762573902.

[236] DPS. Final Generic Environmental Impact Statement in Case 03-E-0188 Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio Standard. Issued August 26, 2004. Accessed September 18, 2014 at: http://www.dps.ny.gov/NY_RPS_FEIS_8-26-04.pdf.

[237] NYSDEC. Wildlife Recreation Provides Economic Benefits. Accessed August 16, 2014 at: http://www.dec.ny.gov/press/90441.html.

3.8 AESTHETIC AND VISUAL RESOURCES

New York contains one of the most geographically diverse landscapes in North America, distinguished by its unique mix of mountains, forests, rivers and streams, ponds and deep glacial lakes, waterfalls, islands, barrier beaches, tidal estuaries, wetlands, and ocean shore lands. Aesthetic resources and scenic quality are typically defined by a combination of landscape characteristics and viewer activity and sensitivity. Some of these resources enjoy official designation, while others are simply perceived as attractive or sensitive to visual change. Existing aesthetic quality is often described by considering landscape character types, the expectations of different viewer groups, and official designations – typically assigned by some governmental body – recognizing a resource or site as having aesthetic value or sensitivity. Owing in part to its unique visual and aesthetic landscape and resources, tourism is one of the State's most important industries.

Landscape Similarity Zones

New York State's landscape is varied, ranging from mountainous forests to level farmland and from small rural hamlets to major metropolitan cities. Within this varied landscape, areas of similar landscape character are referred to as "landscape similarity zones." As shown in **Exhibit 3-12,** the State has18 landscape similarity zones. Each zone exhibits a distinct combination of vegetation, topography, water, and land use that defines its aesthetic quality.

EXHIBIT 3-12 NEW YORK STATE LANDSCAPE SIMILARITY ZONES

- Undeveloped coastlines
- Developed coastlines
- Wooded hills
- Forested mountains
- Undeveloped lakeshores
- Developed lakeshores
- River valleys
- River gorges
- Rural agricultural land
- Rural hamlets
- Villages
- Suburban residential areas
- Suburban commercial areas
- Urban downtowns
- Urban residential areas
- Urban commercial areas
- Industrial areas
- Highway corridors

Viewer Groups

The importance of scenic resources is affected, in part, by their accessibility and the sensitivity of its viewers. A resource may be more valuable if it is readily available and viewed by many people. The value of an aesthetic or scenic resource varies from viewer to viewer, depending on each viewer's expectation of scenic quality or sensitivity to visual change. **Exhibit 3-13** summarizes the five general types of viewer groups that occur within the State. These groups are not, however, mutually exclusive; that is, viewers may fall into more than one category over the course of their life.

Visually Sensitive Resources

A number of sites throughout New York State are recognized for their aesthetic value under existing Federal, State, or local laws. At the State level, two existing frameworks define resources of aesthetic or visual value: (1) Section 49 of the New York State Environmental Conservation Law (ECL); and, (2) a policy issued in 2000 by the NYSDEC. Each framework is discussed below in more detail.

EXHIBIT 3-13 NEW YORK STATE PRIMARY VIEWER GROUPS

VIEWER GROUP	GROUP DESCRIPTION
Local Residents	Local residents generally view the landscape from their yards, homes, and local roads. Except when involved in local travel, these viewers are likely to be stationary and have frequent or prolonged views of certain landscape features. Local residents may view the landscape from ground level or elevations (typically upper floors/stories of homes and apartment buildings). Residents' sensitivity to visual quality is variable and may be tempered by the aesthetic character/setting of their neighborhoods.
Business Employees	Business employees work primarily in commercial, industrial, and urban landscape settings. Except while traveling to and from their places of employment, business employees generally work indoors and are focused on their job responsibilities. They typically experience limited views of the surrounding landscape and have relatively low sensitivity to visual change.
Through-Travelers/ Commuters	Through-travelers and commuters view the landscape from trains or automobiles on their way to work or other destinations. Most views will be from street level, although travelers on bridges and overpasses are afforded elevated views of the surrounding area. Commuters and through-travelers are typically moving, have a relatively narrow visual field, and for the most part are preoccupied with traffic and the roadway. Their perception and sensitivity to visual change is therefore relatively low.
Recreational Users	Recreational users include local residents involved in outdoor recreational activities at parks, playgrounds, recreational facilities and in undeveloped natural settings such as forests, fields, and water bodies. This group includes those involved in competitive sports, snowmobilers, bicyclists, hikers, joggers, recreational boaters, hunters, fishermen and those involved in more passive recreational activities (e.g., picnicking or walking). Visual quality may or may not be an important part of the recreational experience for these viewers. However, scenery may be a very important part of their recreational experience, and recreational users will often have continuous views of landscape features over relatively long periods of time. Their perception and sensitivity to visual change is therefore relatively high.
Tourists	Tourists come to certain areas of the state specifically to enjoy the cultural, recreational, and scenic resources. Tourists may view landscape features on their way to a destination or from the destination itself. Their sensitivity to visual quality and landscape character will be variable, depending on their reason for visiting an area, although this group is generally considered to have relatively high sensitivity to aesthetic quality. In many areas tourists will expect to see a variety of man-made features in the landscape, while in others, man-made features will be considered an intrusion into the natural landscape.

ECL Article 49 specifically designates and preserves areas of "scenic or natural beauty," as well as areas with particular "historical, archaeological, architectural, or cultural amenities." The ECL states that these assets are fundamental to the development of the state's recreational opportunities, tourism industry, and community attractiveness, and further that they contribute to balanced economic growth and quality of life.[238]

In 2000, NYSDEC established a policy to guide the evaluation of visual impacts potentially generated by proposed facilities. As part of this policy, NYSDEC defines several general categories of aesthetic resources that are considered "scenic resources of statewide significance." If a proposed facility is within the viewshed of a designated aesthetic resource, applicants are required to implement reasonable and necessary measures to eliminate, mitigate, or compensate for any adverse aesthetic or visual impacts identified.[239,240]

Recognition of aesthetic quality also occurs at the local level. Counties, towns, and villages may consider local parks and recreation facilities, heavily used roads, local scenic overlooks/corridors, water bodies, and public gathering places as visually sensitive resources and may officially designate them as such in local planning documents.

EXHIBIT 3-14 SCENIC RESOURCES OF STATEWIDE SIGNIFICANCE

- State Parks
- State Heritage Areas
- State Nature and Historic Preserve Areas
- State Forest Preserves
- National Wildlife Refuges, State Game Refuges, and State Wildlife Management Areas
- National Natural Landmarks
- The National Park System, Recreation Areas, Seashores, Forests
- Rivers designated as National or State Wild, Scenic, or Recreational
- Adirondack Park Scenic Vistas
- Palisades Park
- Scenic Areas of Statewide Significance (SASS)
- Sites listed on the National or State Register of Historic Places (or that are eligible for inclusion)
- A site, area, lake, reservoir, or highway designated or eligible for designation as scenic
- A state or federally designated trail, or one proposed for designation
- Bond Act Properties purchased under Exceptional Scenic Beauty or Open Space category.

3.9 OPEN SPACE[241]

The definition of open space depends on the context. In a big city, a vacant lot or a small marsh can be open space. A small park or a narrow corridor for walking or bicycling is open space, though it may be surrounded by developed areas. 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 include agricultural and forest land, undeveloped

[238] New York State Environmental Conservation Law. Article 49, Protection of Natural and Man-Made Beauty. Accessed September 12, 2014: http://pb.state.ny.us/parking%20lot%20item%20attachments/Article%2049%20-%20Conservation%20Easements.pdf.

[239] NYSDEC. 2000. Assessing and Mitigation Visual Impacts. Division of Environmental Permits. DEP-00-2. July 31. Accessed August 1, 2014 at: http://www.dec.ny.gov/docs/permits_ej_operations_pdf/visual2000.pdf.

[240] **Chapter 6** provides additional discussion on applicable regulations and policies to mitigate impacts on aesthetic and visual resources.

[241] NYSDEC. 2009. Final New York State Open Space Conservation Plan. June. Accessed August 20, 2014. http://www.dec.ny.gov/lands/47990.html.

coastal and estuarine lands, undeveloped scenic lands, public parks, and preserves. Waterways, water bodies, and wetlands are also important, especially those with public access, including the public shorelines and waters of two Great Lakes and other major lakes, major rivers, such as the Hudson River, and the Atlantic sea coast.

Open space can be publicly or privately-owned. New York State has one of the largest and oldest public land bases in the country. For example, at six million acres, the Adirondack Park is the largest state park in the U.S. The statewide park system administered by NYSDEC and New York State Office of Parks, Recreation and Recreation (NYSOPRHP) currently contains more than 200 State parks and historic sites, the State constitutionally-chartered Adirondack and Catskill Parks, along with numerous other recreation areas.[242] The State park system attracted more than 60 million visitors in 2012.[243] A significant portion of the publicly available open space and recreational resources is also held by county and local governments, and includes a wide variety of facilities such as forests, beaches, reservoirs, and playing fields. Privately held farms, forests, and undeveloped areas also contribute to open space protection, particularly those of local and national not-for-profit land conservancy organizations. Cultural and historic resources, discussed further in the subsequent **Section 3.10**, are also part of the heritage of New York State and are often protected along with open space.

The value of open space and parks is well-established. For example, one study documented $2.74 billion in added annual benefits from open space in Suffolk and Nassau counties on Long Island.[244] These benefits result from added tax revenues from increased land values near open space, reduction in governmental services on open space, recreation and tourism revenues, agricultural revenues, source water protection, storm water treatment, and pollution reduction, among other benefits.

Besides economic benefits, open space contributes to a greater quality of life for nearby residents, which also translates to added health benefits. Physical activity promotes health, and open space provides access to walking, riding, and hiking trails. In the largest study of its kind, a study in England examined mortality in 360,000 deaths from a population of 41 million people. The study showed that mortality was related to many factors, including income, but after correcting for such factors, access to open space was a significant factor contributing to lower mortality rates.[245]

[242] New York State Office of Parks, Recreation, and Historic Preservation. State Parks. 2013. Accessed August 20, 2014 at: http://nysparks.com/parks/.

[243] 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.

[244] Trust for Public Land. 2010. The Economic Benefits and Fiscal Impact of Parks and Open Space in Nassau and Suffolk Counties, New York. A Report by The Trust for Public Land for the Long Island Community Foundation and the Rauch Foundation. Accessed August 20, 2014 at: http://cloud.tpl.org/pubs/ccpe--nassau-county-park-benefits.pdf.

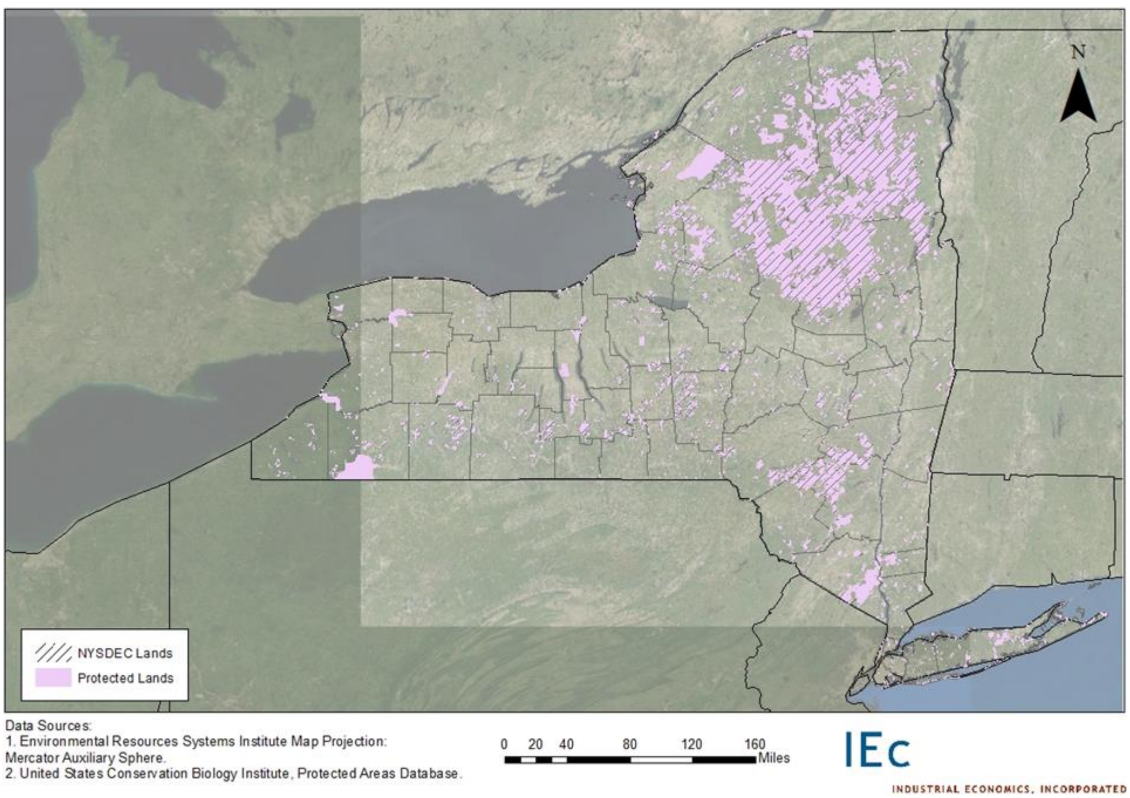
[245]Mitchell, R. and F. Popham. 2008. "Effect of exposure to natural environment on health inequalities: an observational population study." In The Lancet 372 (9650), pp. 1655-1660. (As cited in in Indian Point Contingency Plan Final Generic Environmental Impact Statement. July 2013)

EXHIBIT 3-15 SUMMARY OF PROTECTED AREAS IN NEW YORK STATE

OWNERSHIP	ACRES	PERCENT OF TOTAL
State Land	4,161,717*	80%
Private Conservation Lands	567,012	11%
Federal Land	223,035	4%
Local Government	160,347	3%
Native American	87,442	2%
TOTAL	**5,199,553**	**100%**

* While the Adirondacks Park is approximately six million acres, 43 percent (or 2.5 million acres) of the park are State Conservation Lands. The remainder is private land, classified for use with varying levels of Adirondack Park Agency permitting and approval. For more information, see: Adirondack Park Agency. Adirondack Park Land Use Classification Statistics. August 2, 2011. Accessed on September 12, 2014 at: http://www.apa.ny.gov/gis/stats/colc1108.htm.
Source: Conservation Biology Institute. PAD-US 1.1 (CBI Edition) May 1, 2010.Accessed August 15, 2014 at: http://databasin.org/protected-center/features/PAD-US-CBI/download.

EXHIBIT 3-16 PROTECTED CONSERVATION LANDS



New York State Open Space Conservation Program

The open space conservation program maintains broad public support throughout the State. This is a testament to the program's many environmental, health, and economic benefits. In addition to outdoor recreational opportunities, goals of the open space conservation program include protecting plant and animal diversity to ensure viable ecosystems, protecting the drinking water supply and the water quality for aquatic ecosystems, improving the quality of life for the State's citizens, maintaining natural resource industries such as farming, forestry, fishing, and tourism, and combating global climate change and its potential effects.

To ensure citizen input into State land acquisition decisions, New York established a formal open space conservation program in 1990. NYSDEC and NYSOPRHP developed a comprehensive statewide Open Space Conservation Plan that covers conservation actions, tools, and cooperation with other participating State agencies, including the Department of State (DOS), the Adirondack Park Agency, the Department of Agriculture & Markets (DAM), and the Department of Transportation (DOT). Updated every three years, an update and revision of the 2009 plan was released on September 17, 2014. The revised Plan addresses open space conservation activities within four critical priority areas: Promoting Outdoor Recreation; Addressing Climate Change; Ensuring Clean Water, Air and Land for a Healthy Public and Vibrant Economy; and Protecting, Using and Conserving Our Natural Resources and Cultural Heritage. NYSDEC and NYSOPRHP will be accepting public comments on the revised Plan until December 17, 2014.[246]

3.10 CULTURAL AND HISTORIC RESOURCES

New York State is home to a diverse array of cultural, historic, and archaeological resources, spanning prehistory through the modern era with elements of both the natural and anthropogenic environments. In this section, we summarize the State's cultural and historic resources, including but not limited to, historic buildings, archaeological sites, burial grounds, Native American sacred sites, and other significant cultural resources.

National and State Registers of Historic Places

The National and State Registers of Historic Places (NRHP/SRHP) serve to document the historic significance of various buildings, sites, structures, objects (e.g., sculptures, statuary, etc.), and districts throughout New York State. Eligibility for both registers is determined by SHPO, and is based on the property's age and level of historic significance, integrity, and context. The 5,000 SRHP/NRHP-listed places in New York State feature approximately 90,000 contributing properties. In addition, SHPO has identified more than 30,000 properties as eligible for listing on the SRHP/NRHP. Although these NRHP-eligible properties are not formally nominated for listing, they receive the same protections and consideration as SRHP/NRHP-listed properties. The New York City Landmarks Preservation Commission is the authority delegated by the SHPO to evaluate potential impacts on cultural and historic resources within New York City.

National Historic Landmarks

The National Historic Landmarks Program, administered by the National Park Service (NPS), recognizes 269 places within New York State for their contribution to American history and culture.[247] Like the properties on the National and State Registers, National Historic Landmarks can include buildings, sites, objects, or districts; however, eligibility for the latter program requires a greater threshold of historic significance. National Historic Landmarks may include the following:

[246] NYSDEC. 2014 Draft Open Space Conservation Plan. Accessed October 14, 2014 at: http://www.dec.ny.gov/lands/98720.html.

[247] National Park Service, National Historic Landmarks Program (NPS NHPL). 2012. List of National Historic Landmarks. Accessed August 20, 2014 at: http://www.nps.gov/nhl/find/statelists/ny/NY.pdf.

- Properties with the strongest association with a given historical event;
- The properties that best interpret the story of a given individual who played a significant role in the nation's history;
- Exceptional representations of a particular building or engineering technique or method, or building type; or,
- Archaeological sites that may yield new and innovative information about the past.

Locally Designated Historic Sites

Many municipalities throughout the state also recognize buildings and sites that are historically significant. Local governments may also establish historic preservation committees, designate local landmarks, and grant protections for local historic and cultural resources identified in their communities. To date, the SHPO has approved the adoption of historic preservation ordinances by approximately 70 local governments.[248]

New York Heritage Areas

SHPO's Heritage Area Program preserves and develops areas of special historical significance in New York State. The program currently features 20 Heritage Areas, formerly managed under the Urban Cultural Park system, which are recognized for their significant contributions to the history, development, and culture of New York State.[249] Each Heritage Area celebrates unique regional contributions to important historical themes, such as industry, agriculture, national defense, transportation, the natural environment, or civil society. The boundaries of each Heritage Area are designated through enabling legislation.

Archaeological Resources

Archaeological sites in New York State include both prehistoric Native American sites, which date back as far back as 12,000 years ago through 1500 AD, and historic-period resources related to the settlement and development of the State since the arrival of European colonists and settlers. While the exact number of archaeological sites is unknown, SHPO records include approximately 18,000 archaeological sites, while New York State Museum's records (consolidated with the SHPO's files) identify approximately 12,000 sites. Of these, approximately 560 sites are listed on the NRHP, and the SHPO has identified an additional 1,100 sites as eligible for and therefore receiving protection under the NRHP.[250]

[248] DPS and Ecology and Environment Inc. 2013. Indian Point Contingency Plan Final Generic Environmental Impact Statement. Prepared for New York State Public Service Commission. July 2013. Accessed September 17, 2014 at: http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7B4FEE54FA-74C8-4954-B76F-ECDEEEC16266%7D.

[249] New York State Office of Parks, Recreation, and Historic Preservation. 2007 Heritage Development Resource Guide. Accessed August 20, 2014 at: http://www.nysparks.com/historic-preservation/documents/HeritageDevelopmentResourceGuide.pdf.

[250] DPS and Ecology and Environment Inc. 2013. Indian Point Contingency Plan Final Generic Environmental Impact Statement. Prepared for New York State Public Service Commission. July 2013. Accessed September 17, 2014 at: http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7B4FEE54FA-74C8-4954-B76F-ECDEEEC16266%7D.

3.11 WASTE MANAGEMENT[251]

In 2008, New York residents generated approximately 36.6 million tons of materials and waste, of which the majority was municipal solid waste (18 million tons, or 50 percent), followed by industrial waste (13 million tons, or 36 percent), with the remaining composed of Construction and Demolition (C&D) at ten percent, and biosolids at five percent.

Electric utilities in New York State generate approximately two million tons of solid waste per year as a by-product of conventional energy production and the burning of fossil fuels. Such production, primarily in coal-fired units, creates approximately two million tons per year of fly ash, bottom ash, and scrubber sludge as fuel generation waste. While some of the electric industry's solid waste is recycled, most is buried in landfills. In 2008, New York's ten Waste-to-Energy (WTE) facilities, each with a capacity of approximately 300 MW, processed approximately four million tons of Municipal Solid Waste (MSW) per year, delivering approximately one percent of the electric power generated in the State. In 2010, landfill gas-to-energy facilities in New York State generated 774,891 MWh of electricity.[252] According to NYSDEC, New York's WTE facilities also produce approximately one million tons of non-hazardous combined ash (a combination of fly ash and bottom ash) each year.

New York also contains six operational nuclear plants that produce both high-level (HLRW) and low-level (LLRW) radioactive wastes.[253] These plants currently store more than 2,000 tons of spent fuel on-site in spent fuel pools.

3.12 NOISE AND ODOR POLLUTION

Noise Pollution

NYSDEC defines noise as any loud, discordant, or disagreeable sound or sounds.[254] In an environmental context, noise is more generally defined as unwanted sound, with measurable impacts based on a complex, subjective relationship between the noise source and the person or place impacted by the noise ("receptor"). The level of sound perceived at the receptor depends on numerous variables, including the noise level at the source and the distance from the noise source to the receptor. Local topography can further influence whether a particular sound level is considered a noise in one location but insignificant in another area.[255] Finally, the quality or characteristics of the sound and the sensitivity of the receptor can be as significant a factor as the volume of the sound when determining whether or not sound is unwanted or should be characterized as noise.

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[251] NYSDEC. Solid Waste Composition and Characterization. Accessed August 14, 2014 at: http://www.dec.ny.gov/chemical/65541.html.

[252] NYSDEC. Landfill Gas-to-Energy Facility Data. 2010 Annual Report Data. Accessed on September 12, 2014 at: http://www.dec.ny.gov/chemical/48873.html.

[253] U.S. Nuclear Regulatory Commission. List of Power Reactor Units. Updated May 15, 2014. Accessed on September 12, 2014 at: http://www.nrc.gov/reactors/operating/list-power-reactor-units.html.

[254] NYSDEC. 2001. Assessing and Mitigating Noise Impacts – NYSDEC Document DEP-00-1. Issued October 6, 2000. Revised February 2, 2001.

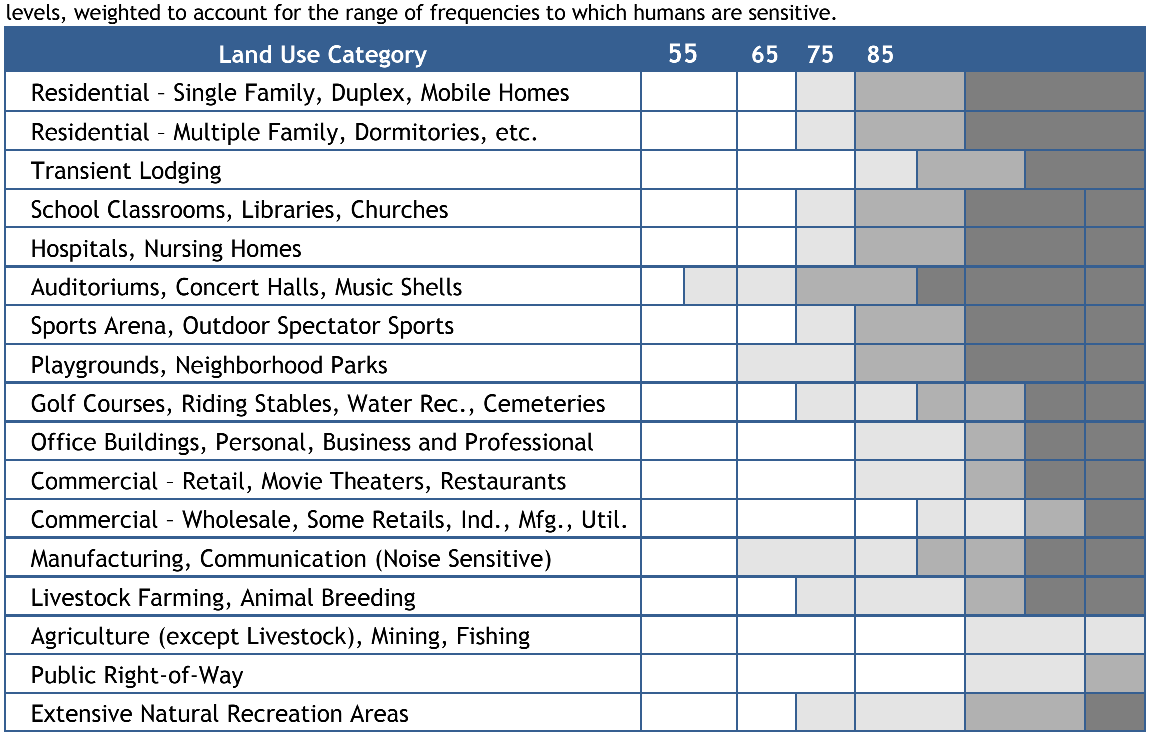
[255] Sound intensity decreases with the square root of the distance from the source or barriers that may attenuate or block the noise from reaching a receptor.

Many municipalities in New York State maintain noise ordinances defining noise impacts and appropriate noise levels for categories of receptors, with different allowable noise thresholds for each category. Acceptable noise levels generally take into account the permitted land uses. Most ordinances take into account the sound generator's permitted land use and also include different noise thresholds for time of day, construction noise, and noise during operations.

Exhibit 3-17 identifies generally acceptable and unacceptable sound levels by land use category, showing basic land use compatibility guidelines as ranges of allowable sound levels for each identified land use. As such, the ranges presented in **Exhibit 3-17** are not binding and are only used as guidelines.

EXHIBIT 3-17 LAND USE INTERPRETATION FOR L_{DN} NOISE VALUES (DBA)

Key:
No shading = Clearly acceptable noise levels;
Light Shading = Normally acceptable noise levels;
Medium Shading = Normally unacceptable noise levels;
Dark Shading = Clearly unacceptable noise levels.
L_{dn} is the average noise level over a 24-hour period. The noise level between 10:00 p.m. and 7:00 a.m.is artificially raised 10 decibels (dB) to account for normal reductions in background noise at night. The dBA is "A-weighted" sound pressure levels, weighted to account for the range of frequencies to which humans are sensitive.



Odor Pollution[256]

Many New York municipalities have ordinances addressing nuisances such as odor, but project-related odor problems can still arise. While the ordinances can be viewed as a general guide, there are no commonly-accepted, objective means of quantifying the objectionable nature of an odor.

[256] DPS and Ecology and Environment Inc. 2013. Indian Point Contingency Plan Final Generic Environmental Impact Statement. Prepared for New York State Public Service Commission. July 2013. Accessed September 17, 2014 at: http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7B4FEE54FA-74C8-4954-B76F-ECDEEEC16266%7D.

Whether an odor is objectionable is subjective, and there is a wide variation in how people perceive odors. Variables contributing to odor impacts include type of odor, proximity to the source, wind and other weather-related variables, time of day, personal preference, health-related impacts, and perceptions of health-related impacts.

Energy generation facilities that are frequently cited in odor complaints include coal-fired plants, manufacturing facilities, landfills, farms, and diesel-related transportation facilities. Instead, the majority of odor complaints generally arise when new facilities (odor sources) are built and new odors are suddenly introduced to receptors. Such rapid, noticeable changes are more likely to lead to an odor complaint than the continuing operation of an existing, established facility.

3.13 PUBLIC HEALTH

Relevant public health issues include: asthma and air quality-related health concerns and exposure of the public to electric and magnetic fields (EMFs), including extremely low frequency (ELF) radiation.

Ozone

Ozone can have an adverse effect on the human body. High ozone concentrations irritate nasal, throat, asthma, and bronchial tissues. Ozone attacks certain components of the body's defense system, raising concerns about the effects of ozone exposure on the human immune system. High concentrations of ozone can also harm forests, thereby altering wildlife habitats, lowering crop yields, and damaging materials such as rubber, plastics, synthetic fibers, dyes, and paints.[257]

While ozone formation occurs most commonly over cities with large numbers of industries, power plants, and vehicles, ozone pollution is also found in remote locations—such as the Adirondack Mountains. This pollution occurs because hydrocarbons, NO_x and ozone are carried by the wind from their origins in cities or industrial areas to rural areas. In large urban areas, ozone mixes with other pollutants to create smog. Smog reduces visibility and can irritate and inflame eye tissues. Generally, hot and dry weather fosters smog production.

Particulate Matter

Particulate matter (PM) is a generic term for a broad class of chemically and physically diverse substances that exist as discrete particles (liquid droplets or solids) over a wide range of sizes. As previously discussed, particulate matter is classified in terms of the particle's aerodynamic diameter. PM2.5 is particulate matter with an aerodynamic diameter of 2.5 microns or less. PM10 includes all particulate matter with an aerodynamic diameter of 10 microns or less. Thus, PM2.5 is, by definition, a subset of PM10. In general, the term "fine particulate matter" is used to describe PM2.5, while "coarse" particulate matter describes particulate matter with an aerodynamic diameter of greater than 2.5 microns and equal to or less than 10 microns.

Elevated levels of PM2.5 in the atmosphere have been linked to serious health conditions in humans. Exposure to PM2.5 has been closely associated with increased hospital admissions and emergency room visits for heart and lung disease, increased incidence of respiratory disease, including asthma, decreased lung function and premature death. Sensitive groups that appear to be at greatest risk of such effects include the elderly, individuals with existing cardiopulmonary

[257] EPA. The Science of Ozone Depletion. Accessed August 14, 2014 at: http://www.epa.gov/ozone/science.

disease, and children. Reductions in the NO_x and SO_2 will in turn reduce the fine particulates formed from those emissions.

After several years of efforts to control pollution sources, the New York metropolitan area achieved compliance with EPA air quality standards for PM2.5, bringing the entire state into federal compliance in April 2014. Measurements showed that long-term PM2.5 concentrations in outdoor air went from 14 percent above the federal 24-hour standard in 2003 to 26 below in 2013.[258]

Mercury

Mercury is a toxic metal that persists in the environment and exists in several forms. Metallic mercury is a shiny, silver-white, odorless liquid at room temperature. Inorganic mercury or mercury salts are usually white powders or crystals created when mercury combines with elements such as chlorine, sulfur, or oxygen. Organic mercury occurs when mercury combines with carbon, including, for example, methylmercury, a compound produced by small organisms in water and soil that can bioaccumulate up the food chain. Methylmercury and metal vapors are the most harmful forms.

Exposure to mercury at high levels may damage the brain, kidneys, and a developing fetus. Very young children are more sensitive to mercury than adults and may develop nervous and digestive system problems and kidney damage. Mercury is used in thermometers, barometers, hydrometers, pyrometers, mercury arc lamps, switches, fluorescent lamps, pharmaceuticals, anti-fouling paints, and agricultural chemicals. Mercury is naturally occurring in the environment, but human activities, primarily fossil fuel combustion, mining, smelting, and solid waste incineration, have resulted in additional mercury in the environment. Efforts are being made to eliminate the use of mercury containing products and recycle mercury in order to reduce mercury levels in the waste stream. To the extent that the operations of fossil-fuel power plants - particularly coal plants - are reduced by the addition of renewable resources, mercury emissions from those plants may also decrease. In 2010, power plants in New York State ranked 34th in the country in terms of airborne mercury emissions, at 259 pounds or approximately 0.4 percent of the nationwide power plant emissions of mercury reported to EPA's Toxics Release Inventory.[259]

Asthma[260]

Asthma is a chronic lung disease caused by restriction of the airways that can result from a variety of genetic and environmental factors. Chronic asthma is usually controllable with drugs that relax the constricted airways or block inflammation caused by allergens and irritants. Common triggers for acute attacks include, but are not necessarily limited to, tobacco smoke, dust mites, cockroach allergen, pets, molds, smoke, and outdoor air pollution, which may come from power plant

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[258] NYSDEC. 2014. New York Statewide Air Quality Now Meets Federal Standard. April. Accessed September 22, 2014 at:http://www.dec.ny.gov/press/96759.html.

[259] Environment America Research & Policy Center. 2011. America's Biggest Mercury Polluters. How Cleaning Up the Dirtiest Power Plants Will Protect Public Health. November. Accessed on September 13, 2014 at: http://www.environmentamerica.org/sites/environment/files/reports/AME-Biggest-Mercury-Polluters---WEB.pdf.

[260] New York State Department of Health. 2009. New York State Asthma Surveillance Summary Report. Public Health Information Group, Center for Community Health. October. Accessed August 20, 2014 at: http://www.health.ny.gov/statistics/ny_asthma/pdf/2009_asthma_surveillance_summary_report.pdf.

emissions, and other chemical irritants.[261] Nationally, nearly one in 13 school-age children suffer from asthma. The incidence of childhood asthma, however, is rising more rapidly in preschool-aged children and children living in urban inner cities, where asthma rates are generally higher than in non-urban populations. In 2008, an estimated 1.3 million adults and 475,000 children in New York State were diagnosed with asthma. Current asthma prevalence among adults increased from 6.3 percent in 1999 to 8.7 percent in 2008. Asthma prevalence in New York State has been higher than the national average since 2002.

In New York State, asthma emergency department visits and hospitalization rates are higher than the national rates for all age groups and exceeded the Healthy People 2010 objectives, a U.S. Department of Health and Human Services initiative that defines the 10-year national goals and objectives for health promotion and disease prevention. For 2005 to 2007, an average of 255 deaths due to asthma occurred per year in New York State, an age-adjusted asthma mortality rate of 12.5 per one million residents. During the same time frame, New York State children missed more than 1.9 million days of daycare, pre-school, or school due to asthma each year. Adults with asthma reported approximately 7.6 million days within the past year when they were unable to work or carry out usual activities because of asthma and approximately 30 percent of New Yorkers follow an asthma self-management plan. The total cost of asthma hospitalizations in New York State in 2007 was estimated at approximately $535 million.

Electric and Magnetic Fields

Electric and magnetic fields (EMFs) are generated by all electric currents, including kitchen appliances and cellular telephones, as well as power transmission lines. The health effects of EMF and, specifically, ELF fields, which are generated when the direction of current flow in an AC line switches, have been studied since the 1970s. Although some studies have shown a correlation between exposures to magnetic fields and childhood leukemia, brain tumors, and breast cancer, because many other factors correlate with houses located in close proximity to transmission lines, a causal relationship between EMF exposure and cancer is unclear. While there are no national or New York State standards for occupational exposures, the New York State Public Service Commission has established two electric field strength standards:

- **Opinion 78-13** (issued June 19, 1978) established a limit for electric fields at the edge of a right-of-way (ROW), at three feet above ground level to 1.6 kV/m for electric transmission lines.
- **Interim Policy guidelines** (issued on September 11, 1990) limit magnetic fields at the edge of an ROW at three feet above ground level to 200 milligauss (mG).

In addition to public exposures, the Occupational Health and Safety Administration (OHSA) monitors and sets international and industrial guidelines for worker safety.[262]

Currently, urban populations are exposed to EMF in the home and workplace from appliances and power cables, many of which, however, are belowground or shielded. Rural populations are also

[261] Centers for Disease Control and Prevention. Asthma webpage. Accessed August 20, 2014 at: http://www.cdc.gov/asthma/faqs.htm.

[262] U.S. Department of Labor, Occupational Health and Safety Administration. Safety and Health Topics: Extremely Low Frequency (ELF) Radiation. Accessed August 20, 2014 at: http://www.osha.gov/SLTC/elfradiation/.

exposed, albeit at relatively low levels, from overhead transmission lines, in addition to exposure in the home and workplace. However, public exposure is many thousands of times less than worker exposures because EMF strength diminishes with the square root of the distance from a power line and the cube root of the distance from a point source. For example, a magnetic field measuring 57.5 mG immediately beside a 230 kV transmission line measures just 7.1 mG at a distance of 100 feet, and 1.8 mG at a distance of 200 feet.[263]

The National Institute of Health and the National Institute of Environmental Health sponsored a scientific review of the existing health literature related to power line exposures. This scientific review found only a weak statistical link between EMF exposure and cancer, but could not confirm the presence (or absence) of a causal link between EMF exposure and cancers.

3.14 GROWTH AND CHARACTER OF COMMUNITIES

Community character is influenced in large party by shifts in population and regional economic patterns. 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.

Municipalities typically guide community character through comprehensive plans or master plans, implemented through local land use regulations, including zoning. Community character, as described by residents, however, is more difficult to define (or legislate), and is sometimes associated with more intangible community qualities such as the visual landscape (**Section 3.8**), demographics (**Section 3.16**), density (**Section 3.16**), open space (**Section 3.9**), noise (**Section 3.13**), air quality (**Section 3.4**), or traffic patterns (**Section 3.11**).

Population[264]

New York State was the most populated state through the mid-twentieth century. Aside from 1940 to 1945, when New York and many states experienced population decline, its population steadily increased until the mid-1970s. At that point, New York's total population began to taper. New York is now the third most populous state, behind California and Texas.[265] The U.S. Census estimated the population of New York at 19,651,127 on July 1, 2013, a 1.4 percent increase from the state's 2010 population of 19,378,102.

New York State is divided into 62 counties, 11 metropolitan statistical areas (MSAs) and five combined statistical areas (CSAs). Approximately 42.8 percent of New York's population resides within the New York City metropolitan area, which is also the most populous metropolitan area in

[263] National Institute of Environmental Health Sciences. 2013. Electric and Magnetic Fields. May 26. Accessed August 20, 2014 at: http://www.niehs.nih.gov/health/topics/agents/emf/.

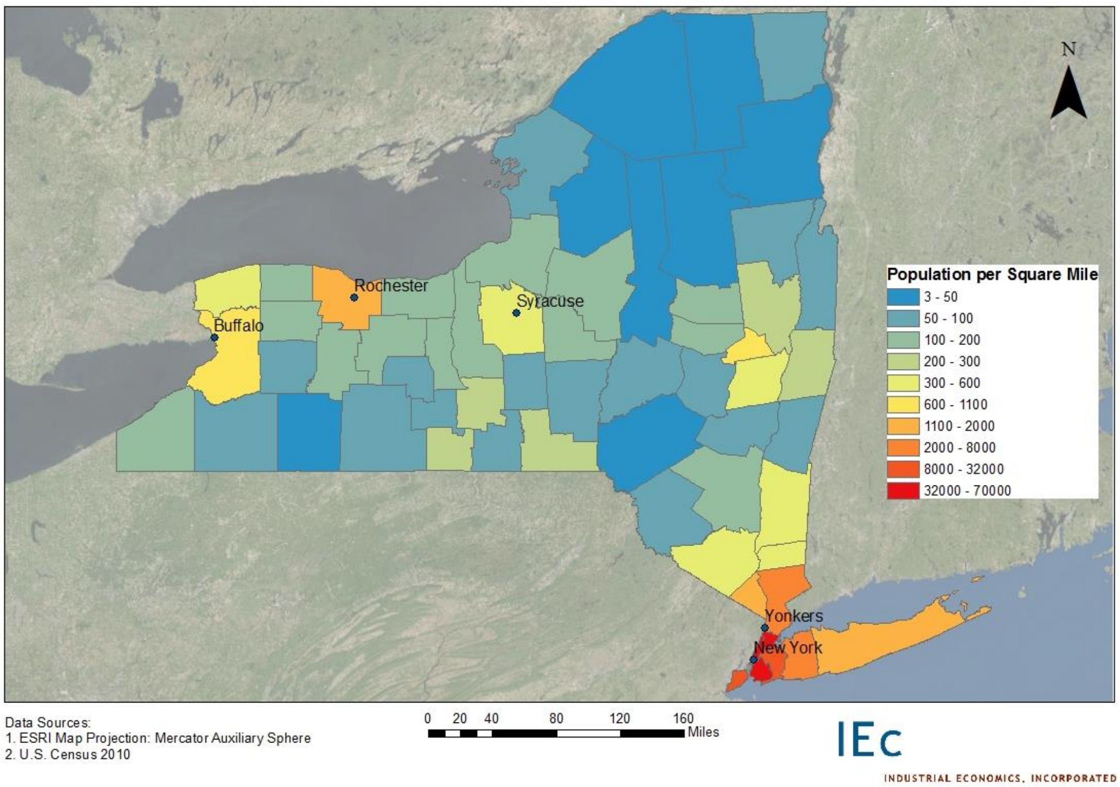
[264] U.S. Census Bureau. State & County Quick Facts – New York. Accessed August 14, 2014 at: http://quickfacts.census.gov/qfd/states/36000.html.

[265] 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.

the U.S.[266] With a 2013 population of approximately 8.4 million people, New York City is also the most populous city in the U.S., followed by Los Angeles and Chicago.

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 8.2 million residents and feature a population density of 27,012 per square mile. By comparison, the remainder of the State contains 11.2 million residents at a density of 239 per square mile.[267] Upstate and downstate are often used to distinguish New York City and its greater metropolitan area (i.e., 'downstate') from the rest of New York State (i.e., 'upstate'). **Exhibit 3-18** illustrates the relative population densities across New York State.

EXHIBIT 3-18 NEW YORK STATE POPULATION DENSITY BY COUNTY



Population growth follows similar patterns as population levels and density, with the majority of population gains occurring in the downstate New York metropolitan area. New York City is the largest contributor to the State's overall population growth, adding a net population increase of 161,561 persons in 2010, as compared to a total state-wide total population growth of 104,500 between 2010 and 2011.[268] Between 2010 and 2012, 27 counties gained population and 35 counties

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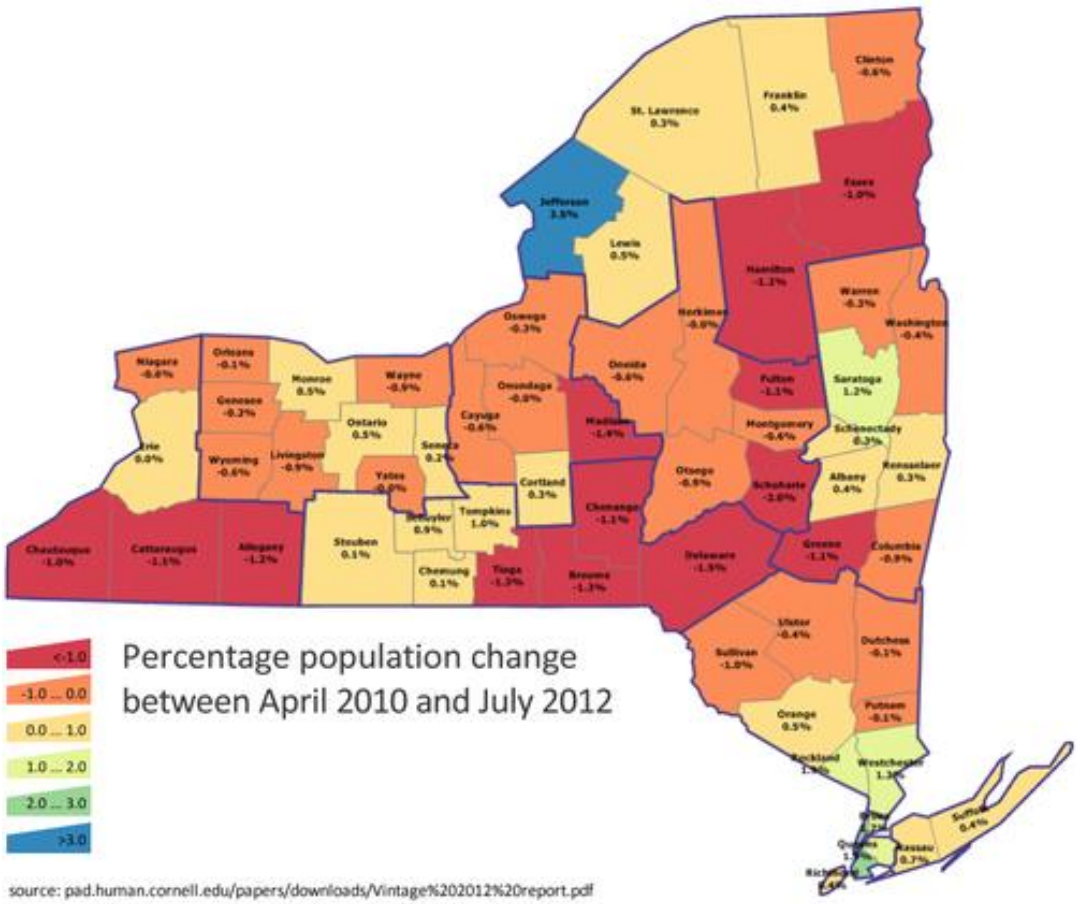
[266] U.S. Census Bureau. State & County Quick Facts – New York. Accessed August 14, 2014 at: http://quickfacts.census.gov/qfd/states/36/3651000.html.

[267] New York State Department of Health. 2012. Vital Statistics of New York State 2010. Accessed August 20, 2014 at: http://www.health.ny.gov/statistics/vital_statistics/2010/.

[268] U.S. Census. Population Estimates. Accessed August 14, 2014 at: http://www.census.gov/popest/data/state/totals/2013/tables/NST-EST2013-01.xls.

lost population. Jefferson County in northern New York was the fastest growing county at 3.5 percent, whereas Schoharie County in the central part of the State experienced the largest relative population loss at 2.0 percent. **Exhibit 3-19** below illustrates changes in population between 2010 and 2012.

EXHIBIT 3-19 PERCENT POPULATION CHANGE BETWEEN APRIL 2010 AND JULY 2012

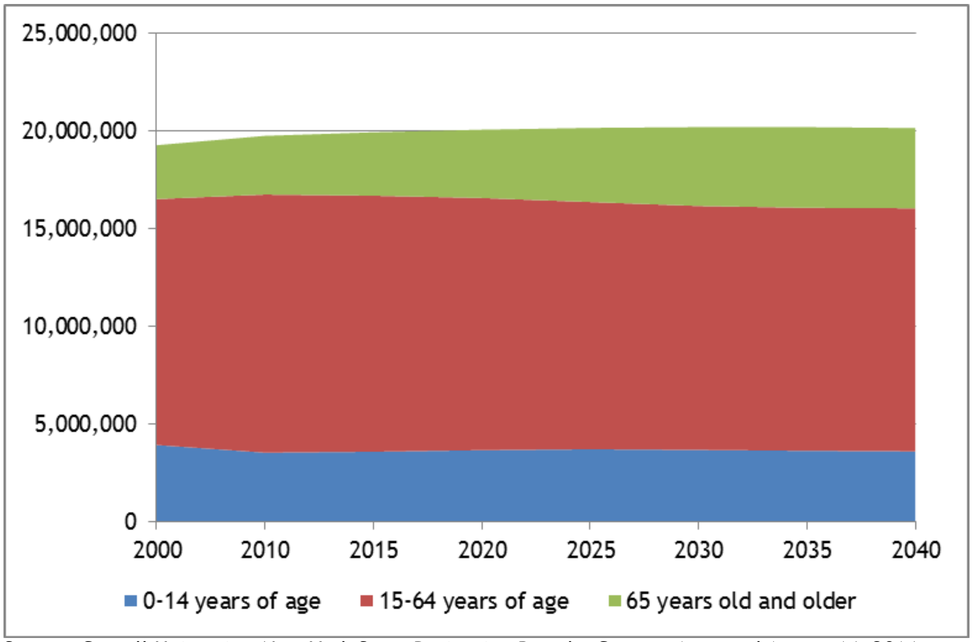


Source: Cornell University based on July 2013 U.S. Census Population Estimate. Accessed on August 12, 2014 at: http://cornelluniversity.tumblr.com/post/45343876159/downstate-n-y-and-albany-see-population-growth-35.

Relying on population data from the 2000 Census, Cornell University's Applied Demographics program developed State-wide population projections through 2040. Assuming that historical rates of population growth and decline remain relatively constant, the State is expected to grow 1.3 percent to a 2040 population of approximately 19.62 million people (**Exhibit 3-20**). Of the estimated population for 2040, 63 percent are anticipated to be between 15 and 64 years of age and 21 percent older than 65 years of age.[269]

[269] Cornell University notes that state-wide population projections are not meant to be forecasts; forecasts are predictions of future conditions while these projections are meant to gain insight into what might happen if the future looks like the past. (Cornell University. New York State Projection Data by County. Accessed August 14, 2014 at: http://pad.human.cornell.edu/counties/projections.cfm.)

EXHIBIT 3-20 POPULATION PROJECTION, 2010-2040, BY AGE GROUP



Source: Cornell University. New York State Projection Data by County. Accessed August 14, 2014 at: http://pad.human.cornell.edu/counties/projections.cfm.

Community Types

While community character can sometimes appear relatively constant, it is always evolving due to shifting demographics, changes in the local and regional economy, and the passage of time. Regardless of size, development projects have the potential to affect community character over both the short- and long-term. Although often difficult for residents or visitors to define, elements of community character can be highly influential in individuals' decisions to migrate, start a business, or travel to a given location. These elements can work in either positive or negative ways, either attracting or deterring residents, businesses, or visitors. **Exhibit 3-21** summarizes the seven most common community types in New York State.

EXHIBIT 3-21 SUMMARY OF NEW YORK COMMUNITY TYPES

COMMUNITY TYPE	COMMUNITY TYPE DESCRIPTION
Rural Agricultural	The dominant land use in this community type is agriculture, and farm structures/equipment, livestock, and open fields are significant components of this landscape. Rural residences are typically scattered along a network of country roads. The topography in this setting will vary from hilly to flat, with a mix of crops and pastureland, woodlots and hedgerows.
Rural Hamlet	The dominant feature in this community type is a cluster of residential structures in a largely rural setting. These areas may have a small commercial center that is usually located at an intersection of two rural roadways. Historic structures of varying significance are often present.
Village	These communities typically consist of a concentration of residential structures with a commercial business core. Historic structures and/or historic districts are often present. The structures may be of a vernacular material or style but typically include a mix of new and old architecture. Vegetation consists of large street trees, landscaped yards,

COMMUNITY TYPE	COMMUNITY TYPE DESCRIPTION
	and parks. The streets are often organized in a traditional grid pattern, and the more modern commercial and industrial facilities are typically located on the village periphery.
Suburban	Suburban residential areas consist of mostly residential structures along existing road frontage, as well as residential subdivisions with curvilinear roads and cul-de-sacs. These moderate-to high-density residential developments include larger yards and relatively modern homes of varying architectural styles and materials. Commercial portions of suburbs generally consist of strip development along a highway, including retail stores, automobile dealers, shopping centers, and malls; residential uses are limited. Suburban commercial character is typically dominated by highways, buildings, automobiles, and pavement (roads and parking lots). This type of setting usually surrounds a village or urban area; the surrounding landscape can vary from suburban residential, to farmland, to forested hills.
Urban	Urban residential settings are typically dominated by 2-to 4-story masonry apartment blocks and single family and multiple family homes, although some urban residential areas (e.g., portions of New York City) feature structures much larger than this. The streets are generally organized in a grid pattern and lined by narrow sidewalks and street trees. Urban commercial areas generally feature buildings that are at least two to four stories in height, with retail storefronts along the sidewalks and upper floors that are used as offices and apartments. Urban downtowns typically occur in the center of a city and are characterized by high-rise buildings and gridded street patterns. Both urban commercial and downtown areas usually feature gridded street patterns, which are busy with traffic, and frequently accommodate on-street parking. In general, views along urban streets are framed or screened by adjacent buildings, and vegetation is typically limited to street trees, planters, pocket parks, or larger public parks.
Industrial	Industrial areas are dominated by an often haphazard mix of buildings and structures associated with manufacturing, warehousing, utility, and transportation-related activities. An industrial setting often occurs along the outskirts of urban and village areas. The topography is generally flat and vegetation is limited or nonexistent. Pedestrian activity is generally insignificant, as most activity typically occurs within the industrial facilities in such areas, although some industrial settings (typically older manufacturing districts) feature limited residential uses that may contribute a degree of community character.
Developed Shoreline	Along New York State's coastlines (e.g., Long Island Sound, New York Harbor, and the Hudson River), open water is the dominant feature but is frequently interrupted by docks, piers, and/or boats. The shoreline may include natural beach or may be bulkheaded or otherwise structurally reinforced. A developed coastline will include ports, marinas, and shorefront commercial, residential, and recreational facilities. Along lakeshores other than those of the Great Lakes, the dominant natural feature is water, with surrounding hills and mountains typically in the background. However, the natural shoreline in these settings is interrupted by man-made features such as seasonal homes/camps, boathouses, and docks. The foreground that frames the water views includes both man-made and natural features.

3.15 TRANSPORTATION

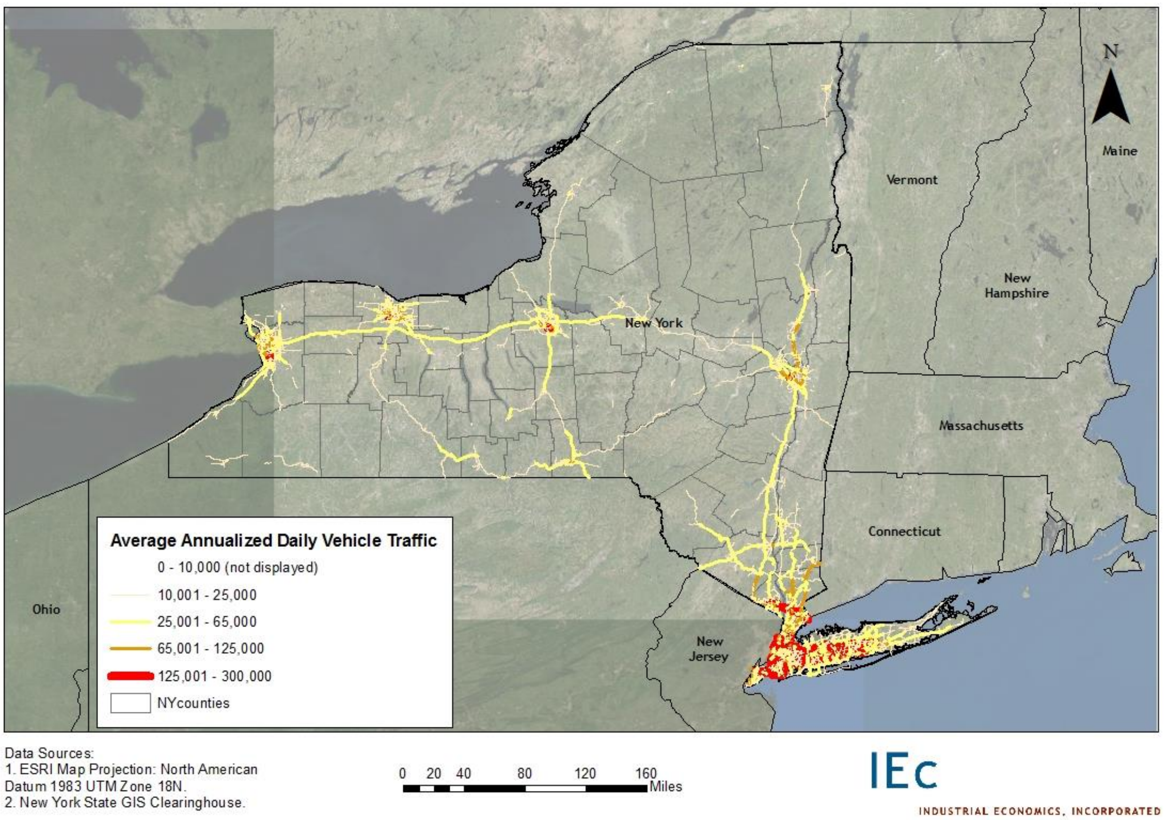
The transportation modes and facilities found throughout New York State and in the southeastern portion of the State include:

- Highway infrastructure and motor vehicle traffic;

- Rail shipping and travel;
- Recreational boating and commercial shipping;
- Air travel and shipping;
- New York City subway and other public transit modes; and,
- Pedestrian and bicycle travel.

In particular, the Hudson Valley forms a critical transportation corridor across multiple modes between the New York City-Long Island area and the rest of the state. This corridor has a high concentration of north-south oriented highways and rail lines, in addition to the Hudson River itself. **Exhibit 3-22** below outlines traffic volume in 2012 collected by the New York State DOT from over 35,000 traffic count stations along major roads and highways throughout the State.

EXHIBIT 3-22 NEW YORK STATE TRAFFIC VOLUMES



Roads and Highways

New York's primary transportation network consists of the existing system of interstate highways, urban expressways, rural highways, and local streets. Ownership of the State's roads, highways, and, in particular, bridges, is a patchwork of federal, State, county, local, and private ownership. The New York State Thruway is maintained by the New York State Thruway Authority and Canal Corporation, whereas the remaining federal and state highways are under the jurisdiction of the DOT. While counties and municipalities are responsible for local roads and bridges, federal funds from the Federal Highway Administration (FHWA) are frequently relied upon for periodic repairs and routine maintenance. The State's inventory of bridges includes a number of State and local bridges that currently require rehabilitation or replacement due to age and higher traffic loads in excess of the bridges' constructed capacity.

Vehicular traffic between New York City and the rest of the state is a major area of focus. In particular, the Hudson Valley corridor, which funnels traffic to New York City, consist of New York State Routes 9 and 9A and several limited access highways, including the New York State Mainline Thruway (I-87), which crosses the Hudson at the Tappan Zee Bridge and continues to I-278 in the Bronx, Sawmill River Parkway, Bronx River Parkway, Hutchinson River Parkway (I-678), and I-95. Highway capacity in these areas is generally insufficient, adversely affecting vehicular traffic in the southeastern part of the State. Insufficient highway capacity is further exacerbated from the State's ongoing efforts to repair, reconstruct, and maintain the State's aging roads and highways; the capacity for existing highways to bear extra loads for construction vehicles or fuel deliveries is varied and in some areas limited.

Transit, Rail and Air Services

The Metropolitan Transportation Authority (MTA) is the largest transportation network in North America. The MTA owns and operates New York City's public transit network, including the subways, buses, and the Metro-North and Long Island commuter railroads. The MTA also maintains most of the bridges in and out of New York City.[270] Across its network, MTA serves a population of more than 15.1 million people who travel to, from, and thru New York City, Long Island and the southeastern portions of the State. The MTA estimates that its subways, buses, and railroads provide 2.62 billion trips each year – the equivalent of approximately one in every three users of mass transit in the U.S. and two-thirds of the nation's rail riders. MTA bridges and tunnels carry more than 280 million vehicles a year – more than any bridge and tunnel authority in the nation.

Established in 1921, the Port Authority of New York and New Jersey (Port Authority) operates a number of facilities and transportation systems that serve the New York and adjacent New Jersey area, including commuter rail service to and from Manhattan and New Jersey, marine terminals and ports, six tunnels and bridges, and the Port Authority Bus Terminal in Manhattan. [271]

New York State also maintains an extensive system of rail lines for passengers and freight. Amtrak is the sole provider of intercity rail passenger service in New York State, providing passenger service over rail lines owned by freight railroads. Amtrak links downstate with upstate cities, including Albany, Utica, Syracuse, Rochester, Buffalo, and many other intermediate points. The owners and operators of the State's freight corridors include CSX Transportation, Canadian Pacific Railway, and Norfolk Southern Railway.

The southeastern portion of New York State is served by six airports (**Exhibit 3-23**). Of these, three airports – John F. Kennedy International Airport (JFK), Newark Airport, and LaGuardia Airport – manage the majority of the area's air travel. In 2012, the Port of Authority of New York and New Jersey, which manages these three major airports, estimated a passenger service

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[270] New York Metropolitan Transportation Authority. The MTA Network. Accessed August 14, 2014 at: http://web.mta.info/mta/network.htm.

[271] The Port Authority of New York and New Jersey. Overview of Facilities and Services. Accessed August 14, 2014 at: http://www.panynj.gov/about/facilities-services.html.

population of approximately 112.2 million passengers, while JFK accounts for approximately 45 percent (or 50.4 million passengers) of the total airline travel across the three airports.[272] Other sizable airports in New York State include Buffalo Niagara International Airport, Greater Rochester International Airport, Albany International Airport, and Syracuse Hancock International Airport; all of which had over one million enplanements in 2010.[273]

EXHIBIT 3-23 AIRPORTS SERVING SOUTHEASTERN NEW YORK STATE
Long Island MacArthur Airport
John F. Kennedy International Airport
LaGuardia Airport
Newark Airport (New Jersey)
Stewart International Airport
Westchester County Airport

Plug-in Electric and Fuel Cell Vehicles

Interest and availability of electric vehicles (including plug-in, battery, fuel cell and hybrid vehicles) is continuing to rise. In 2011, the EIA estimated the United States' fleet of battery electrical vehicles (BEVs) at 67,295.[274] Over the last year, from January 2013 to January 2014, the Electric Drive Transportation Association (EDTA) estimated cumulative EV sales of 592,232 plug-in vehicles, a sales figure 21.4 percent higher than cumulative EV sales from 2012 (487,480) and more than double the total number of sales from 2011 (284,064).[275]

In 2012, New York State accounted for 3.5 percent of the total number of electric vehicles sold; California is the leader in electric vehicle sales with approximately 40 percent of national sales.[276] In 2013, there were 210 registered EVs in Manhattan, 591 in nearby Westchester County, and 972 in Suffolk County.[277] New York State has made significant efforts to develop infrastructure that supports EVs. For example, New York State features 414 charging stations and 882 charging

[272] The Port Authority of New York and New Jersey. 2014. 2013 Annual Traffic Report. April 1. Page 31. Accessed August 14, 2014 at: http://www.panynj.gov/airports/pdf-traffic/ATR2013.pdf.

[273] FAA. 2011. Enplanements at Primary Airports (Rank Oder CY10). October 26. Accessed on September 12, 2014 at: http://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/passenger/media/cy10_primary_enplanements.pdf.

[274] EIA. 2011. "Frequently Asked Questions: How Many Alternative Fuel and Hybrid Vehicles Are There in the U.S.?" January 11. Accessed on August 14, 2014 at: http://www.eia.gov/tools/faqs/faq.cfm?id=93&t=4.

[275] EDTA. Electric Drive Sales. Accessed August 14, 2014 at: http://electricdrive.org/index.php?ht=d/sp/i/20952/pid/20952.

[276] Berman, Brad. "Ten States Ranked for Electric Car Adoption." PluginCars.com. 1 Nov. 2012. Accessed August 14, 2014 at: http://www.plugincars.com/ten-states-ranked-electric-car-adoption-125108.html; and California Plug-In Electric Vehicle Collaborative. PEV Sales Dashboard – California Sales. Accessed August 14, 2014 at: http://www.pevcollaborative.org/.

[277] Motavalli, Jim. New York Requires Garages and Lots to be Built EV-Ready. Plugincars.com December 10, 2013. Accessed on September 12, 2014 at: http://www.plugincars.com/new-york-requires-lots-and-garages-be-built-ev-ready-129063.html.

outlets (not including residential charging infrastructure).[278] New York City features 151 charging stations along with more than 140 EVs in the City's municipal fleet as of 2013.[279]

In 2013, New York State passed the Alternative Fuel Vehicle Recharging Tax Credit, which, through 2017, provides tax credits for 50 percent of the cost, up to $5,000, for the purchase and installation of alternative fuel vehicle refueling and electrical vehicle recharging property. Additionally, the legislation allowed EVs (along with hybrids) to use high-occupancy vehicle (HOV) lanes through the Clean Pass Program without restriction.[280] The Port Authority also required newly constructed and upgraded parking lots to include EV charging conduits (that can support Electric Vehicle Supply Equipment to an electric supply panel with a minimum capacity of 3.1 kilowatts) for up to 20 percent of all parking spaces.[281]

In November 2005, New York State enacted a Low Emission Vehicle (LEV) program, subsequently amended in November of 2011 and 2012. Modeled after California's LEV program, New York's LEV program sets emission standards for all new, on-road motor vehicles, motor vehicle engines, and emission control systems sold in New York State. New York also adopted California's fleet standards, which requires manufacturers to produce a certain percentage of zero emission vehicles as part of their fleet, and to produce a fleet with a determined average emissions rate. All of the standards adopted by New York's LEV program are more stringent than the equivalent Federal standards.[282]

Additionally, the governors of New York and seven other states signed a memorandum of understanding pledging action to support development of zero-emission vehicles (ZEV).[283] The agreement coordinates policy actions across the states to foster the growth and ownership of ZEVs. The multi-state initiative has established a goal to placing 3.3 million ZEVs in use by 2025.[284]

3.16 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

The socioeconomic setting that may be affected by the approval of the REV and CEF proceedings comprises several factors: employment levels; housing requirements; municipal revenues; and, electricity rates. Depending on the geographic footprint of clean energy and potential effects on electricity rates, environmental justice concerns may also emerge.

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[278] DOE. 2014. "Alternative Fueling Station Counts by State." Alternative Fuels Data Center. April 18. Accessed August 14, 2014 at: http://www.afdc.energy.gov/fuels/stations_counts.html.

[279] Motavalli, Jim. 2013. "New York Requires Garages and Lots to Be Built EV-Ready." PluginCars.com. December 10. Accessed August 14, 2014 at: http://www.plugincars.com/new-york-requires-lots-and-garages-be-built-ev-ready-129063.html.

[280] Hartman, Kristy. 2013. "State Hybrid and Electric Vehicle Incentives." State Hybrid and Electric Vehicle Incentives. National Conference of State Legislatures. November 15. Accessed August 14, 2014 at: http://www.ncsl.org/research/energy/state-electric-vehicle-incentives-state-chart.aspx#ny.

[281] The Port Authority of New York and New Jersey. 2014. 2013 Annual Traffic Report. April 1. Page 31. Accessed August 14, 2014 at: http://www.panynj.gov/airports/pdf-traffic/ATR2013.pdf.

[282] NYSDEC. New Vehicle Technology. Subpart 218. Accessed on September 13, 2014 at: http://www.dec.ny.gov/chemical/8575.html.

[283] California, Connecticut, Maryland, Massachusetts, Oregon, Rhode Island, and Vermont.

[284] ZEV Program Implementation Task Force. 2014. Multi-State ZEV Action Plan. May. Accessed on September 12, 2014 at: http://governor.maryland.gov/documents/MultiStateZEVActionPlan.pdf.

General Demographics

New York City's long history as a principal point of entry into the U.S. serves as a source of ethnic and cultural diversity unique to the State of New York. According to the U.S. Census, Caucasians make up the majority of the State's population in 2013 with 70.9 percent, followed by black or African Americans at 17.5 percent, Asians at 8.2 percent, and American Indian, Pacific Islanders each less than one percent. In addition, approximately 22 percent of the population is foreign-born. Socioeconomic conditions vary substantially across the state.

Employment Characteristics[285]

In New York State, approximately nine million people were employed in non-farm positions in May 2014. This represents a 1.5 percent increase compared to May 2013.[286] According to the New York State Department of Labor, total private sector jobs (including construction) increased by 134,400 jobs during the same period, equivalent to a year-over-year growth rate of 1.9 percent. The majority of the private sector job growth occurred in the downstate area; employment in the 10-county downstate region increased by 2.4 percent, with the most rapid growth occurring in New York City, which experienced job growth at a rate of three percent. In the 52-county upstate region, private sector jobs grew by 0.9 percent over the past year. Job growth in the upstate region occurred primarily in metro areas (increasing by one percent), with significant growth in Kingston (2.2 percent) and Poughkeepsie-Newburgh-Middletown (1.6 percent increase). Counties outside of the metro areas also experienced a slight increase in employment by 0.3 percent over the past year.

Income and Wage Characteristics[287]

The average wage for an employed person in New York State in 2013 was $63,097, an increase of 0.62 percent from $62,766 in 2012. The annual mean wage for all occupations was $54,580 in 2013, an increase of 1.8 percent from 2012. In 2012, the average median wage[288] in counties in Upstate New York was $51,264.35; the average median wage in counties Downstate New York during the same year was $64,914.80.[289]

Counties with the highest median household income include Nassau County ($97,049), Putnam County ($95,259), and Suffolk County ($87,778). In Upstate New York, Saratoga County had the highest median household income in 2012 ($67,712). Counties with the lowest median household incomes in 2012 include Bronx County ($34,300), Chautauqua County ($41,975), and Allegany County ($42,095).

[285] New York State Department of Labor. 2014. Press Release: New York State's Economy Adds 17,300 Private Sector Jobs in July. August 14. Accessed August 22, 2014 at: http://labor.ny.gov/stats/pressreleases/pruistat.shtm.

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

[287] U.S. Bureau of Labor Statistics. Occupational Employment Statistics. Last updated April 1, 2014. Accessed August 21, 2014 at: http://www.bls.gov/oes/tables.htm.

[288] A weighted average median household income was calculated for each region based on the number of households and median household income of each county in each region.

[289] Calculated using weights constructed from ACS 2012 household totals and median household income (2012 dollars) data. Source: U.S. Census Bureau. 2008-2012 American Community Survey 5-Year Estimates. Accessed on September 12, 2014 at: http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t&keepList=t.

Exhibit 3-24, on the following page, presents key economic characteristics for the entire State of New York.

EXHIBIT 3-24 SELECT INCOME AND WAGE CHARACTERISTICS OF NEW YORK STATE (2008-2012)

METRIC	NEW YORK STATE	U.S.
Households	7,230,896	115,938,468
Homeownership rate	54.5%	65.5%
Median home value	$295,300	$181,400
Per capita income ($2012)	$32,104	$28,051
Median household income	$57,683	$53,046
Persons below poverty level	14.9%	14.9%
Source: U.S. Census. State and County Quick Facts - New York. Accessed August 14, 2014 at: http://quickfacts.census.gov/qfd/states/36000.html.		

Housing Characteristics

From 2002 to 2010, housing vacancy rates across New York State ranged between 10 percent and 12 percent.[290] In 2012, the housing vacancy rate in New York State was estimated by the American Community Survey at 10.89 percent, a slight decrease from 11.48 percent in 2011 and 11.2 percent in 2010.[291] According to the 2012 American Community Survey, 54.5 percent of occupied housing units are owner-occupied.[292] In 2012, 47 percent of housing units were single unit residences, while 27.5 percent of housing units were a part of structures containing two to 19 housing units, and 23 percent of housing units were a part of structures containing 20 or more housing units. Mobile homes account for 2.4 percent of all housing units.[293]

The 2012 American Community Survey estimated that 43.9 percent of renters in New York paid gross rent costs totaling 35.0 percent or more of household income.[294] In 2011, of 2,172,634 total rental units in New York City, approximately 1.02 million units (or 47 percent) were rent-regulated.[295]

According to the Federal Reserve Bank of New York, the housing boom and bust in the early part of the 2000s largely bypassed upstate New York, where construction activity is a relatively small part of the overall economy. As a result, home prices generally stabilized across upstate New York,

[290] Cresce, Arthur A. January 2012. Evaluation of Gross Vacancy Rates from the 2010 Census Versus Current Surveys: Early Findings from Comparisons with the 2010 Census and the 2010 ACS 1-Year Estimates. Social, Economic and Housing Statistics Division, U.S Census Bureau. Accessed August 20, 2014 at: http://www.census.gov/housing/files/FCSM%20paper.pdf.

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

[292] U.S. Census Bureau, 2008-2012 American Community Survey 5-Year Estimates. Accessed on September 12, 2014 at: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_12_5YR_DP04&prodType=table.

[293] *Ibid.*

[294] *Ibid.*

[295] Furman Center for Real Estate & Urban Policy. Rent Stabilization in New York City. Accessed September 26, 2014 at: http://furmancenter.org/files/publications/HVS_Rent_Stabilization_fact_sheet_FINAL.pdf.

with some parts even experiencing appreciation of home prices; for example, Buffalo, Rochester, and Syracuse all ranked in the top ten percent in terms of home price appreciation in 2009.[296]

Municipal Revenue

Real estate property taxes (RPT) are the primary source of revenue for the majority of cities, towns, and villages in the State. The RPT is levied in more than 4,700 taxing jurisdictions in New York State, calculated based on the value of residential and non-residential real properties, with certain exceptions. Reliance on the RPT varies by type of government. In fiscal year 2012, counties across New York State received 22 percent of their revenue from the RPT, cities received 23 percent, and school districts received a range of less than 10 percent to more than 95 percent.[297] Across all local governments, RPT accounted for 39 percent of total revenues.

In addition to the RPT, New York City is unique in its authority to levy several additional taxes, including personal and business income taxes. The City of Yonkers is also authorized to levy an individual income tax. Certain other local governments, including cities, counties, and school districts, are authorized to impose sales/use taxes, hotels and motel taxes, real estate transfer taxes, mortgage recording taxes and utility taxes.

Environmental Justice

The EPA defines environmental justice as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Environmental justice efforts focus on improving the environment in communities, specifically minority and low-income communities, and addressing disproportionate adverse environmental impacts that may exist in those communities.

NYSDEC promulgated regulations at 6 NYCRR Part 487 for incorporating environmental justice issues into proceedings before the PSC for determining whether to site a major electric power plant pursuant to Article 10 of the Public Service Law.[298] For matters overseen by the NYSDEC, for example the DECs environmental permit review process and DECs application of the SEQRA, DEC Commissioner Policy 29 on Environmental Justice and Permitting (CP-29) provides guidance to DEC staff on environmental justice issues. Under CP-29, potential environmental justice areas are U.S. Census block groups of 250 to 500 households each that, in the 2000 census, had populations that met or exceeded at least one of the following statistical thresholds:

1. At least 51.1 percent of the population in an urban area reporting themselves to be members of minority groups; or
2. At least 33.8 percent of the population in a rural area reporting themselves to be members of minority groups; or

[296] Federal Reserve Bank of New York. 2010. “Bypassing the Bust: The Stability of Upstate New York’s Housing Markets during the Recession.” Accessed August 1, 2014 at: http://www.newyorkfed.org/research/current_issues/ci16-3.pdf.

[297] Office of the NYS Comptroller, Division of Local Government and School Accountability. 2014. 2013 Annual Report on Local Governments. February. Accessed August 5, 2014 at: http://www.osc.state.ny.us/localgov/datanstat/annreport/13annreport.pdf.

[298] NYSDEC. 2014. Environmental Justice. Accessed August 20, 2014 at: http://www.dec.ny.gov/public/333.html.

3. At least 23.59 percent of the population in an urban or rural area with household incomes below the federal poverty level.[299]

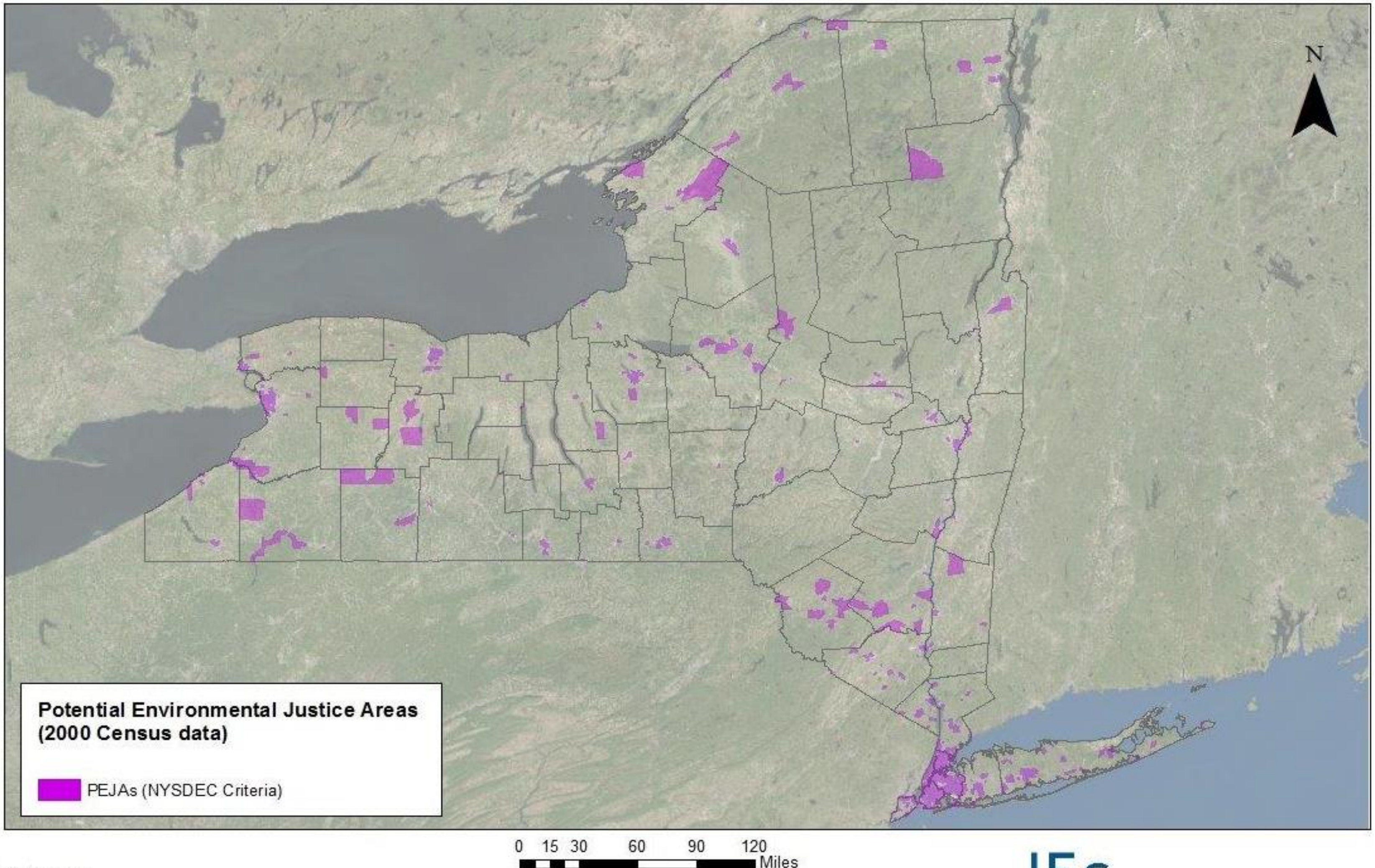
As shown in **Exhibit 3-25**, based on 2000 Census data, PEJAs occur throughout the state, with an area of concentration in New York City. The 2000 Census PEJA is the most recent mapping available of New York's PEJAs.[300] NYSDEC is currently in the process of developing a new map of New York PEJAs that better reflect changes in income and ethnicity since the 2000 Census; this new mapping effort is not expected to be complete until 2015.[301]

[299] NYSDEC. 2013. County Maps Showing Potential Environmental Justice Areas. Accessed at: http://www.dec.ny.gov/public/899.html.

[300] The 2010 Census does not provide the necessary information to define updated PEJAs. In addition, while the 2012 American Community Survey (ACS) provide more recent information on median household income and the racial and ethnic population of New York State, additional data limitations preclude the use of this data for the purposes of developing updated PEJA maps. In particular, the 2000 Census represented a complete count of the population of New York, while the ACS represents only a sample subset.

[301] Personal communication with Doug Morrison, New York State Office of Information Technology Services, on August 15, 2014.

EXHIBIT 3-25 NEW YORK STATE POTENTIAL ENVIRONMENTAL JUSTICE AREAS (2000)



Data Sources:
1. Environmental Systems Research Institute Map Projection: Mercator Auxiliary Sphere.
2. New York State Department of Environmental Conservation.

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CHAPTER 4 | ALTERNATIVES CONSIDERED

This chapter characterizes the regulatory and market alternatives that could arise in response to the approval and implementation of the REV and CEF proceedings. The chapter is organized into four sections.

- Section 4.1 describes the baseline or "no action" definition developed as a point of reference for the comparison of alternatives.
- Section 4.2 identifies the alternatives as defined for purposes of this GEIS and summarizes their characteristics.
- Section 4.3 presents summary peak demand, energy, emissions, and cost impacts for the alternatives by resource type.
- Section 4.4 describes the methodology used to construct the scenarios and provides detail on the individual resource components of the scenarios.

4.1 BASELINE DEFINITION

Defining a baseline or "no action" condition is necessary to provide a common point of reference to which each of the alternatives considered can be compared. This baseline should represent the most likely state of resources, activities, markets, and behaviors that would exist absent any efforts to achieve or accomplish one of the alternatives. Because of the uncertainty regarding the potential timing of the alternatives (as described in Section 4.2, below) and the fact that nearly all of the resources evaluated as part of the alternatives are currently subject to various State and federal policy and market interventions, the baseline definition for this GEIS is framed in terms of a reference year. The year 2015 has been selected as the reference year to account for currently approved spending on energy efficiency, renewable energy, and other alternatives.

The overall approach to developing the baseline uses current capacities, rates of installation, and approved levels of spending to project the additional capacity of each energy resource type that will likely be developed between the time of the analysis and the end of 2015. The starting year for these estimates varies slightly across resources, based on the most recent available data. Details regarding the baseline are provided as part of the resource detail in Section 4.3.

4.2 ALTERNATIVES DEFINITION

As previously noted, REV and CEF, along with other regulatory changes, are enabling mechanisms that will facilitate a variety of initiatives. This GEIS addresses a broad spectrum of potential impacts from these initiatives, in both quantitative and qualitative form. The quantitative modeling exercise focuses on the potential consequences of alternative outcomes based on the analysis of a limited number of hypothetical scenarios designed to capture a reasonable and representative spectrum of potential effects of these enabling mechanisms.

Developing the two alternatives requires first identifying the outcome or outcomes that the alternatives seek to achieve. Successful implementation of the REV and CEF is expected to result in a wide range of potentially-measurable outcomes, such as reduced total energy consumption, reduced greenhouse gas and other air pollutant emissions, lower total energy bills for ratepayers, increased private-sector investment in the energy sector, greater fuel and resource diversity, improved system reliability and resiliency, avoided infrastructure costs, increased penetration of DER, EE and demand management (DM), and reduced system peak loads. While many of these metrics are potentially measurable, for the majority of these metrics, REV/CEF-specific targets or thresholds are not currently defined. The REV and CEF also does not prioritize any one outcome over another, but rather anticipates numerous individual initiatives which in aggregate will move the State closer toward each of its stated objectives. Similarly, the REV and CEF do not prescribe the pathway to achieving these objectives, instead considering a diverse portfolio of actions and strategies that will in aggregate transform the ways in which energy is valued, generated, distributed, managed and used across the entire energy industry.

In response to these uncertainties, the GEIS focuses on the central vision of the REV, i.e., increasing the use and coordination of distributed energy resources.[302] To measure this central vision, the GEIS selects system peak reduction as the basis (or metric) for constructing the two alternatives and through which the other objectives of the REV and CEF can be achieved. Looking to the DPS Staff REV proposal, the substantial benefits of reducing system load during the 100 hours of greatest peak demand are noted.[303] Flattening the top 100 hours translates to a roughly 14 percent reduction in peak load. The DPS Staff REV proposal also notes the benefits from improvements to system efficiency, where a one percentage point improvement in load factor from the current value of 55 percent to 56 percent would reduce peak load by three percent.[304] These outcomes provide the basis for constructing the upper and lower bound scenarios, respectively, as well as the associated energy and emissions impacts of the alternatives. Selecting peak reduction as the metric by which to construct the two alternatives does not, however place a value on the importance of peak reduction relative to other REV/CEF objectives, nor does it mean that the components of the bounding scenarios were selected and analyzed based solely on their peak reduction potential. As discussed further below, peak reduction serves to guide the development of each alternative, but the estimates projected for an individual resource category are based on a variety of factors, in addition to peak reduction potential. In other words, changing the metric by which the two alternatives are constructed will not necessarily change the portfolio of technologies and approaches considered in this analysis, nor the relative quantity that each resource is likely to contribute under each scenario.

The nature of the REV and the CEF translate to outcomes that are widely distributed, both physically and temporally. EISs typically examine the impact of discrete actions, such as the

[302] DPS. Case 14-M-0101. Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision. Developing the REV Market in New York: DPS Staff Straw Proposal on Track One Issues. Filed August 22, 2014. Page 4.

[303] *Ibid*, pp. 9-10.

[304] “Load factor” refers to the ratio of average load to peak load, whether for an individual consumer, a utility, or an entire electrical system. Higher load factors translate into more efficient use of system resources, because fewer resources are needed to supply peak demands of relatively short duration, more generators can have longer run hours, and there is a reduced need to construct or upgrade transmission and distribution infrastructure.

construction of a gas-fired generator or expansion of a gas pipeline. In contrast, the alternatives in this GEIS will be developed incrementally over time. For example, increasing the penetration of customer-sited renewables will occur through thousands of individual transactions over several years. The assessment of each resource in the alternatives must account for time as a constraint or factor. Therefore, the lower-bound alternative is assumed to be achievable in the near to medium-term, approximately five years, and individual resource estimates are developed accordingly. The upper-bound alternative is assumed to be achievable in the medium to long-term, approximately ten years.

The alternatives represent just two possible scenarios concerning the potential evolution of the electrical system in New York over the next several years. They are meant to be illustrative, not prescriptive. They do not represent the DPS's intended or preferred outcomes, nor should they be considered targets or expectations for any individual sector or entity. Furthermore, the alternatives are not limited to those likely to result from any specific policy actions or State initiatives. The estimates for each specific resource are determined based on limitations in technology, market acceptance, current trends in adoption, and cost/diffusion, rather than policy factors. Similarly, the set of resources for the alternatives were developed based on technology and resource types rather than along the lines of enabling policies. For example, both the New York Green Bank and NY-Sun are enabling factors for growth in customer-sited solar photovoltaic capacity, but the GEIS does not distinguish between these two "buckets" of resources. Rather, to avoid the potential for double-counting, customer-sited solar PV (and other customer-sited renewables) is considered one resource.

Under NYSERDA's new CEF proposal, the agency is requesting approval for a 10-year program that, in conjunction with the outcomes of the REV proceeding, will promote and encourage the development of clean energy resources in New York for the coming years.[305] As a result, the CEF proposal indicates possible outcomes for several of the resources included in the alternative scenarios. Importantly, the CEF proposal represents just a portion of the potential resources that could be brought to bear on facilitating the development of a portfolio of DER such as included in the alternatives described here. Most significantly, the electric utilities in the state are likely to continue promoting energy efficiency with continuing programming and financial resources. The REV process also contemplates a larger role for the utilities with respect to other DER. Therefore, they may have a role to play in supporting nearly all of the resources that compose the alternatives in this GEIS.

4.3 SUMMARY OF OUTCOMES FROM ALTERNATIVES ANALYSIS

Peak Demand and Energy Impacts

Exhibit 4-1 below summarizes the contribution of each energy resource in the baseline as well as under the lower and upper bound alternatives. The resource contributions are characterized in gross terms and relative to the forecast baseline for each resource. Peak reduction, in units of MW, is the preferred metric for assessing the selected three percent and 14 percent peak reduction

[305] NYSERDA. 2014. Case 14-M-0094 – Proceeding on the Motion of the Commission to Consider a Clean Energy Fund. Clean Energy Fund Proposal. Issued September 23, 2014.

goals. Because emissions impacts are correlated with energy reduction, the table also shows the resulting reduction in grid-based generation as measured in MWh.

The first four resources in the table (through demand response) are currently the subject of public support or initiatives in the form of funding from a system benefits charge or other spending by NYSERDA. The future contribution of these resources to the objectives of REV would be closely linked with the ultimate outcome of CEF directions and policies.

- **Energy Efficiency** refers to efforts that reduce the energy required to achieve a particular outcome (e.g., conditioned living or working spaces, lighting, water heating) with less energy input.
- **Customer-sited Renewables** are energy-generating technologies with no fuel input (e.g., wind, solar, hydroelectric) or renewable fuel input (e.g., biomass, biogas) that are located at and often owned by end-users, such as solar photovoltaic panels on a homeowner's roof or a biomass-fired boiler at an industrial facility. These resources tend to reduce customer energy purchases from distribution utilities.

EXHIBIT 4-1 PEAK DEMAND AND ENERGY IMPACTS, BY ALTERNATIVE AND RESOURCE TYPE

	SUMMER PEAK CAPACITY (MW)					REDUCTION IN GRID-BASED GENERATION (GWH)	
		ALTERNATIVE		INCREMENTAL			
	BASELINE	LOWER	UPPER	LOWER	UPPER	LOWER	UPPER
Energy Efficiency	437	1,335	2,539	898	2,102	5,890	13,787
Customer-sited Renewables	54	171	295	116	241	156	324
Combined Heat & Power	25	81	250	56	225	397	1,588
Demand Response	1,150	1,293	2,586	143	1,437	-	-
Fossil Fuel Distributed Generation	-	-	250	-	250	-	110
Grid Integrated Vehicles	2	21	155	19	153	(2)	(17)
Storage (flywheel and battery)	102	152	227	50	126	(6)	(14)
Rate Structures	-	188	188	188	188	-	-
Total		**3,241**	**6,491**	**1,471**	**4,721**	**6,436**	**15,778**
	Reduction from Forecast			*4.1%*	*13.2%*		
Utility-scale ("Main-tier") Renewables	165	667	1,169	502	1,004		

- **CHP** is the use of fuel to simultaneously generate electricity and useful thermal output. These systems are typically located at customer facilities rather than as stand-alone merchant generators. For purposes of this analysis, CHP systems are assumed to be located at a customer facility and to provide their electric and thermal output to that customer.
- **Demand Response** is a set of activities intended to reduce electric demand during peak hours or other times of high electric prices. This can be accomplished through shifting consumption to non-peak times or simply forgoing electric usage altogether.

DG refers to a broad range of technologies by which electric generation is distributed among many smaller facilities rather than a large central-station plant. For example, the customer-sited renewables described above qualify as distributed generation. This analysis includes fossil-fuel fired distribution generation as a subset of DG relevant to the REV and CEF proceedings and the GEIS, primarily because of the very different environmental impacts of a natural-gas fired combustion generator as opposed to a rooftop PV installation.

NYSERDA has thus far provided limited support for the following three resources, but may increase this support in the future.

- **Grid integrated vehicles** can supply energy to the electric grid from their on-board batteries or be managed to avoid drawing energy for charging during peak periods
- Several **storage** technologies exist that can either store electric energy directly or convert electric energy to a storable form for later reconversion. This analysis assesses the possibility of two such technologies that are also capable of being widely distributed. Flywheel systems convert electric energy to kinetic energy in the form of large spinning masses, which can then drive a generator to convert kinetic energy back to electricity. Batteries, for purposes of this analysis, are systems that store electric energy through reversible chemical processes.
- **Rate structures** are policy and regulatory instruments that can influence electric consumption patterns and can therefore be applied to achieve reductions in peak energy demand.

Last, the table presents an estimate of the potential future contribution of utility-scale or "main-tier" renewable energy resources, but not contributing to the target REV peak demand reduction. The scale of these resources generally precludes locating them near load centers; therefore, they contribute less to the distributed energy objectives of the REV. Nevertheless, they do support the objective of decreasing reliance on fossil-fuel based generation, and are therefore presented here to illustrate the potential scale of the impacts from increased penetration of utility-scale renewables in New York.

Emissions Impacts

Changes in the total emissions of air pollutants resulting from fuel combustion is one of the primary impacts from the alternatives examined in this GEIS. In some cases (e.g., energy efficiency, renewable energy systems), the resources deployed to reduce peak demand may also result in reductions in grid-based energy generation, which translates to lower emissions. In other cases (e.g., fossil fuel distributed generation, energy storage), the resources may result in either no change or an increase in total energy consumption and emissions. Changes in annual grid-based generation reported in Exhibit 4-1 are across all time periods, not just periods of peak demand.

Exhibit 4-2 summarizes the emissions impacts of the alternatives for three important pollutants. Both nitrogen oxides and sulfur dioxide are criteria pollutants under the Clean Air Act and carbon dioxide is the most prevalent greenhouse gas. Changes in the emissions of these pollutants are compared against a baseline inventory of statewide emissions resulting from electric generation only. That is, the baseline excludes emissions from mobile sources and from space and process heating. The factors used to estimate emissions reductions from displacing grid-based generation were provided by NYSERDA and are the same as those used in the recent statewide energy efficiency and renewable energy potential study.[306]

EXHIBIT 4-2 EMISSIONS IMPACTS, BY ALTERNATIVE

ALTERNATIVE	NITROGEN OXIDES (1,000 TONS)			SULFUR DIOXIDE (1,000 TONS)			CARBON DIOXIDE (1,000 TONS)		
	ANNUAL EMISSIONS	CHANGE FROM BASELINE	% CHANGE	ANNUAL EMISSIONS	CHANGE FROM BASELINE	% CHANGE	ANNUAL EMISSIONS	CHANGE FROM BASELINE	% CHANGE
Baseline	24.0	-	-	43.2	-	-	33,173	-	-
Lower Bound	22.0	(2.0)	(8%)	40.8	(2.4)	(6%)	31,461	(1,712)	(5%)
Upper Bound	19.3	(4.7)	(20%)	37.6	(5.6)	(13%)	29,180	(3,993)	(12%)

Emissions reductions from all resources, excluding CHP, fossil-fuel distributed generation, and utility-scale renewables Base Case from 2011 National Emissions Inventory, Electric Generation sector only.

Emissions reductions as a percentage of the baseline follow the reduction in grid-energy consumption relatively closely, which is to be expected. For fossil fuel distributed generation, the reduction in grid-supplied electricity does not contribute to emissions reductions, as these resources consume fossil fuels and largely replace emissions from central-station generating plants with emissions from more widely distributed locations. Displacing grid-based generation with CHP could result in a wide variety of net emissions impacts depending on fuel type, operating characteristics, and overall efficiency. Because information is not available to determine that net impact, the analysis does not include emissions reductions for CHP.[307] There are also potential differences between the emissions profiles of distributed fossil-fuel based generation and grid-based generation that result from variations in the mix of resources in use at different times and different portions of the load curve, particularly with respect to the marginal generating resource. Capturing these potential temporal differences would require a detailed dispatch model of the entire New York electrical grid, including assumptions regarding the load shape of each of the analyzed resource types. Uncertainty regarding the potential impacts of the REV and CEF, however, precludes the feasibility of undertaking such an exercise. The projected emissions reductions are intended to be a conservative (*i.e.*, more likely to under-estimate the reductions) estimate of the range of impacts from the bounding scenarios.

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[306] Optimal Energy, Inc. et al. 2014. Energy Efficiency and Renewable Energy Potential Study of New York State. Prepared for the New York State Energy Research and Development Authority, Carl Mas, Project Manager. April. Accessed on September 26, 2014 at: https://www.nyserda.ny.gov/Energy-Data-and-Prices-Planning-and-Policy/Energy-Prices-Data-and-Reports/EA-Reports-and-Studies/EERE-Potential-Studies.aspx.

[307] For example, systems with high total efficiency fueled by natural gas or cleaner fuels may decrease emissions, particularly if operating mostly at times that displace grid-based resources with higher than average emissions. On the other hand, less efficient systems that largely displace low or no-emissions generation such as nuclear and hydroelectric may result in increased emissions. Without a highly disaggregated and detailed assessment of both the wide variety of operating characteristics and a power sector model to determine changes in grid-based generation on a daily or hourly basis, the GEIS makes the assumption that for purposes of this analysis and on average, across all potential scenarios, CHP systems result in no net reduction in emissions.

The reduction in carbon dioxide emissions in the upper bound, 12 percent, represents a rate over time that is roughly two-thirds that needed to achieve the 80 percent reduction by 2050 proposed in Executive Order 24.[308]

Cost Impacts

Implementing or installing the resources that compose the alternatives, like any type of energy supply, requires spending on equipment, materials, and labor. **Exhibit 4-3** presents cost estimates for each resource under each alternative, along with the incremental capacity, for reference. These costs represent the gross incremental capital cost to realize the projected capacity for each resource. They do not include the cost savings from displaced grid generation, or the value of any other changes in emissions, non-electric resources, risk, or environmental impacts. Under the objectives of the REV and the realities of electric market in New York, only those resources that can provide value in excess of their costs are likely to be implemented. Because the simplifications in the analysis are more likely to under-value the avoided costs for all resources, particularly those that operate for relatively short periods of time to offset very expensive peak power needs, it is anticipated that even those resources with positive net costs represent viable contributions to the peak reduction alternatives.

EXHIBIT 4-3 ILLUSTRATION OF COST IMPACTS, BY ALTERNATIVE SCENARIO AND RESOURCE TYPE

	INCREMENTAL CAPACITY (MW)		INCREMENTAL CAPITAL COST (MILLION $)	
	LOWER	UPPER	LOWER	UPPER
Energy Efficiency	898	2,102	1,898	3,665
Customer-sited Renewables	116	241	995	1,837
Combined Heat & Power	56	225	213	850
Demand Response	143	1,437	88	886
Fossil Fuel Distributed Generation	-	250	-	472
Grid Integrated Vehicles	19	153	12	96
Storage (flywheel and battery)	50	126	76	188
Rate Structures[1]	188	188	-	-
Total	**1,471**	**4,721**	**3,281**	**7,995**
Utility-scale ("Main-tier") Renewables	502	1,004	394	727

Notes:
1. Any decision to invest public funds in advanced metering will be based on a broader set of policy and technical objectives. Given the uncertainty surrounding these policy objectives, data are not available to permit an allocation of advanced metering costs to multiple objectives, including enabling time-varying rate structures; thus, the analysis assumes zero incremental cost for this resource.

[308] NYSDEC Executive Order No. 24, Establishing a Goal to Reduce Greenhouse Gas Emissions Eighty Percent by the Year 2050 and Preparing a Climate Action Plan. Accessed on September 29, 2014 at: http://www.dec.ny.gov/energy/71394.html.

REV will monetize numerous system and societal values in a uniform transaction market that is not presently available. It is not possible to predict with certainty, based on past experience, which alternatives will represent net cost savings. REV will also introduce non-monetized customer preferences into market decisions. Therefore, only an illustrative scenario can be provided.

The recent CEF proposal includes a request for $5 billion in funding over a period of 10 years. Over a similar timeframe, this analysis indicates a cost of roughly $8 billion for all of the resources including the alternatives. In part, this difference is attributable to the fact that the CEF proposal represents funds for NYSERDA only, whereas the alternatives include resources that may be the recipient of funding from other sources. This is particularly significant in the areas of utility funding for energy efficiency and demand response programs.

4.4 METHODOLOGICAL APPROACH BY RESOURCE

Energy Efficiency

EE has long been a key component of alternative energy supply in New York. It is typically defined as any action or technology that results in an equal or greater level of desired outcome or service with lower total energy consumption.[309]

Energy efficiency has been supported by public funds in New York since the mid-1990s. This support has largely taken the form of programs that provide financial incentives to customers across all sectors (i.e., residential, commercial, institutional, and industrial). These incentives reduce the (typically) higher initial costs of more efficient equipment or the costs of retiring existing inefficient equipment before the end of its useful life in favor of more efficient options. In New York, efficiency programs have been delivered by investor-owned utilities, NYSERDA, and public authorities (NYPA and LIPA).

The recent CEF proposal also includes a fuel neutral approach to funding that attempts to provide a more comprehensive program approach. The most likely impact of a more fuel neutral funding strategy on the alternatives is the possibility that CEF energy efficiency activities would be more supportive of heating fuels switches, where this would be to the customer's benefit and result in overall increases in total system efficiency.

Baseline

The 2014 Load & Capacity Data "Gold Book" prepared by NYISO was used to develop the baseline for energy efficiency savings.[310] This source forecasts 491 MW of reductions from energy efficiency and customer-sited ("retail") solar photovoltaic generation in 2015.[311] This load

[309] By this definition, efficiency is distinct from conservation, which is defined to mean reducing energy consumption even if this results in worse outcomes or services. Installing a more efficient air conditioning unit is efficiency, but setting the thermostat to a higher temperature is conservation.

[310] NYISO. 2014 Load & Capacity Data 'Gold Book.' April 2014. Accessed September 18, 2014 at: http://www.nyiso.com/public/webdocs/markets_operations/services/planning/Documents_and_Resources/Planning_Data_and_Reference_Docs/Data_and_Reference_Docs/2014_GoldBook_Final.pdf.

[311] Retail solar PV refers to small-scale solar powered photo-voltaic systems which generate electric energy and are installed at retail customer sites or locations on the customer's side of the meter, rather than large-scale systems which are interconnected to the bulk power system.

reduction was allocated to EE and solar PV using the proportion of actual 2013 reductions from those two resources as reported by the IOUs and NYSERDA.[312]

Projections

To estimate EE's contribution under the two bounding scenarios, several sources were relied on. First, two key metrics were calculated for efficiency programs from reported 2013 program results: the ratio of energy savings to peak demand reduction (MWh/MW) and the cost with which the programs generate peak demand reduction ($/MW). For the alternative bounding scenarios under the REV, efficiency programs were assumed to improve achievement of peak reduction, resulting in lower cost per MW. The assumption is that the statewide average (roughly $1.7 million per peak MW) could be improved to match the average of the best performing utilities and sectors in 2013, which translates to a 10 percent to 20 percent improvement in this metric. Next, a 20 percent increase in annual spending on efficiency was assumed for the lower bound alternative, with a 30 percent increase for the upper bound. While the recent CEF proposal contemplates a decrease in spending from recent levels, both in total and in terms of the amount of funding for direct payments to customers for energy reductions (e.g., through rebates and incentive payments), it is assumed that the distribution utilities will continue to invest resources in energy efficiency programs for their customers. Furthermore, one of the three long-term outcomes for the revised CEF is to attract private capital to invest in clean energy in New York, which could make up the difference.

The combination of spending and cost efficiency results in a projection of efficiency capacity reduction that could be acquired in the medium term for the lower-bound scenario and in the longer-term for the upper-bound scenario. The resulting energy savings were estimated using information on the ratio of energy saving to peak demand reduction from both existing program experience and the results of the EE potential study.

Outcomes

Energy efficiency contributes a substantial portion of the peak reduction capacity for both alternatives. These projections appear reasonable for inclusion at these levels based on the results of the NYSERDA EE potential study referenced earlier.[313] The estimate of energy efficiency's contribution to the upper-bound scenario represents less than half of the 10-year achievable peak reduction forecast by that study.

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[312] Data on IOU and NYSERDA-administered EE programs were gathered from: DPS. 2014. Energy Efficiency Portfolio Standard website. Accessed on September 29, 2014 at: http://www3.dps.ny.gov/W/PSCWeb.nsf/All/2197DAD6F78ECCB085257BA9005E71A6?OpenDocument. Data for renewables were gathered from "The New York State Renewable Portfolio Standard Performance Report through December 31, 2012" and "The New York State Renewable Portfolio Standard Performance Report through December 31, 2013." See, NYSERDA. 2014. New York State Renewable Portfolio Standard. Annual Performance Reports. Accessed September 18, 2014 at: https://www.nyserda.ny.gov/Publications/Program-Planning-Status-and-Evaluation-Reports/Renewable-Portfolio-Standard-Reports.aspx.

[313] Optimal Energy, Inc. et al. 2014. Energy Efficiency and Renewable Energy Potential Study of New York State. Prepared for the New York State Energy Research and Development Authority, Carl Mas, Project Manager. April. Accessed on September 26, 2014 at: https://www.nyserda.ny.gov/Energy-Data-and-Prices-Planning-and-Policy/Energy-Prices-Data-and-Reports/EA-Reports-and-Studies/EERE-Potential-Studies.aspx.

Customer-sited Renewables

As with energy efficiency, New York has been providing public support for customer-sited renewable energy systems for several years. Customer-sited energy systems typically are located “behind-the-meter.” Rather than producing energy that is separately metered and fed into the grid as an independent generating source, the system serves to offset the customer’s electricity consumption. When generating power, the customer draws fewer kilowatt-hours from the grid through the meter. Although there are several eligible technologies for customer-sited renewable energy systems in New York, including fuel cells, small wind turbines, and solar thermal generation, the vast majority of systems installed to date (94 percent) have been solar PV.[314] Therefore, the role of customer-sited renewables in the alternative scenarios was assessed as a whole, rather than on a technology-by-technology basis.

Baseline

The baseline forecast for this resource is determined in conjunction with the energy efficiency forecast as described previously. It is noteworthy that this forecast only represents the incremental capacity likely to be installed between now and 2015, not the total installed base by that time. Nearly 170 MW of capacity, 150 MW of which is PV, has been installed through mid-2014.

Projections

As with energy efficiency, the projection for customer-sited renewables is based on the energy/capacity ratio (MWh/MW) and cost efficiency ($/MW) from 2013 actual program results. Reported nameplate capacities are adjusted to peak demand using coincidence factors developed from a review of the literature. Unlike the analysis of efficiency, there is no assumption of any improvement in cost efficiency. Although improvements may be feasible by dramatically increasing the installation of system types with higher on-peak coincidence than solar PV, this outcome was deemed unlikely. To the extent that cost efficiency could actually be improved by changes in incentive structures and continued reductions in system prices, our estimate is conservative. On the other hand, assumed increases in spending on customer-sited renewables are greater than those for efficiency, because renewables fulfill several of the objectives of the REV and CEF. As with energy efficiency, this analysis does not limit spending to the proposed amounts in the CEF.

The combination of spending and cost efficiency results in a projection of efficiency savings that could be acquired in the medium term for the lower-bound scenario and in the longer-term for the upper-bound scenario. We estimate resulting energy savings using information on the ratio of energy saving to peak demand reduction from both existing program experience and the results of the RE potential study.

Outcomes

Customer-sited renewables can also provide a substantial peak reduction contribution to the alternatives. NYSERDA’s 2012 potential study was again consulted as a check on the possible contribution from energy efficiency to the upper-bound scenario, which represents roughly 21

[314] Data from Renewable Portfolio Standard Performance Reports, year-end 2012 and 2013, issued by NYSERDA in March of the following year. See NYSERDA. New York State Renewable Portfolio Standard. Annual Performance Reports. Accessed September 18, 2014 at: https://www.nyserda.ny.gov/Publications/Program-Planning-Status-and-Evaluation-Reports/Renewable-Portfolio-Standard-Reports.aspx.

percent of the 10-year economic peak reduction forecast by that study.[315] Given that this comparison is based only on the potential for PV and that other customer-sited resources will also contribute to reduce peak load, this estimate is considered reasonable for purposes of the GEIS.

Combined Heat and Power

CHP, also referred to as cogeneration, includes systems that generate both electricity and useful thermal energy within one facility. Typical systems involve either combustion turbines or steam-driven generators for generating electricity, followed by heat exchangers that capture the waste heat for use as space heat, domestic hot water, or process heat loads. Systems can range in size from 100 kW to several MW. CHP systems are attractive because the overall system efficiency can exceed the combined efficiencies of separate electric generation and thermal energy systems. Similar to customer-sited renewable systems, they can result in lower customer loads on the electrical system if located "behind-the-meter." Larger systems may be separately metered, similar to a generation resource. This analysis does not distinguish between these two approaches, but even when separately metered, their physical proximity to loads provides much of the benefit of behind-the-meter distributed energy resources.

Baseline

New York currently supports CHP through programs similar to those that promote renewable energy systems. Between 2002 and 2014, over 200 CHP systems with total capacity exceeding 470 MW were installed in the State. Recent installation rates have been slower, averaging about seven MW per year. Current programmatic budgets support similar installation rates through 2015, which forms the basis of the baseline estimate for the GEIS.

Projections

Current estimates of the technical and economic potential for CHP in New York State far exceed both past and current installation rates. For example, a study completed in 2002 estimated state-wide technical potential for CHP at roughly 8,500 MW, far greater than the amount installed since that time.[316],[317] A new analysis of the economic potential for CHP, nearing completion, finds 2,500 MW.[318] The difference between the economic potential and realized investment in CHP is the result of many barriers, including challenges with interconnection, risk from changes in fuel and electricity prices, and technical complexity. Therefore, rather than rely on the potential estimates, the potential contribution from CHP to the alternatives as a function of recent and

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[315] Optimal Energy, Inc. et al. 2014. *Energy Efficiency and Renewable Energy Potential Study of New York State*. Prepared for the New York State Energy Research and Development Authority, Carl Mas, Project Manager. April. Accessed on September 26, 2014 at: https://www.nyserda.ny.gov/Energy-Data-and-Prices-Planning-and-Policy/Energy-Prices-Data-and-Reports/EA-Reports-and-Studies/EERE-Potential-Studies.aspx. Note, economic potential estimates in this study are presented in terms of installed capacity. These estimates are adjusted to peak capacity basis to be comparable to the alternatives estimates.

[316] Energy Nexus Group et al. 2002. *Combined Heat and Power Market Potential for New York State*. Prepared for the New York State Energy Research and Development Authority by Energy Nexus Group, Onsite Energy Corporation, and Pace Energy Project. October.

[317] The 2002 study is also cited in the recent NYSIO report "A Review of Distributed Energy Resources," released September 2014.

[318] Optimal Energy, Inc. Forthcoming potential study for CHP, under preparation for Bryan Berry, Innovation and Business Development Project Manager. This study included more conservative assumptions about the operation and economics of CHP systems, resulting in lower economic potential than previous analyses.

planned installation rates was estimated, increased to reflect the possibility of additional focus and prioritization of this resource under the REV and revised CEF frameworks. The increased installation rate was limited to 50 percent greater than current rates in the lower-bound scenario, and three times the current rate for the upper-bound scenario. The resulting energy displaced from the grid is determined using information on the ratio of energy saving to peak demand reduction from both existing program experience and the results of the CHP potential study. Although CHP systems are typically run to follow the available thermal load at their site in order to achieve maximum operating efficiency, the analysis assumes that CHP systems have very high coincidence with the period of peak demand. Depending on the nature and severity of peak load conditions, it may be economically reasonable for CHP systems to operate at less than maximum efficiency in order to provide distributed electric energy in support of the power system.

Outcomes

Within these alternative scenarios, CHP provides far fewer megawatts of peak demand reduction than do efficiency and customer-sited renewables. Given that even at the upper-bound, the resulting estimate for CHP is just nine percent of the estimated 10-year economic potential from the forthcoming potential study, it may be reasonable to include even more CHP resources beyond what is included in the alternatives.

Demand Response

Demand response refers to the practice of intentionally reducing electric consumption, usually for purposes of avoiding high prices or maintaining system reliability during periods of peak demand. While some technologies can reduce a customer's load on the system through on-site generation (e.g., customer-sited renewables and CHP), demand response typically refers to situations where customers actually reduce their overall consumption, rather than simply shift it to on-site resources. In deregulated electric markets like New York with sophisticated energy and capacity markets, demand response is typically managed by the ISO or regional transmission organization (RTO). Such is the case with NYISO.

Baseline

Substantial demand response capacity exists in the New York electric market. For example, NYISO maintains four demand response programs with approximately 1,200 MW of capacity.[319] Nearly 90 percent of this capacity represents true load reduction, with the remainder composed of on-site generation, typically via backup generators designed for very few run-hours per year. As a baseline, NYISO is assumed to maintain current levels of enrolled capacity in its DR programs through 2015.

Projections

The alternative projections for demand response as a resource are derived from estimates presented in a study published by the FERC.[320] These estimates include a variety of strategies related to demand response, including both direct load control and dynamic pricing. Importantly,

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[319] NYISO Semi-Annual Report Compliance Report on New Generation Projects; Docket Nos. ER01-3001-000 and ER03-647-000. Filed June 2, 2014.

[320] Brattle Group, et al. *A National Assessment of Demand Response Potential*. Federal Energy Regulatory Commission Staff Report Prepared by The Brattle Group, Freeman, Sullivan & Co, and Global Energy Partners, LLC. June 2009.

they do not include fixed time-of-use rates, which are captured in a separate resource category, below. To the extent that new market mechanisms anticipated in REV open demand response markets to more customers and internalize values such as distribution system needs the projections relied on here may be conservative as applied to REV.

Outcomes

The estimates for demand response in New York suggest a potential nearly twice the currently enrolled capacity. Demand response participation is driven largely by the financial return available to the customer or project sponsor. To the extent that peak capacity in New York continues to be constrained, the value of demand response resources will increase, which will then promote greater participation. The alternatives are therefore aligned with greater demand response activity. The greater the need for demand response, the more demand response is feasible as an economic resource choice.

Distributed Generation[321]

DG can encompass a wide variety of resources, technologies, and fuels. In the context of this analysis, DG is limited to non-CHP fossil-fuel fired generation of limited scale and located in physical proximity to load centers. This would include several types of “prime mover” technologies including reciprocating internal combustion engines, combustion turbines (including micro-turbines), and fuel cells; fuel types could include natural gas, propane, gasoline, and diesel fuel. While DG of this type has few of the benefits associated with the renewable and demand-side resources described in previous sections, it does support the REV objective of distributed energy resources. In fact, it may have detrimental effects on air quality and other environmental resources. For this reason, including capacity of this type in the alternatives analysis supports the goal of creating a GEIS that encompasses as broad a range of environmental impacts as feasible.

Baseline

As noted previously, currently over 100 MW of generation-based DG is enrolled in NYISO’s demand response program. These generators closely match the definition of DG used here. The analysis did not locate any projections for near-term expansion of this resource, and therefore assumes that no additional capacity of this type will be installed prior to the baseline reference year.

Projections and Outcomes

Research did not identify any useful projections of non-CHP fossil-fuel distributed generation to include in the alternative scenarios. Combined with the fact that the lower-bound scenario can be structured without need for contribution from this form of DG, the simplifying assumption was made to include 250 MW of DG in the upper bound scenario. As noted above, this facilitates the inclusion of a resource with potentially detrimental environmental effects, in support of the overall GEIS objective to identify the potential impacts of the REV and CEF.

Grid Integrated Vehicles (GIVs)

While the resources discussed to this point are all currently contributing to the overall resource portfolio in New York State, the remaining three resource types are relatively new contributors to the portfolio and are in limited use. One of the newest resources of this type is the use of electric

[321] Also see additional discussion of Demand Response in **Section 5.2.**

vehicle batteries as a form of storage that can provide capacity and energy during peak periods. As the State and the nation moves further towards electrification of the transportation system, the opportunity for the distributed capacity in the form of GIV will increase. If charged during periods of lower demand (typically overnight) and made available during periods of high demand (e.g., summer peak hours, typically weekday afternoons), vehicle batteries could represent a widely distributed source of peak generation capacity. The small individual capacity of each battery is offset by the very large number of potential units. One of the biggest challenges in developing this resource is the need for infrastructure that coordinates power flow regulation and converts direct-current battery energy to alternating-current grid energy.

Baseline

Developing estimates for GIV storage capacity requires consideration of the likely penetration of electric vehicles, the storage capacity of each vehicle, and the implementation of regulation systems. The baseline estimate begins with data on existing plug-in electric vehicles (PEVs) in New York as of 2013.[322] Given the rapid growth in this area, additional capacity between now and the reference year are projected based on projections for growth in the installed base of these vehicles at the national level.[323] Estimates of the potential peak capacity contribution from this fleet are based on typical and forecast battery sizes, peak period duration, and a limitation on the percentage of a vehicle's total energy capacity that can be realistically provided to the grid while maintaining the usability of the vehicle for the driver.[324]

Projections

To estimate the potential contribution of electric vehicle batteries as peak demand resources in the two alternatives, the growth rate used to construct the baseline estimate is continued for several additional years. More importantly, further growth in the availability and distribution of the infrastructure necessary to realize this capacity as a resource for the grid is also assumed, such that 15 percent of EV's could be grid-integrated in the lower-bound alternative and 33 percent in the upper-bound alternative.

Outcomes

The resulting estimates of the potential peak demand reduction capacity from vehicle storage represent substantial increases from what is currently a non-existent resource, reaching 165 MW in the upper bound scenario. Yet several sources suggest that growth in the PEV market will be material over this same time period. The estimate predicts over 25,000 PEV's on the road in New York by 2015, which would represent a ten-fold increase from 2013.[325] As a further point of comparison, the New York Battery and Energy Storage Technology Consortium suggested in 2012

[322] Ruder, A. *EV Readiness in New York and the Northeast*. Presentation January 10, 2013. Accessed September 29, 2014 at: https://www.naseo.org/Data/Sites/1/documents/committees/transportation/webinars/2013-01-10/Ruder.pdf.

[323] Navigant Research. *Electric Vehicle Geographic Forecasts, Executive Summary.*, Published 2Q2014. Accessed on September 29, 2014 at: http://www.navigantresearch.com/newsroom/plug-in-electric-vehicles-on-roads-in-the-united-states-will-surpass-2-7-million-by-2023.

[324] Average capacity of 24 kWh (Nissan Leaf) and 40 kWh (Toyota RAV4 or entry-level Tesla); 5-hour peak duration, 25% limit on discharge.

[325] Ruder, A. *EV Readiness in New York and the Northeast*. Presentation January 10, 2013. Accessed September 29, 2014 at: https://www.naseo.org/Data/Sites/1/documents/committees/transportation/webinars/2013-01-10/Ruder.pdf.

that the state develop 1,000 MW of storage, including from electric vehicles, by 2022.[326] The estimate of total storage contribution to the alternatives (including vehicles and other storage described below) comes to less than half of this goal. Note that EV storage is less than 100 percent efficient. That is, each unit of energy input to the system produces less than one unit of energy output. For this reason, **Exhibit 4-1** shows vehicle storage with a negative value for energy displaced from the grid, meaning that it requires additional grid energy to produce the stated peak capacity reduction.

Other Storage

Several technologies exist to provide grid-connected electricity storage, ranging in scale from small batteries such as those found in electric vehicles (above) to large pumped-storage hydroelectric facilities such as the 441 MW Lewiston Pump-Generating Plant at Niagara Falls or the 1,160 MW Blenheim-Gilboa project in the Catskills.[327] For purposes of the GEIS, this category is limited to flywheel systems (which convert electricity into kinetic energy in the form of large rotating masses) and a variety of battery technologies. Large-scale pumped-storage projects are not assumed to be feasible in the time-frame of this analysis, and small-scale pumped storage is not sufficiently developed for inclusion. Similarly, compressed air energy storage (CAES) systems have typically been deployed at scales requiring appropriate geologic sites and are therefore not included.

Baseline

Information on the installed base of storage resources in New York is limited. The analysis located several sources that refer to individual installations in various stages of planning and construction, but no single source for an overall state-wide estimate. A report by NYISO from 2010 indicates 80 MW of storage projects under construction or in planning.[328] This forms the basis for the baseline projection.

Projections

A more recent study of the market for energy storage in the U.S. provides estimates of installed storage capacity in the U.S. and a forecast of installed capacity after five years.[329] This translates into an estimate of compound annual growth rate (8.4 percent), which is applied to the installed capacity in New York to develop projections for the lower-bound and upper-bound alternatives. As noted above, storage results in an increase in energy consumption, shown as a negative reduction in energy consumption in **Exhibit 4-1**.

Outcomes

In terms of peak demand response, energy storage is a relatively minor contributor to the overall alternative resource portfolio. The conservative growth rate projection that was developed assumes no federal financial incentives for this technology and its implementation. Therefore, efforts to promote storage could result in greater quantities of this resource as part of the

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[326] New York Battery and Energy Storage Technology Consortium. *2012. New York Energy Storage Roadmap*. September.

[327] New York Independent System Operator. 2010. *Energy Storage in the New York Electricity Markets*. March.

[328] *Ibid.*

[329] Kema, Inc. 2012. *Market Evaluation for Energy Storage in the United States*. Prepared for the Copper Development Association, Inc. January.

alternatives. A recent report on demand-side resources includes a "base case" estimate of storage in New York, projecting 75 MW of capacity by 2020 and 115 MW by 2030.[330] Adjusting for peak coincidence as reported in that study results in peak capacities of 45 MW and 120 MW in 2020 and 2030, respectively. These estimates represent the forecast of storage without specific policies to support demand-side and distributed energy resources and without technology advancement. Therefore, while the estimates developed for this GEIS are greater than the forecast from one study, the comparison is between a projection that assumes intentional emphasis on DER versus one of 'business as usual.' In addition, the capability of energy storage to reduce losses of electricity during transmission and distribution may provide further impetus to expand the use of this resource beyond the projections included here.

Innovative Rate Structures

Traditional electric rate design most often results in a single value for unit energy prices, regardless of the timing of energy consumption. Because the costs of electric supply vary considerably over time, both throughout the year and throughout any given day, customers who pay the same for electricity at all times have little incentive to shift their consumption in ways that reduce total system load.[331] Rate structures that address this issue have been used to provide consumers with more accurate price signals and to more closely align cost recovery with consumption. A wide variety of such structures exists, but they have typically been implemented for larger consumers in the commercial and industrial sectors. Therefore, the GEIS alternatives analysis incorporates adoption of rate structures for the residential sector. One of the simplest strategies for these customers is a two-phase time-of-use rate (TOU), where consumption is charged at two prices, one for on-peak hours and one for off-peak. Both the rates and the definition of the peak periods is fixed over time (or at least over relevant rate-making time-scales) and known by the customer in advance. Other options include providing customers with rebates or rewards for reducing their peak-time consumption voluntarily and critical peak pricing, where cost premiums are implemented only when system conditions require it.

Baseline

Although some utilities in New York currently offer time-of-use rates, for purposes of the GEIS alternatives, we assume no growth in innovative rates, i.e., any reduction in peak loads resulting from existing rates is already part of the load forecast. Therefore, with no new implementation, the baseline capacity for this resource is zero.

Projections

To assess the potential expansion of innovative rates, several studies of TOU rates were reviewed. Since a limited number of studies exclusively address TOU rates, the review also included studies that assess other rate structures, such as critical peak pricing and peak time rebate programs. The results of the studies varied widely, with some finding no statistically significant change in consumption and others showing dramatic results. In general, TOU rates were the least effective

[330] Navigant Consulting, Inc. 2013. *Assessment of Demand-Side Resources within the Eastern Interconnection*. Prepared for EISPC and NARUC. March. Accessed September 29, 2014 at: https://eispctools.anl.gov/document/19/file.

[331] Higher total system costs do increase overall rates, but this generally occurs much later (months to years) and is socialized across all user.

at reducing energy consumption of all the rate types studied.[332] Nevertheless, a study covering over 20,000 households in the northeast U.S. between 2006 and 2011 did find substantial reductions from TOU rates among households with the greatest monthly energy consumption.[333] For these customers, average reductions were 9 percent for energy and 13 percent for peak demand. These results, derated by 50 percent and applied only to 20 percent of residential load, are used to project the potential contribution of innovative rates to the alternatives. No distinction is made between a lower-bound and upper-bound estimate for this resource. Also, no limit is placed on the expansion of TOU rates or other innovative rate structures for residential households based on the presence or absence of the advanced metering infrastructure (AMI) necessary to support its implementation.

Outcomes

Relative to the other resources considered in this analysis, the potential capacity reductions from rate structures are highly uncertain. With resources that are based on the installation of physical equipment, there can be a high degree of confidence that if the equipment is installed (and therefore, costs incurred), the capacity will be generated. As some studies have shown, innovative rate structures can be implemented with little to no change in customer behavior. On the other hand, changes in rate structures can be implemented at very little cost. In fact, none of the information we located presented any cost information for this strategy. Generally, changes in rates are designed to be revenue-neutral. The relatively low cost of this resource therefore offsets the greater uncertainty in results. To be conservative, innovative rates are limited to only a fraction of the state's residential customer load. Even with this constraint, this strategy could provide almost 200 MW of peak demand reduction for the GEIS alternatives.

Utility-Scale Renewable Energy

Renewable energy systems (e.g., wind, solar, biomass, hydro, geothermal, and others) represent important contributions to New York's current resource portfolio and remain a policy priority for the state. Because many renewable energy resource units have small individual capacities, generating facilities can be developed that cover a wide range of total capacities, from residential scale PV arrays of less than 5 kW to large solar farms of 10 MW or more. Renewable resources located at customer facilities are presented in a separate category discussed earlier. The analysis assumes that larger renewable installations, such as wind farms, hydroelectric facilities, or wood-fired biomass plants promoted under the "main tier" of New York's RPS, will not be sited in close proximity to population and load centers or in load constrained areas, and are therefore not included as distributed energy resources that contribute to the peak reduction alternatives under REV. On the other hand, these resources are important for other objectives in the REV and CEF will likely receive some level of support under those frameworks, and therefore are included here.

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[332] Commercial and industrial customers were also far less likely to change consumption patterns as a result of rate structures.

[333] Jessoe, K., D. Rapson, and J.B. Smith. "The Effect of a Mandatory Time-of-Use Pricing Reform on Residential Electricity Use." Accessed September 29, 2014 at: http://www.aeaweb.org/aea/2013conference/program/retrieve.php?pdfid=318.

Baseline

The baseline estimate for main-tier renewables is derived from the NYSIO "Gold Book" estimates of summer peak capacity by resource type. This source estimates an increase of 165 MW in renewable capacity between the 2013/2014 and 2014/2015 forecast years.[334]

Projections

The estimate of main-tier renewables as part of the alternatives is based on recent installation rates under the RPS.[335] A moderate increase in program activity level from recent rates (25 percent) is assumed, similar in scale to the increase in energy efficiency. As with efficiency, renewable energy technologies, even at utility scale, contribute to several REV and CEF objectives. Furthermore, efforts to leverage private investment in clean energy are likely to be directed towards larger-scale projects such as utility-scale renewables. Although some improvement in the cost-efficiency of peak reduction from this resource is feasible, particularly from biomass and biogas-fired systems that are more likely to be dispatchable during peak energy periods, no changes in cost efficiency is assumed. This is consistent with the approach for customer-sited renewables describe earlier.

Outcomes

Main-tier renewables do not contribute to the reduction in peak demand for purposes of the alternatives analysis. Nevertheless, they do play an important role in the State's resource mix. As a possible outcome of future REV and CEF changes, moderate expansion of renewable generation of the magnitude estimated here is well within the identified potential for these resources. At the lower-bound, the estimate is 22 percent of the economic potential in 2020, while the upper-bound estimate is just 6 percent of the economic potential in 2030.[336]

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[334] NYISO. 2014 Load & Capacity Data 'Gold Book.' April 2014. Accessed September 18, 2014 at: http://www.nyiso.com/public/webdocs/markets_operations/services/planning/Documents_and_Resources/Planning_Data_and_Reference_Docs/Data_and_Reference_Docs/2014_GoldBook_Final.pdf. Table V-2a.

[335] From "The New York State Renewable Portfolio Standard Performance Report through December 31, 2012" and "The New York State Renewable Portfolio Standard Performance Report through December 31, 2013," See, NYSERDA. 2014. New York State Renewable Portfolio Standard. Annual Performance Reports. Accessed September 18, 2014 at: https://www.nyserda.ny.gov/Publications/Program-Planning-Status-and-Evaluation-Reports/Renewable-Portfolio-Standard-Reports.aspx.

[336] Optimal Energy, Inc. et al. 2014. Energy Efficiency and Renewable Energy Potential Study of New York State. Prepared for the New York State Energy Research and Development Authority, Carl Mas, Project Manager. April. Accessed on September 26, 2014 at: https://www.nyserda.ny.gov/Energy-Data-and-Prices-Planning-and-Policy/Energy-Prices-Data-and-Reports/EA-Reports-and-Studies/EERE-Potential-Studies.aspx.

CHAPTER 5 | ENVIRONMENTAL IMPACTS OF PROPOSED ACTION

SEQRA requires State and local agencies to assess the potential of their actions to change the use, appearance, or condition of the environment. Specifically, this chapter evaluates the impacts that could arise from actions taken in response to the approval and implementation of the REV and CEF proceedings. As previously discussed, the REV and CEF are designed 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 considering how to implement the REV and CEF programs, it is also necessary to assess the potential for these programs to directly or indirectly change (or impact) other aspects of the environment. In particular, such changes include those that may not be the primary goal of the State or local agency's proposed action, but nonetheless, could result in significant and/or adverse impacts on the environment.

5.1 FRAMEWORK FOR EVALUATING THE ENVIRONMENTAL IMPACTS OF THE REV AND CEF

As presented in Chapter 4, the GEIS illustrates changes in peak load reduction based on two scenarios, one scenario designed to achieve a peak load reduction of three percent and a second scenario that considers the potential for achieving a 14 percent peak load reduction. For each scenario, Chapter 4 evaluates a portfolio consisting of eight categories of clean energy resources and technologies, including: EE; customer-sited renewable energy (CHRE); CHP; demand response (or load shedding); DG; GIV; other storage technologies; and rate structures. Chapter 4 notes, however, that the contributions estimated for each resource category are illustrative only; that is, the estimates represent just one possible pathway for achieving REV and CEF energy goals. The REV and CEF proceedings are unique in that they are not designed to rely on one prescriptive pathway. Indeed, the REV and CEF seek to use and leverage a wide-range of mechanisms, tools and approaches to achieve their objectives. The goal of the REV and CEF will not be achieved by one or two large actions, but by numerous separate individual initiatives over several years. The REV and CEF also do not prescribe the scope and scale of these transactions – that is, the REV and CEF do not establish technology-specific standards or targets. Instead, the REV and CEF are goal and process-oriented, focused on designing and establishing a framework and incentive structure that will drive new investment and activities in a direction that aligns with the underlying goals.

The portfolio of technologies developed, and the extent to which each technology will be used (or activated) in response to the REV and CEF is uncertain. Accordingly, in evaluating the environmental impacts of the REV and CEF, Chapter 5 considers the eight categories of clean energy resources presented in Chapter 4 as a starting point.[337] The chapter then expands the

[337] As previously discussed, for purposes of this GEIS, the term 'clean energy' is broadly defined to include the full breadth of energy-related technologies, programs and solutions that New York State may use to achieve its energy

discussion to consider additional clean energy technologies, resources, and programs that may contribute to REV and CEF goals. As such, the collection of clean energy technologies and resources addressed in this chapter is broader than discussed in Chapter 4.

Further, because the exact mix of clean energy resources and technologies that will be implemented under the REV and CEF programs is uncertain, 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 concerning those clean energy resources and technologies that will be implemented in response to the REV and CEF, as well as information on how such changes will affect other parts of the State's energy industry (e.g., fossil-fuel based energy generation). However, as discussed, such information is not available because the REV and CEF do not prescribe or set in motion certain actions, standards, or targets. For example, while the REV and CEF seek to increase the amount of power generated by customer-sited renewable energy, information regarding the type of renewable energy, the location and timing of such development, the likely amount of installed capacity, and the amount and type of fossil-fuel based energy generation that may be displaced is all uncertain.

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. We focus on two types of effects: direct and indirect. In promulgating regulations under the NEPA at 40 CFR §1508.8, the Council on Environmental Quality defines **direct effects** as those occurring at the same time and in the same place as the action itself; i**ndirect effects** are those occurring later in time and farther away, but which are still reasonably foreseeable.

Chapter Organization

The remainder of this chapter is organized in five parts:

- Section 5.2 summarizes our analysis of the direct environmental impacts;
- Section 5.3 summarizes our analysis of the indirect environmental impacts;
- Section 5.4 provides a summary of the direct and indirect environmental impacts of the REV and CEF;
- Section 5.5 considers the potential for the REV and CEF programs to spur development of new technologies, yet unknown; and
- Section 5.6 considers the potential cumulative impacts of the REV and CEF programs 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 REV and CEF programs are discussed in **Chapter 9**.

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policy objectives including, but not necessarily limited to main-tier and customer-sited renewable energy sources (e.g., hydro, solar, wind and other carbon-free solutions), energy efficiency, energy storage, smart grid, demand response, distributed generation, and low carbon technologies (e.g., CHP and co-generation).

5.2 DIRECT EFFECTS

This section presents an analysis of the direct environmental effects of the REV and CEF proceedings. As previously discussed, uncertainty surrounds the portfolio of technologies developed, and the extent to which each technology will be used (or activated), in response to the REV and CEF; as a result, the clean energy resources and technologies presented in this section are more diverse than the eight resource categories analyzed in Chapter 4.[338] Specifically, this section considers clean energy resources and technologies across two broad categories: (1) those that optimize power consumption and reduce the need for electric power and (2) those that increase the use of low carbon and carbon-free energy resources. For each resource and technology considered in this section, direct environmental impacts are considered on an individual basis. In other words, and for example, the analysis considers the question what are the potential environmental impacts of an increase in the installed capacity of solar PV or wind energy? Examination of the indirect impacts of the REV and CEF – 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 Optimizing Energy Consumption

The U.S. electric system has remained essentially the same for most of its history. Energy is generated at central stations, transmitted long distances via high-voltage lines, then stepped down in voltage and delivered to customers through local distribution systems. At the time our electric system was built, fossil fuels were abundant, customer demand inelastic, and the environmental consequences of burning fossil fuels unknown. Today, as society's use and demand for electricity continues to grow, federal, State and local governments are reexamining the foundational assumptions inherent in our electric system.

Our aging electric system has significant inefficiencies. By the time energy is delivered to consumers in a usable form, the energy delivered represents only a fraction of the energy contained in its original state. Energy is lost at every stage of its development, from its generation at power plants, during transmission and distribution, and also when energy is used (i.e., consumed) by customers in their buildings, cars, homes and appliances.[339] **Exhibit 5-1** illustrates energy losses from generation through transmission, distribution and end use.

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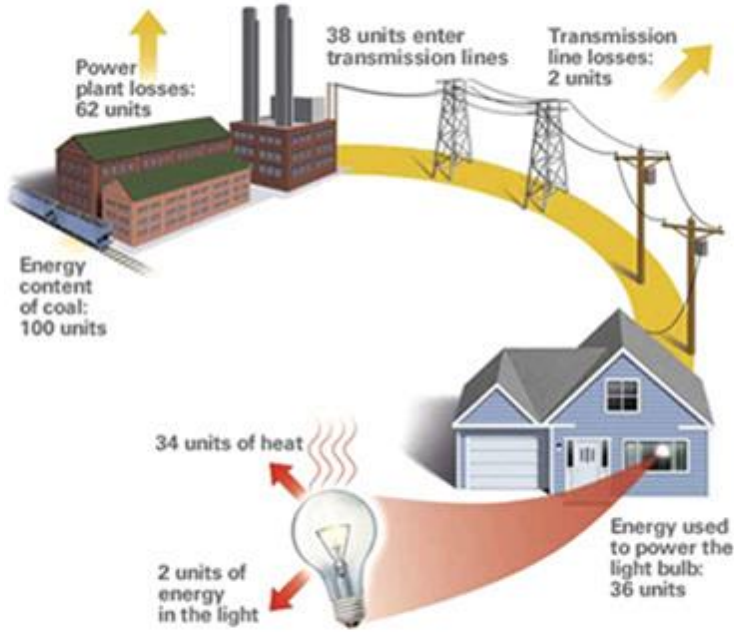
[338] As previously discussed, for purposes of this GEIS, the term 'clean energy' is broadly defined to include the full breadth of energy-related technologies, programs and solutions that New York State may use to achieve its energy policy objectives including, but not necessarily limited to main-tier and customer-sited renewable energy sources (e.g., hydro, solar, wind and other carbon-free solutions), energy efficiency, energy storage, smart grid, demand response, distributed generation, and low carbon technologies (e.g., CHP and co-generation).

[339] For example, a 2012 study prepared by DOE and EPA reports that "the average efficiency of power generation in the U.S. has remained at 34 percent since the 1960s — the energy lost in wasted heat from power generation in the U.S. is greater than the total energy use of Japan." (Source: DOE and EPA. 2012. Combined Heat and Power: A Clean Energy Solution. Washington, D.C. August. Accessed September 2, 2014 at: http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_clean_energy_solution.pdf.)

Improving energy efficiency and reducing the amount of energy lost is as important for achieving a modernized, clean energy economy as developing renewable energy sources such as solar, wind and hydropower. While New York has initiated a variety of clean energy initiatives, large reservoirs of energy efficiency remain untapped, due in part to the aforementioned limitations associated with an outdated electric grid. In addition to the aging infrastructure, the existing regulatory structure and energy markets are not designed or operated to value system-based investments or operation protocols that drive innovation or foster greater system efficiencies.

EXHIBIT 5-1 ENERGY LOSSES THROUGHOUT THE CURRENT ELECTRIC SYSTEM



Source: National Academies of Science. "Energy Sources and Uses." Accessed on August 27, 2014 at: http://www.nap.edu/reports/energy/sources.html.

In the following sections we describe five types of clean energy resources and technologies that will likely evolve under the REV and CEF to improve energy efficiency and optimize the distribution and use of energy. This section concludes with a discussion of the common direct and indirect impacts of discussed technologies.

Demand Management

To ensure safe and reliable energy delivery, electric grids must maintain a continuous (second-by-second) balance between the electricity supplied by power plants and the electricity demanded by customers. When demand rises, utilities can respond in one of two ways: increase power generation or decrease customer demand. DM works with the latter side of the equation, finding opportunities to reduce consumption, which, in some cases, may be less expensive than increasing power generation. Energy efficiency and demand response programs, two types of DM, are discussed in more detail below.

Energy Efficiency

Energy efficiency is one of the easiest and most cost-effective ways to reduce energy consumption. The term energy efficiency generally refers to actions that: (1) use less energy to deliver the same service or (2) deliver more services for the same amount of energy.[340] One of the more common examples is the compact florescent light bulb, which uses less energy (one-third to one-fifth) than an incandescent bulb to produce the same amount of light.[341]

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[340] International Energy Agency. Energy efficiency. Accessed August 29, 2014 at: http://www.iea.org/topics/energyefficiency/.

[341] *Ibid*.

Energy efficiency markets differ across the residential, commercial, and industrial sectors. For the residential sector, efficiency applications are segmented primarily by major end use and building type (single family and multifamily). The industrial sector is segmented primarily by product (chemicals, mining, etc.), consistent with the unique energy demands of specific industries.

Relative to the industrial sector, the commercial sector is segmented into an even larger number of end-uses and greater variation in building types and technology applications. As the largest energy consumer, the commercial sector could offer the greatest opportunities for gains in energy efficiency. Moreover, residential and industrial usage is anticipated to stay relatively flat, while commercial usage is forecast to increase by about 40 percent over the next 20 years.[342]

Energy efficiency applications can target either modes of supplying energy or modes of consuming energy.[343] Energy efficiency applications that target energy consumption are most common within the residential and commercial sectors and include, for example, measures that increase the efficiency of lighting, heating and cooling systems, appliances, buildings and vehicles.[344] Supply-side efficiency occurs primarily within the industrial sector, consisting of efficiency measures that target manufacturing processes such as heat recovery, boiler optimization, and combustion controls.

Energy efficiency technologies may generate hazardous materials during the construction process. For example, compact fluorescent bulbs contain mercury.[345] Energy efficiency upgrades in buildings could require handling new building materials and disposing of older, hazardous materials such as asbestos, lead-based paint, polychlorinated biphenyls, and arsenic.[346]

Demand Response[347]

Demand response (DR), also known as peak load management or load control, describes behavior programs that focus on changing customers' normal consumption patterns (e.g., shifting load from periods of peak electricity demand to periods of low demand) in response to price signals or incentive payments. There are generally five types of DR:

[342] Optimal Energy, Inc. et al., 2014. Energy Efficiency and Renewable Energy Potential Study of New York State. Prepared for the New York State Energy Research and Development Authority, Carl Mas, Project Manager. April. Accessed on September 26, 2014 at: https://www.nyserda.ny.gov/Energy-Data-and-Prices-Planning-and-Policy/Energy-Prices-Data-and-Reports/EA-Reports-and-Studies/EERE-Potential-Studies.aspx.

[343] Ryan, L. and N. Campbell. 2012. Spreading the Net: The Multiple Benefits of Energy Efficiency Improvements. IEA. Paris, France. Accessed August 29, 2014 at: http://www.iea.org/publications/insights/ee_improvements.pdf.

[344] The U.S. Department of Energy (DOE) estimated that over two-third of the nation's electrical energy and greater than 40 percent of natural gas consumption is used inside buildings. In residential and commercial buildings, space heating and cooling and water heating consume greater than 40 percent of electrical power. (Menhert, E. 2004. The Environmental Effects of Ground Source Heat Pumps – A Preliminary Overview. Illinois State Geological Survey (ISGS). Open-Files Series Report 2004-2. Accessed September 1, 2014 at: http://library.isgs.uiuc.edu/Pubs/pdfs/ofs/2004/ofs2004-02.pdf.)

[345] EPA. Recycling and Disposal After a CFL Burn Out. Accessed September 27, 2014 at: http://www2.epa.gov/cfl/recycling-and-disposal-after-cfl-burns-out.

[346] DOE, Offices of Electricity Delivery and Reliability and Energy Efficiency and Renewable Energy. 2014. Hawai'i Draft Clean Energy. Programmatic Environmental Impact Statement. April. p. 8-39.

[347] Strong, Courtney. 2014. New York Demand Response Programs: Recent Changes and Pathways to Participation. Webinar prepared for NYSERDA. September 18. Accessed September 30, 2014 at: http://courtneystrong.com/services/webinars/.

- Dynamic pricing without enabling technology;
- Dynamic pricing with enabling technology;
- Direct load control;
- Interruptible tariffs; and
- "Other" DR programs, such as capacity/demand bidding and wholesale programs.[348]

DR programs are typically administered by ISOs and RTOs.[349] NYISO currently runs four DR programs, consisting of two reliability programs and two customer-directed economic programs.[350] DR programs today are generally event-driven, meaning they are activated for short timeframes during periods of atypically high electricity demand. As an example, during the heat waves in 2013, NYISO activated the State's DR programs each day of the heat wave in southern New York and two days statewide. As technologies advance, however, there is capacity to expand DR beyond its current use during peak periods.

In responding to the activation of a DR event by the ISO, local utility, or elsewhere, a DR participant agrees to shed a certain amount of load from the system. This load shedding can be accomplished either through curtailment of demand or with on-site generation. With curtailment, the DR participant shuts down or partially curtails unneeded systems such as lighting, HVAC or process loads that consume large amounts of electricity, thus reducing load on the system. A DR participant that uses on-site generation in response to an event will generally maintain their total load as is, but use customer-owned on site generators to supplant a portion of the load that would otherwise be supported by the utility service connection. In either case, the distribution system sees a load reduction from the DR participant, but the environmental impacts of load shedding between the two approaches (e.g., demand curtailment or on-site generation) may be quite different. Currently, the vast majority of DR in New York is in the form of load curtailment. As of May 2014, there is 1,082 MW enrolled in the major NYISO DR programs (i.e., ICAP/SCR). Of this, only 120 MW, or 11 percent, is derived from local or self-generation; the remainder represents "real" load reduction that creates no emissions.[351]

DR programs may provide consumers with greater access to low-carbon electricity, by shifting the load profile in a manner that complements variable generation technologies such as wind and solar and reducing the need for renewables curtailment when overgeneration would otherwise cause reliability issues.[352] In so doing, DR serves as a mechanism that improves the economic return of

[348] FERC. 2009. A National Assessment of Demand Response Potential. Prepared by the Battle Group, Freeman, Sullivan & Co., and Global Energy Partners, LLC. June. Accessed August 28, 2014 at: http://www.ferc.gov/legal/staff-reports/06-09-demand-response.pdf.

[349] In New York, customers participating in DR programs typically fall into two groups. Large companies tend to work directly with NYISO. Smaller companies, who individually fall short of NYISO's minimum response capacity, form groups called Responsible Interface Responsibilities (RIPs) in order to participate in DR programs.

[350] Also see: NYISO. Demand Response Programs. Accessed August 4, 2014 at: www.nyiso.com/public/markets_operations/market_data/demand_response/index.jsp.

[351] NYISO Semi-Annual Report Compliance Report on New Generation Projects; Docket Nos. ER01-3001-000 and ER03-647-000. Filed June 2, 2014.

[352] Energy and Environmental Economics. 2012. Investigating a Higher Renewables Portfolio Standard in California. Accessed December 30, 2014 at: https://ethree.com/documents/E3_Final_RPS_Report_2014_01_06_with_appendices.pdf

variable renewable energy resources, which may, in turn, facilitate greater development of such technologies that otherwise may be too expensive for certain customers to develop in the absence of demand response. More broadly, demand response programs provide economic signals that educate consumers on the cost of the electricity between on-peak and off-peak hours. Such economic signals will create incentives that may encourage further development of clean energy resources.

The fuel mix used to generate electricity can also differ across points in time.[353] In New York, off-peak generation is increasingly composed of low-carbon or carbon-free technologies. In particular, many of New York's dual fuel generators switch from natural gas to oil during periods of peak winter energy demand, therefore increasing the greenhouse gas intensity of electricity generated.[354] Increased reliance on off-peak versus fossil-generated peaking units will result in reduced emissions. Because the emissions profile of electricity can differ depending on the fuel mix of generation facilities online at a particular moment, DR programs that shift electricity generation across time can affect total emissions.

The magnitude with which DR program may affect total emissions depends on the difference in the fuel mix between generation during off-peak and peak periods. If customers reduce their load on the grid using on-site generation, such as diesel engines or solar panels, emissions may be greater or smaller than that of the system. As currently deployed, such on-site generation will likely be dirtier than heavily controlled combined cycle natural gas facilities that supply base-load electricity in New York.[355] However, fossil-fuel based on-site generation may compare well with less efficient "peaking" plants that are deployed only during very high load conditions, and their limited use to reduce load is environmentally preferable to the wide scale use of emergency generation that would result if blackout conditions ensued.

EXHIBIT 5-2 MITIGATING POTENTIAL IMPACTS ASSOCIATED WITH SMALL-SCALE FOSSIL FUEL-BASED GENERATION

The market structure envisioned in the REV creates the potential for proliferation of small combustion sources which, in the aggregate, could result in more emissions than an energy structure based on centralized sources of fossil fuel generation, or could result in adverse local impacts. This risk is unlikely to arise from combined heat and power facilities, which tend to be more efficient than central generation. Rather, this risk principally arises from the potential use of backup generators to provide demand response for non-emergency (i.e., economic purposes). Moreover, this risk exists even if all facilities are in compliance with applicable codes and regulations.

Mitigation of this risk can come through several different types of measures, or a combination of measures. One broad option would be to establish limits, with respect to particular distribution feeders

[353] For a discussion of how emissions profiles change with time of day across all regions, see Graff Zivin, J., Kotchen, M., and Mansur, E. 2014. Spatial and Temporal Heterogeneity of Marginal Emissions: Implications for Electric Cars and Other Electricity-Shifting Policies. Forthcoming in *Journal of Economic Behavior and Organization*.

[354] NYISO. 2014. Power Trends 2014: Evolution of the Grid. Accessed September 17, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/ptrends_2014_final_jun2014_final.pdf.

[355] To remove or reduce the level of air contaminants released to the environment, large, utility-scale generation units can afford to install expensive post combustion controls such as catalytic reduction or electro static precipitators. Such controls, however, may not be cost effective on smaller turbine or piston engine generators used for load curtailment or during emergency blackout conditions.

EXHIBIT 5-2 MITIGATING POTENTIAL IMPACTS ASSOCIATED WITH SMALL-SCALE FOSSIL FUEL-BASED GENERATION

or networks, on the extent to which combustion facilities can participate in REV markets. Such limitations could also be applied within designated Environmental Justice areas to mitigate adverse local impacts on air quality which may result from unintended concentrations of small-scale fossil fuel distributed generation.

Another option is to impose eligibility criteria as a condition for participating in REV markets. Generalized performance metrics can be used to limit the total amount of emissions resulting from facilities participating in REV markets, which include distributed or behind-the-meter sources. Such criteria could include fuel source and permitted emission rates. Emissions limits could be achieved, for example, through installation and use of emission controls or through technical requirements for generation equipment (e.g., emissions limits promulgated by the California Air Resources Board under the state distributed generation program, or model requirements incorporated into the Brooklyn/Queens Demand Management Program). The use of the criteria could also be tied to the number of hours per year during which the facility is eligible to participate in REV markets, or could be tied to a distinction between operation for emergency/reliability purposes versus operation for economic purposes. Eligibility can also be tied to regular inspection and maintenance of facilities.

Another approach to mitigating this risk is market pricing. Given the outcome-based orientation of REV, the value of cleaner measures can be recognized in product pricing, placing these measures in a favorable competitive position compared with non-CHP combustion alternatives. Review and reporting can be used to determine whether this approach results in desired levels of emissions and local impacts.

More broadly, as project portfolio development under the REV proceeds, potential environmental damages from proposed distributed generation installations should also be considered as part of project assessments on a more localized level, such as through benefit-cost analyses. At that time, specific mitigation strategies could be proposed, including specific applications of the options discussed above. The REV may also consider development of a framework by which unintended or unanticipated impacts can be tracked and monitored. For example, a periodic review system with appropriate metrics can serve as mechanism to track, monitor and verify that REV goals are met.

Regulatory Reform and Rate Structures

Current electricity regulations and rate designs generally are based on the cost to serve various customer classes, where costs are driven by assumptions about the peak electricity demands of each customer class. As discussed in Chapter 1, however, traditional regulatory, tariff, and rate designs provide fewer incentives for utilities to innovate or to support third-party innovation. One objective of the REV is to consider changes to New York's current regulatory, tariff, and market design and incentive structures that may better align the energy market with the State's overarching energy policy objectives.[356]

While the exact structure of New York's future regulatory and tariff framework is still under development, DPS's April 2014 staff report discusses different rate design approaches and expected outcomes. **Exhibit 5-3** summarizes these approaches. When integrated with demand response initiatives discussed previously, significant load reductions can be achieved during critical peak periods.

[356] DPS. Case 14-M-0101: Reforming The Energy Vision – NYS Department of Public Service Staff Report and Proposal. April 24, 2014.

EXHIBIT 5-3 SUMMARY OF APPROACHES TO ELECTRICITY RATE DESIGN

RATE DESIGN	DESCRIPTION AND SUMMARY OF EXEPCTED OUTCOME(S)
Fixed charge plus volumetric rates	Fixed charges plus volumetric rates reflect traditional cost allocation principles, with fixed costs recovered through fixed charges, and variable charges recovered through volumetric charges. However, increasing the amount of revenue recovered through fixed charges can dilute price signals delivered through volumetric charges.
Flat rates	Flat rates are the simple and easiest for customers to understand since they send a consistent price signal for all usage levels, but they may not accurately reflect the variable nature of costs being priced, and therefore are unlikely to promote customer engagement.
Inclining block rates	Inclining block rates send a strong price signal to encourage efficient use of the product, but may not accurately reflect the economies of scale of the product being priced.
Declining block rates	Declining block rates could be used to more accurately reflect the economies of scale in the product being priced, but may send a perverse price signal to promote higher usage as the unit price decreases.
Variable and time-sensitive rates	Variable rate components can be designed to reflect the volume used, time of use (TOU)[357] and even location of use. Pricing tied to peak and off-peak times can be precisely indexed to minutes or hours, or more simply to months or seasons. Such rate designs should, however, consider the impact on customers that are least able to change behavior and respond to price signals, and recognize that customers differ in their tolerance for price variability. In addition, time-sensitive rates will require investment in advanced metering, which is more likely to be cost-effective for larger customers.
Source: DPS. Case 14-M-0101: Reforming The Energy Vision – NYS Department of Public Service Staff Report and Proposal. April 24, 2014.	

Various studies provide evidence that utility initiatives such as variable and TOU rates have been successful in reducing peak loads.[358] For example, an impact evaluation of the Sacramento Municipal Utility District's SmartPricing Options pilot demonstrated average peak period load reductions of six to 26 percent.[359] This same study also found an acceptance rate of 16 to 19 percent among customers who opted-in to the TOU rates pilot; this suggests that customers will voluntarily enroll in these types of programs when offered. Another study conducted by Oklahoma Gas and Electric found that time-based rates resulted in peak demand reduction of up to 30 percent during critical peak events.[360] Similar to the Sacramento study, Oklahoma Gas and Electric reported relatively low drop-out levels and favorable customer acceptance.

[357] TOU rates are already in use in parts of New York State. For example, ConEdison offers a voluntary TOU program for customers in New York City; prices vary based on the time of use – either off-peak (12midnight to 8am), peak (8am to 12midnight), or super-peak (2pm to 6pm). (ConEdison. Voluntary time-of-use. Accessed September 1, 2014 at: http://www.coned.com/customercentral/energyresvoluntary.asp.)

[358].Faruqui, Ahmad and Sergici, Sanem. Household Response to Dynamic Pricing of Electricity – A Survey of the Experimental Evidence. January 10, 2009.

[359] Sacramento Municipal Utility District (SMUD). 2013. SMUD SmartPricing Options Interim Evaluation. October 23, 2013. Accessed January 2, 2015 at: https://www.smartgrid.gov/sites/default/files/MASTER_SMUD%20CBS%20Interim%20Evaluation_Final_SUBMITTED%20TO%20TAG%2020131023.pdf.

[360] DOE. 2012. Demand Reductions from the Application of Advance Metering Infrastructure, Pricing Programs, and Customer-Based Systems – Initial Results. Smart Grid Investment Program. December 2012.

Plug-In Electric Vehicles and Vehicle-to-Grid Technologies

More New Yorkers are driving EVs than ever before.[361] As of September 2014, there were over 10,000 EVs and plug-in hybrid electric vehicles (PHEV) registered in the State of New York.[362] All PEVs need a device called an Electric Vehicle Supply Equipment (EVSE), a station that connects PEVs to electricity for charging. As of January 2013, there were approximately 500 EVSEs in the State of New York.[363,364]

Over the next ten years, the number of PEVs on U.S. roads is expected to surpass 2.7 million.[365] In New York alone, estimates place the number of EVs in use at approximately 25,200 by 2015[366] and 125,850 by 2023; New York's forecasted 2023 EV population accounts for approximately 4.66 percent of all EVs nationwide in the same year.[367]

Electric vehicles' ability to reduce energy consumption results from energy storage technologies. Today's electric vehicles rely on one of three types of energy storage systems or devices: (1) batteries, (2) hydrogen fuel cells or (3) gasoline hybrid systems. Battery and gasoline hybrid systems are the most common types of EVs currently in use. Within battery EVs (or BEVs), lithium-ion and nickel-metal hydride are the most common battery types; both battery types are currently used in portable consumer electronics (e.g., cell phones and laptops), computers, and medical equipment. BEVs store electricity in batteries, which is then drawn upon to power a motor located near the vehicle's wheels. Fuel cell EVs (FCVs) are powered by hydrogen fuel, which is stored in a compressed hydrogen tank., rather than a battery, and must be refueled at hydrogen refueling stations.[368] Additionally, BEVs, FCVS and, in certain cases hybrid EVs, are typically more efficient than their gasoline-powered internal combustion engines (ICEs) counterparts. As example, the 2012 Honda Civic Hybrid has an EPA combined city-and-highway

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[361] New York State Energy Planning Board. 2014 Draft State Energy Plan. Accessed July 30, 2014 at: http://energyplan.ny.gov/Plans/2014.aspx.

[362] NYPA. News. September 10, 2014. Accessed September 24, 2014 at: http://www.nypa.gov/Press/2014/091014gphoto-caption.html.

[363] Ruder, A. 2014. EV Readiness in New York and the Northeast. NYSERDA. January 10. Accessed August 29, 2014 at: https://www.naseo.org/Data/Sites/1/documents/committees/transportation/webinars/2013-01-10/Ruder.pdf.

[364] Since 2008, the cost of electric vehicle batteries, a key component of EVs, has dropped by 50 percent. During this time, demand for and use of PEVs is also rising across the U.S. According to DOE, Americans bought more than 87,000 PEVs during the first eleven months of 2013, a sales figure that was nearly twice the sales during the same period in 2012. PEV sales in 2013 pushed the total number of PEVs on the road past 100,000 for the first time. (DOE. The Clean Energy Economy in Three Charts. January 6, 2014. Accessed August 17, 2014 at: http://energy.gov/articles/clean-energy-economy-three-charts.)

[365] Navigant Research. 2014. Plug-In Electric Vehicles on Roads in the United States Will Surpass 2.7 Million by 2023. April 28. Accessed August 29, 2014 at: http://www.navigantresearch.com/newsroom/plug-in-electric-vehicles-on-roads-in-the-united-states-will-surpass-2-7-million-by-2023.

[366] Transportation & Climate Initiative of Northeast and Mid-Atlantic States. Plug-In Electric Vehicle Deployment in the Northeast A Market Overview and Literature Review. Georgetown Climate Center. Prepared by Charles Zhu and Nick Nigro. September 2012. Accessed October 9, 2014 at: http://www.c2es.org/docUploads/pev-northeast.pdf.

[367] *Ibid.* 373.

[368] Center for Climate and Energy Solutions. Hydrogen Fuel Cell Vehicles. Accessed October 9, 2014 at: http://www.c2es.org/technology/factsheet/HydrogenFuelCellVehicles.

fuel economy estimate of 44 miles per gallon, while the estimate for the conventional 2012 Civic (four cylinder, automatic) is 32 miles per gallon.[369]

Because BEVs and FCVs do not produce any direct exhaust emissions, their impact on emissions occurs during the "upstream processes responsible for fuel production, treatment and delivery."[370] The Advanced Power and Energy Program at the University of California (U.C.) at Irvine recently produced a "well-to-wheels" analysis of the variation in greenhouse gas emissions generated by different combinations of fuels sources with BEVs and FCVs as compared to conventional ICEs and compressed natural gas vehicles.[371]

Power stored in batteries can also serve as a source of electricity. Technologies that allow EVs to connect to and communicate with the grid are known as GVI. Such technologies allow power to move back and forth between parked EVs and the grid, providing utilities and grid operators with another mechanism to support grid stability. GVI technologies empower consumers, allowing them to participate as "prosumers" (producer-consumers) of energy and ancillary services to the grid.[372,373]

Energy Storage

One of the key limitations of the current electrical grid is the inability to store large amounts of electricity that could feasibly supplement load demand at a later time. While energy commodities like natural gas, oil, coal can be readily stored in large quantities, storage of electricity is relatively expensive and complex. As a result, in today's electrical grid, electric system operators rely on reserves of conventional generation to meet changes in demand (i.e., consumption) and maintain equilibrium between supply and demand in the grid. Advances in energy storage technology, however, offer new opportunities to increase the flexibility, reliability and market efficiency of New York's electric system.

Energy storage technologies are designed to store excess electricity generated by intermittent resources or during periods when demand is low (e.g., overnight hours) and therefore the price of electricity is also low. There are currently 327 operational energy storage projects in the United States with 21.4 GW of rated power.[374] The majority of this capacity is provided by pumped hydro storage (PHS), which accounts for approximately 95 percent of total capacity. The

[369] DOE. Benefits and Considerations of Electricity as a Vehicle Fuel. Accessed September 28, 2014 at: http://www.afdc.energy.gov/fuels/electricity_benefits.html.

[370] University of California at Irvine. 2014. Well-to-Wheels Greenhouse Gas Emissions of Advanced and Conventional Vehicle Drive Trains and Fuel Production Strategies. Advanced Power & Energy Program. Research Summaries. Sustainable Transportation. August. 3 p.

[371] *Ibid*.

[372] The term "prosumers" is derived from: DPS. Case 14-M-0101: Reforming The Energy Vision – NYS Department of Public Service Staff Report and Proposal. April 24, 2014.

[373] The U.S. Department of Defense (DOD) is a key supporter of EV and GVI technologies. A DOD case estimated that an electric sedan in Southern California could earn $150 a month by allowing the grid operator to use its battery during the 73 percent of the time the electric sedan is not in use. (Snider, A. "Pentagon places big bet on vehicle-to-grid technology." Greenwire. August 5, 2013. Accessed September 4, 2014 at: http://www.eenews.net/stories/1059975837.)

[374] U.S. DOE. DOE Global Energy Storage Database. Last Updated 12/5/2014. Accessed December 30, 2014 at: http://www.energystorageexchange.org/projects/data_visualization.

remaining capacity is provided by Compressed Air Energy Storage with 113.5 MW rated power, advanced battery energy storage with 242.3 MW rated power, and flywheel energy storage with 87.4 MW of rated power.[375] These other types of energy storage have become more common in recent years. Since 2005 for example, the global rated power of operational thermal storage electro-mechanical storage, and electro-chemical storage has increased.[376] In addition, there are currently two thermal storage projects under construction in the United States, with a total rated power of approximately 0.3 GW and 57 electro-chemical projects under construction, with a total rated power of 23.4 MW.[377]

In general, energy storage systems have the potential to increase grid efficiency and reduce transmission and distribution losses.[378] Examples of benefits stemming from energy storage systems include:[379]

- **Electric Energy Time-Shift or Arbitrage:** Purchase electricity when the price is low and then selling or releasing sored energy when the price of electricity is high.
- **Voltage Support:** An ancillary service that supports the stability of grid system voltage levels.
- **Electric Supply Reserve Capacity:** An ancillary service that that can be used when a portion of the electric supply resources become unavailable unexpectedly.
- **Transmission Congestion Relief:** Energy storage systems may provide relief during periods of peak demand.
- **Frequency Regulation:** A method used to reconcile momentary differences between electricity supply and demand.
- **Spinning Reserves:** Electric reserve capacity that is on-line and synchronized to the grid. This capacity has the ability to respond within 10 minutes in cases of generation or transmission outages.
- **Overgeneration**: Storing excess energy generated by renewables during characterized by low load and high renewable generation.[380,381]

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[375] *Ibid.*

[376] Electro-chemical storage includes advanced batteries and electro-chemical capacitors. Electro-mechanical storage includes CAES, flywheels, and gravitational storage.

[377] *Ibid*

[378] Ellison, J. Bhatnagar, D., and Karlson, B. for Sandia National Lab, Maui Energy Storage Study, December 2012. Accessed December 19, 2014 at: http://www.sandia.gov/ess/publications/SAND2012-10314.pdf.

[379] *Ibid.*

[380] Ellison, J. Bhatnagar, D., and Karlson, B. Maui Energy Storage Study, prepared for Sandia National Lab, December 2012. Accessed December 19, 2014 at: http://www.sandia.gov/ess/publications/SAND2012-10314.pdf.

[381] Energy and Environmental Economics. 2012. Investigating a Higher Renewables Portfolio Standard in California. Accessed December 30, 2014 at: https://ethree.com/documents/E3_Final_RPS_Report_2014_01_06_with_appendices.pdf.

Exhibit 5-4 summarizes examples of new and emerging energy storage technologies, including pumped storage, compressed air energy storage, flywheels, and advanced batteries. As previously discussed, PEVs also offer another possible energy storage technology.

When evaluating the environmental impacts of energy storage, such impacts are influenced by the efficiency of the technology and the original source of electricity. By design, a storage device outputs less energy than the charging input.[382] As such, energy storage devices may result in increased electricity demand from the existing grid, which may result in greater emissions when considered on a standalone basis (e.g., not taking into account displacement of other forms of energy generation). When energy storage technologies complement cleaner generation, however, such technologies can contribute to lower levels of both local (i.e., criteria pollutants) and global (i.e., greenhouse gases) emissions. On a large scale, the use of storage as part of a larger strategy to increase the responsiveness of demand will facilitate greater development of low-carbon energy generation. Where system efficiency is measured in terms of average heat rate, storage that complements low-carbon off-peak generation will reduce total carbon output. CAES is the only energy storage technology that emits GHG from the operations of energy storage. Other energy storage technologies have minimal life-cycle GHG emissions ranging from five to 40 gCO_2e/kWh depending on the size, operation, and lifetime of each facility.[383]

EXHIBIT 5-4 ENERGY STORAGE TECHNOLOGY SUMMARY

TECHNOLOGY	DESCRIPTION
Pumped Hydro Storage (PHS)	A pumped storage resource is a hydropower generating facility that stores water as potential energy during off-peak hours for later use when demand is higher. These facilities consist of a hydroelectric power plant served by two reservoirs at different elevations. Water is pumped by the power station from the lower reservoir to an upper reservoir where the water is stored until it is needed to generate power. When the time comes to generate power the water is allowed to flow downhill. The downhill flow of water spins turbines that then generate electricity. PHS facilities typically operate at 75 to 85 percent efficiency.[384] The potential environmental impacts of PHS plants are similar to those of traditional hydropower plants. Damming rivers can inhibit nutrient and sediment transport, create thermal stratification, and inhibit fish migration. Drawing and releasing water can also cause inundation and drawdown of shoreline water levels, which would harm spawning areas and shoreline habitat.[385] Construction of PHS systems may also require modification of the surrounding environment. For

[382] Denholm, P. et al. NREL. The Value of Energy Storage for Grid Applications. May 2013. Accessed December 30, 2014 at: http://www.nrel.gov/docs/fy13osti/58465.pdf.

[383] Denholm, P.; Kulcinski, G.L. (2004). "Life Cycle Energy Requirements and Greenhouse Gas Emissions from Large Scale Energy Storage Systems." Energy Conversion and Management (45/13-14); pp. 2153-2172. (As cited in NREL Renewable Electricity Futures Study Volume 2, 2012).

[384] DOE. 2013. "Grid Energy Storage." December. Page 17. Accessed September 8, 2014 at : http://energy.gov/sites/prod/files/2013/12/f5/Grid%20Energy%20Storage%20December%202013.pdf.

[385] stoRE project. 2012. "Environmental Performance of existing energy storage installations." February. p.94. Accessed September 8, 2014 at: http://www.store-project.eu/en_GB/project-results.

TECHNOLOGY	DESCRIPTION
	example, depending on the configuration, PHS systems can require significant amounts of land to be flooded in constructing the upper and lower reservoirs.[386] The potential environmental impacts of PHS are similar to those of hydropower are discussed further in **Section 5.3.6**. Additionally, PHS facilities require significant amounts of land; approximately 1,100 to 1,500 m^2/MW. Water use impacts vary significantly between two types of PHS plants. Open-cycle plants use an existing body of water for one of the two reservoirs. In contrast, closed-cycle plants use two constructed reservoirs. National Renewable Energy Laboratory (NREL) estimates an approximate water consumption rate of 0.3 gallons/kWh for a 1,300 MW, closed-cycle PHS plant.[387] The use of recycled wastewater as the water resource for PHS facilities is an emerging practice that has the potential to reduce surface water requirements and decrease impacts to biological wildlife.[388]
Compressed air energy storage (CAES)	Similar to pumped storage, CAES systems use excess power from the grid during off-peak hours to compress and store air in underground caverns. During high demand periods of the day, the compressed air can be released into the combustion cycle of a conventional natural gas turbine generator to increase its efficiency by 30 percent or more. In addition to increased efficiency, CAES plants have quick ramping capability, allowing them to respond quickly when grid operators require ancillary services. Operational safety, however, is an ongoing concern with CAES plants, as standard safety and testing procedures are still under development.[389] Because CAES systems are primarily underground, land use requirements are limited; on average, such systems require approximately 140m^2/MW.[390] Adverse environmental impacts may occur during construction, especially if the system is built in a previously unmodified underground environment. CAES systems require approximately eight m^3 (2,113 gallons) of water for every meter excavated to form underground caverns.[391] For reference, a 220 MW plant would require 4.8 million m^3 (1.26 billion gallons).[392] Following excavation activities, brine must be managed properly to avoid adverse environmental impacts.

[386] NREL. 2012. Renewable electricity Futures Study; Volume 2. June. pp.12-30. Accessed September 8, 2014 at: http://www.nrel.gov/docs/fy12osti/52409-2.pdf.

[387] *Ibid.*

[388] Yang, C.-J.; Jackson, R.B. (2011). "Opportunities and Barriers to Pumped-Hydro Energy Storage in the United States." Renewable and Sustainable Energy Reviews (15); pp. 839–844. Accessed January 6, 2015 at: http://people.duke.edu/~cy42/PHES.pdf.

[389] DOE. 2013. "Grid Energy Storage." December. Page 30. Accessed September 8, 2014 at : http://energy.gov/sites/prod/files/2013/12/f5/Grid%20Energy%20Storage%20December%202013.pdf.

[390] Norton Energy Storage. (2000). "Application to the Ohio Power Siting Board for Construction of a Compressed Air Energy Storage Facility." Summit County, OH: Norton Energy Storage. (As cited in NREL Renewable Electricity Futures Study Volume 2, 2012).

[391] Smith, T. (2008). "Opportunities for Subsurface Compressed Air Energy Storage in New York State." Presented at Compressed Air Energy Storage (CAES) Scoping Workshop, Center for Life Cycle Analysis, Columbia University, New York, October 21–22. (As cited in NREL Renewable Electricity Futures Study Volume 2, 2012).

[392] *Ibid.*

TECHNOLOGY	DESCRIPTION
	Water resources are also required during plant operation to cool the compressors used to prepare excess power for underground storage.[393] The NREL Renewable Electricity Futures Study estimates the water requirements for CAES facility operations at approximately 0.2 gallons/kWh.[394] CAES systems typically burn natural gas with a GHG emissions rate of approximately 215-240 gCO_2e/kWh.[395] However, emerging CAES technologies allow systems to use alternative fuels, including liquid or gas biofuels or geothermal electricity.[396][397] Additionally, CAES systems have been configured as hybrid power supplies using both natural gas and wind energy.[398] The life-cycle and operation of CAES systems produce nitrogen oxides in manner similar to conventional gas turbines, but at a lower rate consistent with lower heat rate used by such systems. Nitrogen oxide emissions can be controlled using conventional emissions controls such as selective catalytic reduction.[399]
Flywheel	A flywheel energy storage system is a rotating mechanical device (i.e., a rotating disk) that uses electricity from the power grid to store and then discharge kinetic energy. Flywheels can provide energy with a quick response time. Primary applications include, load leveling, frequency regulation, peak shaving and off peak storage, and transient stability.[400] Large flywheel installations may improve the efficiency of existing energy infrastructure and reduce GHG emissions produced by excess capacity and lowered heat-rates associated with excessive plant cycling.[401] Flywheels are not yet "significantly commercialized" and therefore little information exists on the potential environmental impacts of these systems.[402] In general, energy storage, except for CAES, does not require direct fuel or combustion processes, thus flywheels are expected to generate life-cycle GHG emissions only.
Advanced Batteries	Battery storage systems convert electricity into chemical energy for later release. Batteries do not create any significant, direct environmental impacts, but like any industrial product batteries can indirectly generate life-cycle environmental impacts during manufacturing, transportation and end-of-life product disposal. For example, some battery energy technologies are composed of toxic materials;

[393] DOE. 1983. Review of Environmental Studies and issues on Compressed Air Energy Storage. Prepared by Beckwith & Associates. March. Accessed September 30, 2014 at: http://www.osti.gov/scitech/servlets/purl/6390927.

[394] NREL. 2012. Renewable electricity Futures Study; Volume 2. June. pp.12-30. Accessed September 8, 2014 at: http://www.nrel.gov/docs/fy12osti/52409-2.pdf.

[395] *Ibid.*

[396] *Ibid.*

[397] Pacific Northwest National Laboratory. Press Release: Not just blowing in the wind: Compressing air for renewable energy storage. May 20, 2013. Accessed January 14, 2015 at: http://www.pnnl.gov/news/release.aspx?id=985 .

[398] *Ibid.*

[399] *Ibid.*

[400] DOE. 2013. "Grid Energy Storage." December. Page 20. Accessed September 8, 2014 at : http://energy.gov/sites/prod/files/2013/12/f5/Grid%20Energy%20Storage%20December%202013.pdf.

[401] *Ibid*. Page 8.

[402] NREL. 2012. Renewable electricity Futures Study; Volume 2. June. Page 12-30. Accessed September 8, 2014 at: http://www.nrel.gov/docs/fy12osti/52409-2.pdf.

TECHNOLOGY	DESCRIPTION
	methods that exist for the collection and recycling of batteries can mitigate the public and environmental health consequences associated with improper disposal.[403] Due to the lack of deployment at scale, land requirement estimates for battery storage are limited; depending on the capacity and technology, existing battery storage range between approximately 200 – 850 m^2/MW.[404] One recent study has provided evidence that grid energy storage, in the form of batteries, can generate significant air quality benefits by reducing CO_2 emissions as compared to peaker plant energy generation.[405] Another study found that battery energy storage systems on the Hawaiian island of Maui reduced the cost of producing and supplying wind and solar powered energy.[406]
Source: NYISO. 2009. Energy Storage in the New York Electricity Market. December. Accessed September 1, 2014 at: http://www.nyiso.com/public/webdocs/markets_operations/committees/bic_miwg/meeting_materials/2010-01-21/Energy_Storage_Resources.pdf.	

Smart Grid Technologies

To maximize the potential of many of the technologies described in this chapter, a key element of the REV and CEF proceedings will be to foster greater investment in development of a "smart grid." The EIA defines the term "smart grid" as:

> "a range of devices and systems that leverage recent advances in digital technology and communications to improve the efficiency, performance, and reliability of the existing electric power system infrastructure. Although the [term] 'smart grid' is most frequently discussed in terms of advanced electric meters and other distribution system technologies, it also includes important enhancements to the transmission system."

Smart grid upgrade may cause exposure to and handling of hazardous materials when they are retired and disposed of. Similarly, disposal of outdated utility meters may also involve handling hazardous materials.[407]

Exhibit 5-5 provides a summary of smart grid technologies, broadly organized into two groups based on whether the technology, product or service is used to balance energy supply or energy demand. The table further assigns each technology to one of four categories, as defined by the REV Markets Committee:

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[403] Akhil, A. A. et al. DOE/EPRI 2013 Electricity Storage Handbook in Collaboration with NRECA. Accessed January 7, 2015 at: http://www.sandia.gov/ess/publications/SAND2013-5131.pdf.

[404] NREL. 2012. Renewable electricity Futures Study; Volume 2. June. pp.12-30. Accessed September 8, 2014 at: http://www.nrel.gov/docs/fy12osti/52409-2.pdf.

[405] Lin, J. and Damato, G, Strategen Consulting on behalf of California Energy Storage Association, Energy Storage: A Cheaper Cleaner Alternative to Natural Gas-fired Peaker Plants, February 2011. Accessed December 19, 2014 at: http://www.energy.ca.gov/2011_energypolicy/documents/2011-02-15_workshop/comments/California_Energy_Storage_Alliance_03032011_TN-59863.pdf.

[406] Ellison, J. Bhatnagar, D., and Karlson, B. for Sandia National Lab, Maui Energy Storage Study, December 2012. Accessed December 19, 2014 at: http://www.sandia.gov/ess/publications/SAND2012-10314.pdf.

[407] DOE, Offices of Electricity Delivery and Reliability and Energy Efficiency and Renewable Energy. 2014. Hawai'i Draft Clean Energy. Programmatic Environmental Impact Statement. April. p. 8-39.

- **Base load modifications** – products that affect the base load or delivery of energy;
- **Peak load modifications** – products that affect peak loads or capacity;
- **Grid services** – non-bulk ancillary services and other products affecting the operation of the distribution grid; and
- **Contingency and Planning** – products and services for emergency situations and planning purposes. These products address resiliency, response to power outages, and the inclusion of DER in grid planning.

Summary of Environmental Impacts of Clean Energy Resources that Optimize Power Consumption

The resources, technologies and policies introduced in this section are designed primarily to reduce energy consumption from the centralized grid through technology that enables greater control of energy supply and/or energy demand, by utilities, grid operators and/or energy consumers. All of these technologies create some indirect environmental impacts from raw materials extraction, manufacturing, transport, installation, operation, and end-of-life product disposal. For example, batteries used in EV and GVI technologies can contain hazardous materials; human exposure and releases to the environment are possible during handling, recycling, and disposal.[408] However, most of the energy efficiency technologies, resources, and programs discussed in this section do not have significant direct adverse environmental impacts, as they are designed to reduce energy demand from the inefficient grid.[409]

The primary indirect environmental impact of these technologies and programs is the avoidance of environmental impacts associated with energy generation. The extent of impacts avoided is complex, however, influenced by factors such the current mix of fuel sources used in generation; the "dirtier" the fuels used for generation, the greater the benefits from energy efficiency or demand response programs.

Smart grid technologies, energy storage and reliability demand responses technologies reduce energy losses by helping energy market participants understand, control, and manage energy supply and demand. As such, these technologies, and smart grid in particular, can serve to amplify the indirect benefits of other clean energy technologies, programs, and resources.

[408] DOE, Offices of Electricity Delivery and Reliability and Energy Efficiency and Renewable Energy. 2014. Hawai'i Draft Clean Energy. Programmatic Environmental Impact Statement. April.

[409] Exceptions to this statement include PHS and CAES energy storage technologies. Construction and operational environmental impacts are discussed as part of **Section 5.12.5**.

EXHIBIT 5-5 SMART GRID TECHNOLOGY SUMMARY

ASSET	DESCRIPTION	BASE LOAD MODIFICATION	PEAK LOAD MODIFICATION	GRID SERVICES	CONTINGENCY AND PLANNING
TECHNOLOGIES THAT ALLOW GREATER CONTROL OF ENERGY SUPPLY					
Advanced Interrupting Switch	Switches or technologies that can detect and clear faults more quickly or without a traditional reclosing sequence	-	-	-	✔
Distribution Automation	Distribution devices that can perform automatic switching, reactive device coordination, or other feeder operations/control.	✔	✔	-	✔
Distribution Management System	A utility IT information system capable of integrating, organizing, displaying and analyzing real-time or near real-time electric distribution data to offer a wide range of operational benefits. These systems can improve operations, increase system efficiency, optimize power flows, prevent overloads, improve power flows, prevent overload, improve outage management, and enable other decision support tools. These systems can integrate traditional IT information systems such as Customer Information System, Geographic Information System, and Outage Management System to allow a more holistic and automated treatment of the distribution management problem.	✔	-	-	✔
Enhanced Fault Detection Technology	Enables higher precision and greater discrimination of fault location and type with coordinated measurement among multiple devices. For distribution applications, this technology can detect and isolate faults without full-power re-closing, thereby reducing the frequency of through-fault currents. Using high-resolution sensors and fault signatures, this technology can better detect high impedance faults. For transmission applications, this technology will employ high-speed communications between multiple elements (e.g., stations) to protect entire regions—rather than just single elements. It can also use the latest digital techniques to advance beyond conventional impedance relaying of transmission lines.	-	-	-	✔
Equipment Health Sensor	Monitoring devices that automatically measure and communicate equipment characteristics that are related to the "health" and maintenance of the equipment. These characteristics can include, but are not limited to temperature, dissolved gas, and loading. These devices can also automatically generate alarm signals if the equipment characteristics reach critical or dangerous levels.	-	-	-	✔
FACTS Device Energy Reliability	An electronic system and other static equipment that provide control of one or more AC transmission system parameters to enhance controllability and increase power transfer capability.	-	-	✔	-

ASSET	DESCRIPTION	BASE LOAD MODIFICATION	PEAK LOAD MODIFICATION	GRID SERVICES	CONTINGENCY AND PLANNING
Fault Current Limiter	Similar to surge protector in homes, devices that can be inserted into the grid to limit automatically the amount of through current the system experiences during a fault event.	-	-	-	✔
Microgrid Controller	Devices that control and enable the establishment of microgrids. A microgrid (or "community microgrid") is a group of interconnected loads and DER with clear electrical boundaries that act as a single, controllable entity. Microgrids can operate in connection with the grid, or independently in "island mode." Microgrid implementation can facilitate the quick adoption of fuel efficiency and diversity, may reduce grid energy losses associated with the larger grid, and serve as a secondary energy supply when main grids are offline.	✔	✔	-	-
Phase Angle Regulating Transformer	Transformers that enable phase-angle control between the primary (source) and the secondary (load) side to create a phase shift between the primary side voltage and the secondary side voltage. The purpose of this phase shift is to control the real power flow through interconnected power systems.	✔	-	-	-
Phasor Measurement Technology (PMT)	The phasor measurement units, phasor data concentrators, communications technology, and advanced software applications that enable system operators to collect and analyze synchrophasor data from the bulk transmission system.	-	✔	✔	✔
Two-way Communications (high bandwidth)	A two-way communications infrastructure that can network one or more parts of the smart grid via secure, high speed, high bandwidth connections. This infrastructure system serves as the backbone of the customer systems, AMI, distribution, and transmission smart grid systems.	✔	✔	✔	✔
Very Low Impedance (HTS) cables	Cables that use low-impedance conducting materials, which can enable better power flow control. Cables that use high temperature superconducting (HTS) conductor would be characterized as a VLI cable. HTS cables may enable additional benefits such as lower losses, increased power density, and self-fault limiting.	✔	-	-	-
TECHNOLOGIES THAT ALLOW GREATER CONTROL OF ENERGY DEMAND					
Advanced Metering Infrastructure (AMI) / Smart Meters	Electricity meters that use two-way communication to collect electricity usage and related information from customers and to deliver information to customers.	✔	✔	✔	✔
Customer Energy Management System (EMS)/Display/Portal	Devices or portals through which energy and related information can be communicated to and from utilities or third-party energy service providers. These devices can also help customers control electricity usage	✔	✔	✔	✔

ASSET	DESCRIPTION	BASE LOAD MODIFICATION	PEAK LOAD MODIFICATION	GRID SERVICES	CONTINGENCY AND PLANNING
	automatically by leveraging signals from the utility or owner-set parameters.				
Controllable/ Regulating Inverter	AC to DC converters that properly regulate voltage and can be controlled remotely. These devices can significantly increase the integration of renewable or intermittent sources of electricity.	✔	-	-	-
Consumer Back-Up Generators (BUGs)	Distributed generation units used for either emergency or standby applications; can be found in many dense commercial environments.	✔	✔	-	✔
Home Area Networks (HAN)/Consumer Portal	A dedicated network connecting devices in the home such as displays, load control devices and ultimately "smart appliances" seamlessly into the overall smart metering system. It also contains software applications to monitor and control these networks.	✔	-	-	-
Loading Monitor	Technology that can measure and communicate line, feeder, and/or device-loading data via a communication network in real- or near real-time.	-	✔	✔	✔
Smart Appliances and Equipment	Home appliances and devices (e.g., thermostats, pool pumps, clothes washers/dryers, water heaters, etc.) that use wireless technology (e.g., ZigBee) to receive real-time data from the AMI system to control or modulate their operation	✔	-	-	-
Software - Advanced Analysis/Visualizatio	Systems installed to analyze grid information or help human operators.	-	✔	✔	✔
Vehicle to Grid 2-way power converter	An electric vehicle charging station that uses communications technology to intelligently integrate two-way power flow, enabling electric vehicle batteries to become a useful utility asset.	✔	-	-	-

Sources: Smartgrid.gov. Recovery Act Smart 3Grid Programs. Smart Grid Asset Descriptions. Accessed September 8, 2014 at: https://www.smartgrid.gov/sites/default/files/pdfs/description_of_assets.pdf; DPS. Case 14-M-0101: Staff Report on the Work of the DSPP Markets Committee. REV Working Group 1. July 8, 2014. 36 pp. ; DPS. Reforming the Energy Vision (REV) Working Group II: Platform Technology. Subcommittee on Microgrids and Community Grids. Accessed December 30, 2014 at: http://www3.dps.ny.gov/W/PSCWeb.nsf/96f0fec0b45a3c6485257688006a701a/853a068321b1d9cb85257d100067b939/$FILE/WG%202_Microgrids%20and%20Community%20Grids_Final%20Report%20&%20Appendices.pdf.

5.2.2 Low-Carbon and Carbon-Free Energy Resources

As previously discussed, implementation of the REV and CEF may increase the proportion of renewable energy and other low-carbon technologies used to meet New York's energy needs. The REV is designed to increase penetration of customer-sited carbon-free and low-carbon technologies, which refers to small-scale generators of renewable energy and other low-carbon technologies such as CHP. Customer-sited renewables to date have focused almost entirely on solar PVs, but customer-sited energy can also include solar thermal, fuel cells, anaerobic digesters, microturbines, fossil-fuel distributed generation, and on-site wind energy.[410] The REV and CEF are also likely to increase main-tier and large-scale generators that sell power to the wholesale grid, or in some cases generate power for on-site use. Under the current New York RPS, eligible main-tier renewables include wind energy, hydroelectric power, biomass, biogas, geothermal energy and ocean energy.[411]

In this section, we present the potential environmental impacts that may result from increased development of low-carbon and carbon-free energy resources. Discussion of each type of energy begins with an overview of the technology, followed by a discussion of potential environmental impacts.

Common Impacts During Renewable Energy Construction

This section describes common impacts that arise during construction of any type of energy project. Depending on the technology used, the nature of the project (e.g., main-tier or customer-sited), and the project location, construction activities can include preliminary site reviews, clearing, grading, excavating, transporting components, steel and building erection, equipment installation, and final restoration. Impacts unique to the construction of a specific technology are discussed in subsequent technology-specific sections. For example, this section does not discuss impacts related to drilling that may occur during construction and development of geothermal resources.

Environmental Impact Overview

While the magnitude of impacts will vary depending on the type, scope, and scale of an individual energy project, the construction process creates a number of common environmental impacts. Construction site activities such as 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, sediment disturbance and water pollution via stormwater, and ecological and cultural resource disturbances. Some technologies (such as solar PV and wind energy) can be relatively land intensive, while others (such as waste-to-energy) are not. As with operational impacts, the extent of the site-specific construction impacts will vary according to the location of the site. Proper acquisition of site specific data through research and public involvement, as well as environmental management and construction

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[410] NYSERDA. New York Renewable Portfolio Standard. Accessed August 15, 2014 at: https://www.nyserda.ny.gov/Energy-Data-and-Prices-Planning-and-Policy/Program-Planning/Renewable-Portfolio-Standard.aspx.

[411] *Ibid;* NYSERDA. Renewable Portfolio Standard Frequently Asked Questions. Last Updated: August 8, 2014. Accessed September 30, 2014 at: https://www.nyserda.ny.gov/Energy-Data-and-Prices-Planning-and-Policy/Program-Planning/Renewable-Portfolio-Standard/Main-Tier/FAQs.aspx#sources.

standards and practices, appropriate monitoring and oversight, will help minimize the extent of these impacts during construction. In the majority of cases, environmental impacts from construction are short-term or temporary in nature, although the impacts of clearing land to accommodate a new energy facility are permanent. We provide further discussion of the potential impacts of construction activities below. Site-specific mitigation and best management practices are also discussed in **Chapter 6**.

Discharges to Air, Land and Water

Land clearing for construction can adversely affect terrestrial ecosystems, although the specific effects on vegetation, habitat, and individual species will depend on the nature of the project. Land clearing destroys habitat for native species: removal of vegetation and bare soil during construction can destroy, degrade or fragment habitat, create conditions that introduce and/or support invasive species, as well as adversely impact surface water quality. In addition, the presence of construction workers, equipment and construction activity may displace resident wildlife. Artificial light may also have negative effects on animal health and behavior patterns. All things being equal, projects located on or closer to developed land will likely effect terrestrial ecosystems less than projects sited on previously undeveloped land.

The majority of civil, site preparation, and electrical work required to design and construct an electric generating facility can cause soil erosion. Conventional earth moving equipment such as excavators, bulldozers, graders, and dump trucks, along with cement trucks and other equipment, are used for site preparation and for the construction of access roads, foundations, and the installation of electrical infrastructure. Soil erosion due to stormwater runoff or surface water conditions can occur because of these and other construction activities, which can lead to loss of topsoil in agricultural lands as well as siltation in nearby surface waters. Construction activities will also generate some amount of solid waste and air pollution, including greenhouse gases. Depending on the type of renewable energy development and the infrastructure required, some construction activities may generate hazardous waste.

Marine Ecosystems

Construction activities for offshore projects may negatively affect rare, threatened and endangered species and surrounding marine ecosystems. Placement of generating technologies and supporting pipelines, anchors, and other equipment on the ocean floor or in coastal areas may disrupt the surrounding benthic community structure. Such infrastructure also may disrupt the normal pattern of movement for marine species within affected areas. The settling of suspended sediments may affect certain marine organisms. In particular, the suspension and deposition of sediment blocks photosynthesis. In addition, human activity can attract some animals, such as whales, introducing increased risks of whale-vessel collisions.

Impacts to Visual Aesthetics, Cultural Resources, Communities and People

Land and offshore construction activities may also inhibit peoples' ability to enjoy visual and cultural resources near the project site, due to disamenities such as the presence of construction equipment, loud noise, and dust. Construction activities may affect local transportation, disrupting normal traffic patterns through traffic delays, increased noise, dust, and damage to road surfaces. Air quality may also be adversely affected and create short-term adverse health effects for communities adjacent to construction activities. Commercial and recreational fishing sites and patterns may also be affected during construction and, depending on site conditions where such technology is installed, the affects may be long term as well as short term.

Combined Heat and Power

CHP or cogeneration energy systems capture thermal energy that would otherwise be lost during the production of various types of energy, including energy extraction from fossil fuels, renewable fuels, or other industrial waste materials.[412,413] Both traditional combustion systems and fuel cells can be configured as CHP systems.[414] While CHP technologies have been available for some time, opportunities for further expansion and growth of CHP exists across the country.[415] CHP accounts for approximately eight percent of U.S. generating capacity compared to over 30 percent in countries such as Denmark, Finland, and the Netherlands.[416] According to the ICF Combined Heat and Power Installation Database, New York State has 5,552 MW of installed CHP capacity across 517 sites.[417] CHP is often used at industrial locations; of the total 5,552 MW installed capacity in 2013, 78 percent was generated by the industrial sector.[418,419] In addition, according to NYISO, the majority of installed CHP capacity consists of combined-cycle CHP units. In contrast, the majority of smaller-scale, or distributed CHP is comprised predominantly of microturbines and reciprocating CHP engines.[420] All CHP technologies,

[412] EPA. Combined Heat and Power Partnership. Combined Heat and Power: Frequently Asked Questions. Accessed September 4, 2014 at: http://www.epa.gov/chp/documents/faq.pdf.

[413] Advanced Energy Economy. 2014. Advanced Energy Technologies for Greenhouse Gas Reduction. 40 Solutions for Cutting Carbon Emissions from Electricity Generation. Accessed January 5, 2014 at : http://info.aee.net/epa-advanced-energy-tech-report.

[414] Fuel Cells 2000. 2012. The Business Case for Fuel Cells 2012: America's Partner in Power. Accessed January 5, 2015 at: http://www.fuelcells.org/uploads/FC-Business-Case-2012.pdf.

[415] According to NYISO, since 1882, Consolidated Edison in New York City has operated the largest district heating system in the U.S. using waste heat from both electric generators and dedicated steam facilities to provide space heating and cooling. See, NYISO. 2014. A Review of Distributed Energy Resources. Accessed September 27, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Other_Reports/Other_Reports/A_Review_of_Distributed_Energy_Resources_September_2014.pdf.

[416] DOE. Combined Heat and Power: A Clean Energy Solution. Washington, D.C. August. Accessed September 2, 2014 at: http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_clean_energy_solution.pdf.

[417] ICF International. Combined Heat and Power Units located in New York. Prepared for the U.S. Department of Energy and Oak Ridge National Laboratory. Accessed September 3, 2014 at: http://www.eea-inc.com/chpdata/States/NY.html.

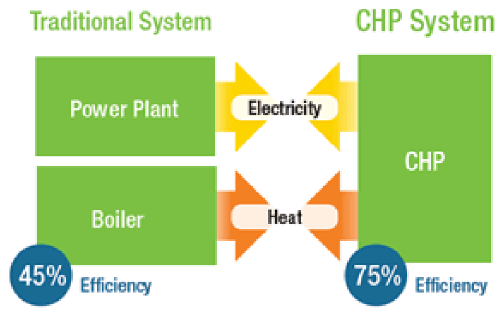
[418] *Ibid*.

[419] This is consistent with nationwide CHP trends. As an example, the U.S. currently has an installed capacity of 82 GW of CHP, with 87 percent in manufacturing plants around the country. (DOE. Combined Heat and Power. A Clean Energy Solution. DOE/EE-0779. August 2012. Accessed September 8, 2014 at: http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_clean_energy_solution.pdf.)

[420] ICF International. Combined Heat and Power Units located in New York. Prepared for the U.S. Department of Energy and Oak Ridge National Laboratory. Accessed September 3, 2014 at: http://www.eea-inc.com/chpdata/States/NY.html.

combined cycle units, microturbines and reciprocating engines, represent well developed technologies.[421]

ENERGY EFFICIENCY BENEFITS OF CHP



Source: DOE and EPA. 2012. Combined Heat and Power: A Clean Energy Solution. Washington, D.C. August.

CHP can be configured as either a topping or bottoming cycle. In a topping cycle, fuel is combusted in a prime mover such as a gas turbine or reciprocating engine, generating electricity or mechanical power. Energy normally lost in the prime mover's hot exhaust and/or cooling systems is recovered to provide process heat, hot water, or space heating/cooling for the site. In a bottoming cycle, also referred to as waste heat to power, fuel is combusted to provide thermal input to a furnace or other industrial process and some of the heat rejected from the process is then used for power production. In either application, CHP applications can increase the efficiency of traditional energy systems from a baseline national average of 45 percent, to efficiencies of 65 to 75 percent.[422] In addition to reducing peak loads, because they generate electricity onsite, CHP systems can also eliminate the problem of electricity losses during transmission.[423]

Environmental Impact Overview

CHP is a distributed energy resource that can increase efficiency by using less fuel per unit of energy output than a comparable traditional system without CHP. By using less fuel, CHP lowers the overall amount of air pollution (e.g., NO_X, SO_X and greenhouse gases) per unit of energy output. Similar to the discussion regarding the use of CHP through DR programs, because hydrocarbon-fueled DER is typically located at point of use and has lower exhaust outlets than power plants, depending on the fuel used, hydrocarbon-fueled DER (such as CHP) have the potential to increase air pollution, when considered on a standalone basis (e.g., not accounting for potentially displaced fossil fuel generation). This can especially be an issue in highly populated areas, where such systems may contribute to existing ozone pollution levels. In New York State, New York City, its surrounding metropolitan area, and Chautauqua County fall within moderate nonattainment areas for 8-hour Ozone.

CHP systems also require the use of hazardous materials, which require proper precautions during operation and disposal. Natural gas is not typically stored at CHP sites, but if released, it can harm nearby environmental receptors. Following guidelines for system design and installation, gas leak detection systems minimize the risk of accidental releases. Lubricants and chemical

[421] NYISO. 2014. A Review of Distributed Energy Resources. Accessed September 27, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Other_Reports/Other_Reports/A_Review_of_Distributed_Energy_Resources_September_2014.pdf.

[422] DOE. Combined Heat and Power. A Clean Energy Solution. DOE/EE-0779. August 2012. Accessed September 8, 2014 at: http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_clean_energy_solution.pdf.

[423] EPA Environmental Technology Verification (ETV) Program Case Studies: Demonstrating Program Outcomes Volume II. September 2006. Accessed December 30, 2014 at: http://nepis.epa.gov/Adobe/PDF/600003MA.pdf.

substances stored at CHP system sites should also be stored securely and according to standard protocols to prevent leaks.

Similar to other energy plants and industrial machinery, CHP systems produce audible noise. In particular, CHP exhaust systems produce noise that may be audible beyond the immediate environment of the CHP system. A CHP system within an acoustic enclosure is estimated to produce approximately 80 dB(A).[424] Techniques to mitigate noise include exhaust silencers or simple acoustic shields.

By definition, CHP systems are installed within existing buildings, attached to existing energy systems. As such, CHP installations must comply with an array of local zoning, electrical, environmental, health, and safety requirements. For example, CHP installations exceeding 1,000 kilovolt-ampere (kVA) in size must be reviewed by the Bureau of Electrical Control (BEC) Advisory Board; units smaller than 1,000 kVA but larger than 480 volts must file with the BEC.[425] CHP facilities must also comply with air permitting requirements under 6 NYCRR Part 201. The specifics of the air permitting process are facility-specific, based upon CHP equipment size and whether projected emissions will exceed local threshold levels.

Solar Energy[426]

Solar technologies can be applied at both large and small scales. Large commercial scale solar power plants feed electricity directly to the utility electric grid. Smaller distributed solar electricity generation installed at individual homes, institutions, or businesses is economically feasible because New York has adopted "net metering," which allows excess electricity generated on sunny days to flow back into the electric grid, with credit or payment from the utility company for the power generated.[427] As previously noted, solar PV is the most common type of customer-sited DER to date. Between 1998 and 2013, the price of installing residential and commercial PV systems declined six to seven percent per year on average.[428]

The primary technology used to capture solar energy is the PV or solar cell system. PV cells convert sunlight directly into electricity. Solar panels consist of multiple, connected PV cells, which are primarily made from crystalline silicon or thin-film semiconductor material.[429] Large-scale PV arrays, sometimes referred to as "solar farms," can generate commercial electric power. Long Island is home to the largest solar farm in the eastern U.S. known as the Long Island Solar Farm (LISF), the facility consists of 164,312 solar panels, with installed peak capacity of 32 MW and an estimated annual average energy output of approximately 44 million kilowatt hours,

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[424] Department of Energy & Climate Change. CHP Design: Environmental Aspects. Accessed September 8, 2014 at: http://chp.decc.gov.uk/cms/noise-3/.

[425] NYSERDA. Combined Heat and Power Market Potential for New York State. October 2002. Accessed October 9, 2014 at: http://www.nyserda.ny.gov/-/media/Files/EERP/Combined-Heat-and-Power/chp-market-potential.pdf.

[426] NYSDEC. Solar Energy in New York. Accessed August 19, 2014 at: http://www.dec.ny.gov/energy/43231.html.

[427] Net metering is also discussed in more detail in **Section 1.6**.

[428] U.S. DOE. SunShot Photovoltaic System Pricing Trends. Historical, Recent, and Near-Term Projections. 2014 Edition. September 22, 2014. Accessed December 29, 2014 at: http://www.nrel.gov/docs/fy14osti/62558.pdf.

[429] NYISO. 2014. A Review of Distributed Energy Resources. Accessed September 27, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Other_Reports/Other_Reports/A_Review_of_Distributed_Energy_Resources_September_2014.pdf.

enough to power approximately 4,500 households.[430] PV cogeneration systems combine CHP and PV cells to harness excess energy in the form of heat, which cannot be captured by a PV system alone.[431] PV trigeneration systems feature additional cooling equipment, generally in the form of an absorption chiller, to more efficiently provide heating and cooling in a single system. Trigeneration systems can also reduce transmission and distribution losses, by generating electricity on-site.[432]

Solar water heating, or solar thermal, is a second way to harvest solar energy. A solar hot water system typically consists of a collector, a storage tank, piping and sometimes valves, controls, and pumps. In freezing climates like New York's, the solar hot water systems often use a non-toxic glycol as the collector fluid and a heat exchanger to transfer the thermal energy to the house drinking water system. Although not currently used in New York, direct concentrating solar power (CSP) is a viable form of solar thermal technology in very sunny areas. In CSP systems, large mirrors or lenses concentrate sunlight onto a small area to produce steam, which then drives an electricity-generating turbine.

Passive solar energy is the third solar "technology" and refers to the process of heating and lighting buildings directly from sunlight. In passive solar buildings, windows, walls, and floors collect, store, and distribute solar heat in cold seasons; other elements such as awnings and overhangs shade the building when the weather is warm.

Environmental Impact Overview

PV Solar technologies operate without sound, air or water emissions, moving parts, and require little maintenance. The lifetime carbon reductions from PV and CSP technologies strongly outweigh the emissions associated with the extraction of resources, facility construction, operations and maintenance, dismantling, and disposal.[433] Lifetime GHG emissions for PV solar technologies are estimated at a range between 30 and 80 g CO_2e/kWh, while CSP technologies are estimated at a range between 14 to 32g CO_2e/kWh.[434]

Large capacity PV systems require land area ranging between 1.4 ha/MW to 4.3 ha/MW for energy capture, depending on site design and whether the solar project integrates a tracking system.[435] While the primary input – silicon – for PV cells is an inert, abundant substance found

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430 Brookhaven National Laboratory. Long Island Solar Farm. Accessed August 20, 2014 at: http://www.bnl.gov/SET/LISF.php/.

431 Nosrat, A., Swan, L., and Peace, J. 2013. "Improved Performance of Hybrid Photovoltaic-Trigeneration Systems Over Photovoltaic-Cogen Systems Including effects of Battery Storage." *Energy* (49): pp.366-374.

432 *Ibid.*

433 Drury, E.; Denholm, P.; Margolis, R. 2009. The Solar Photovoltaics Wedge: Pathways for Growth and Potential Carbon Mitigation in the U.S. September 17. Environmental Research Letters. Accessed September 8, 2014 at: http://iopscience.iop.org/1748-9326/4/3/034010/fulltext/.

434 Arvizu, D., P. Balaya, L. Cabeza, T. Hollands, A. Jäger-Waldau, M. Kondo, C. Konseibo, V. Meleshko, W. Stein, Y. Tamaura, H. Xu, R. Zilles, 2011: Direct Solar Energy. In IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation. Cambridge/New York: Cambridge University Press. 2011. Accessed on September 29, 2014 at: http://srren.ipcc-wg3.de/report/IPCC_SRREN_Full_Report.pdf.

435 U.S. DOE. SunShot Vision Study. Washington, DC. 2012. Accessed on September 9, 2014 at: http://www1.eere.energy.gov/solar/sunshot/vision_study.html.http://www1.eere.energy.gov/solar/sunshot/vision_study.html.

on Earth, PV modules contain some toxic substances, including cadmium, selenium, and arsenic. PV manufacturing processes use some explosive gases and corrosive liquids. The presence and amount of these potentially harmful substances, however, depends on the cell type. Recycling materials in PV modules is already economically viable; higher levels of recycling help to mitigate the potentially adverse environmental impacts of the PV module materials when systems are decommissioned.[436]

CSP technologies have a larger environmental footprint than PV systems. CSP plants require slightly more land, at 1.6 ha/MW to 6.2 ha/MW for energy capture.[437] CSP systems, however, can require a significant amount of water if using cooling; in the arid southwest, for example, water requirements for such systems range from 750 gal/MWh to 1,020 gal/MWh. These rates of water consumption are similar to the rates observed for certain coal and nuclear power plants.[438] Dry cooling approaches, however, can significantly reduce CSP water usage.[439]

Ecosystem Impacts

Solar modules may raise concerns about harm to animals and ecosystems. The existence of utility-scale solar plants can destroy and fragment habitat. Much of the existing research on the impacts of solar modules on ecosystems and animals is based on large-scale solar systems installed in the Southwest. For example, changing plant communities as a result of solar construction can make it more difficult for animals to forage, hunt, and find shelter. Large-scale solar installation may also disrupt natural migration patterns. The impacts of solar modules depend, however, on a number of factors, including the type of technology, project location, project size, and proximity to roads and transmission lines.[440] In contrast, customer sited solar, which typically involves panels installed on existing structures, such as rooftops, does not have any adverse impacts to wildlife, as their installation does not result in any land disturbance.[441]

Visual Resources

Solar modules may raise community concerns regarding visual impacts. Best practices during installation can minimize visual impacts, including proper siting and site operation site, screening with fencing, berms, or vegetation, using non-reflective support structures, avoiding removal of vegetation near modules when possible, and prohibiting commercial messages and symbols on

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[436] Arvizu, D., P. Balaya, L. Cabeza, T. Hollands, A. Jäger-Waldau, M. Kondo, C. Konseibo, V. Meleshko, W. Stein, Y. Tamaura, H. Xu, R. Zilles, 2011: Direct Solar Energy. In IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation. Cambridge/New York: Cambridge University Press. 2011. Accessed on September 29, 2014 at: http://srren.ipcc-wg3.de/report/IPCC_SRREN_Full_Report.pdf.

[437] U.S. DOE. SunShot Vision Study. Washington, DC. 2012. Accessed on September 9, 2014 at: http://www1.eere.energy.gov/solar/sunshot/vision_study.html.http://www1.eere.energy.gov/solar/sunshot/vision_study.html.

[438] *Ibid*.

[439] *Ibid*.

[440] *Ibid*.

[441] DOE, Offices of Electricity Delivery and Reliability and Energy Efficiency and Renewable Energy. 2014. Hawai'i Draft Clean Energy. Programmatic Environmental Impact Statement. April. p. 8-39.

modules, and identify ways to preserve the historic character of potential, particularly for historic buildings.[442]

Fuel Cell Energy[443]

A fuel cell is a device that uses fuel (primarily hydrogen) and oxygen to create electricity by an electrochemical process.[444] While fuel cells are most commonly run using hydrogen gas or methane, fuel cells can also use other fuels including biogas, methanol, ethanol, or diesel.[445] Fuel cells have the capacity to meet electricity demands across a wide range of applications and environments, from small devices such as laptop computers to homes and commercial buildings. As a result, fuel cell design is complex and varies depending on fuel cell type and application.[446] Other applications of fuel cell technology include back-up power, CHP systems, transportation and supplements to intermittent renewable sources, such as solar and wind.[447,448,449] Common types of fuel cells identified by DOE include polymer electrolyte membrane (PEM) fuel cells, direct methanol fuel cells, alkaline fuel cells, phosphoric acid fuel cells, molten carbonate fuel cells, solid oxide fuel cells, and regenerative fuel cells.[450]

NYPA built the first commercial-scale fuel cell plant in Yonkers, Westchester County. The 200-kilowatt Yonkers plant runs primarily on waste gases, including carbon dioxide and methane created at a wastewater treatment plant; the facility is the first commercial-scale, fuel cell operation of its kind.[451] Carbon dioxide and methane emissions were previously flared into the atmosphere, creating pollution.[452] Since then, NYPA has installed eight fuel cells at four wastewater treatment plants operated by the New York City Department of Environmental Protection in the Bronx, Brooklyn and Staten Island.

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442 *Ibid*.

443 DOE. Fuel Cell Basics Accessed September 4, 2014 at: http://energy.gov/eere/fuelcells/fuel-cells-basics.

444 NYISO. 2014. A Review of Distributed Energy Resources. Accessed September 27, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Other_Reports/Other_Reports/A_Review_of_Distributed_Energy_Resources_September_2014.pdf.

445 Advanced Energy Economy. 2014. Advanced Energy Technologies for Greenhouse Gas Reduction. 40 Solutions for Cutting Carbon Emissions from Electricity Generation. Accessed January 5, 2014 at : http://info.aee.net/epa-advanced-energy-tech-report

446 For more information about fuel cells, see: DOE. Fuel Cells – Current Technology. Accessed September 4, 2014 at: http://energy.gov/eere/fuelcells/fuel-cells-current-technology.

447 DOE Office of Energy Efficiency and Renewable Energy Fuel Cell Technologies Office 2012 Fuel Cell Technologies Market Report, 2013. Available online at: http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/2012_market_report.pdf

448 *Ibid*.

449 For example, fuel cells have been used to supplement power generated by on site solar PV panels and onsite wind turbines to provide power when renewable generation is not able to cover the entire load. (Fuel Cells 2000. 2012. The Business Case for Fuel Cells 2012: America's Partner in Power. Accessed January 5, 2015 at: http://www.fuelcells.org/uploads/FC-Business-Case-2012.pdf.)

450 DOE Office of Energy Efficiency and Renewable Energy, Fuel Cell Technologies Office. Types of Fuel Cells. Accessed December 30, 2014 at: http://energy.gov/eere/fuelcells/types-fuel-cells.

451 NYPA. Fuel Cells. Accessed September 4, 2014 at: http://www.nypa.gov/services/fuelcells.htm.

452 *Ibid*.

Environmental Impact Overview

While fuel cells have the potential for the lowest level of air emissions of any fossil fuel-based electricity generating technology, the potential impacts of fuel cells vary based on the source fuel, fuel cell technology, and application. Traditional byproducts of electric generating technologies, including greenhouse gas emissions and criteria pollutants, can be avoided because fuel cells do not involve the combustion of a fuel. For example, NYPA's 200-kilowatt fuel cell in Yonkers generates approximately 1.6 million kilowatt-hours of electricity a year, and in that same timeframe, releases only 72 pounds of emissions to the environment, as compared to average emissions of approximately 41,000 pounds produced by coal- and oil-fueled plants generating the same amount of electricity.[453] Similarly, an impact evaluation of California's Self Generation Incentive Program found that electricity-generating fuel cells avoided 0.05 metric tons of CO_2 per MWh compared to traditional boilers.[454] Outside of construction and decommissioning, fuel cells produce no solid waste and do not use water or make noise.[455] To the extent that fuel cell technology advances to the point where pure hydrogen is used as fuel (and produced using renewable energy), fuel cells could theoretically emit only heat and water as byproducts.

One concern associated with fuel cells is the potential for hydrogen leaks.[456,457] Hydrogen is non-toxic and non-poisonous, is lighter than air, and diffuses rapidly.[458] Like many fuels, hydrogen is a flammable gas, however, and can form explosive mixtures with air. To the extent that hydrogen leaks may result in injury or death, hydrogen fuel cells may present a public health risk. Only a small number of leaks have been reported in the last ten years, however, and large quantities of hydrogen are used safely in the United States for a wide range of applications.[459,460] Ensuring proper handling, monitoring, and maintenance of hydrogen systems in accordance with the manufacturer's recommendations can further reduce the likelihood of such an event. In addition, some fuel cells contain flammable liquids, including methanol, formic acid, certain borohydride materials, and butane, which require proper waste management handling, storing and disposal.

[453] *Ibid*.

[454] Itron. 2012 SGIP Impact Evaluation and Program Outlook. Submitted to PG&E and the SGIP Working Group. February 2014.

[455] DOE, Offices of Electricity Delivery and Reliability and Energy Efficiency and Renewable Energy. 2014. Hawai'i Draft Clean Energy. Programmatic Environmental Impact Statement. April.

[456] To the extent that the fuel source is not co-located, environmental impacts may arise during development and transportation of fuel inputs to fuel cell locations.

[457] US Department of Energy: Fuel Cells Technology Office. Safety Codes and Standards. Accessed December 30, 2014 at: Hawai'i Draft Clean Energy. Programmatic Environmental Impact Statement

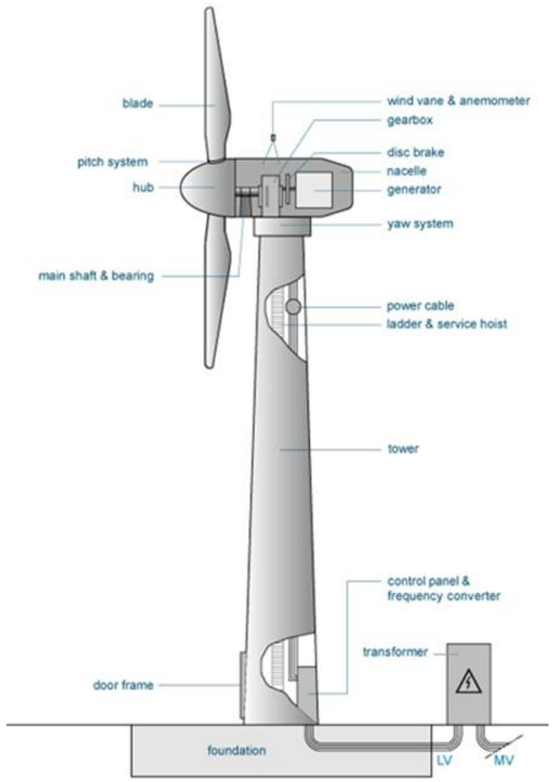
[458] DOE. Office of Energy Efficiency and Renewable Energy. Fuel Cells Technology Office. Safety Codes and Standards. Accessed December 30, 2014 at: http://energy.gov/eere/fuelcells/safety-codes-and-standards

[459] DOE. Office of Energy Efficiency and Renewable Energy. Fuel Cells Technology Office.2011. Safety, Codes, and Standards. Accessed January 2, 2015 at: http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/fct_h2_safety.pdf

[460] While fossil fuels also pose a risk of release and explosions during transport, this analysis does not evaluate the relative danger of these sources. This analysis does not expect additional risk from fossil fuel leaks as a result of the REV/CEF.

Wind Energy

Between 2008 and 2013, wind generation in New York nearly tripled, from an installed capacity of 832 MW in 2008 to an installed capacity of approximately 1,730 MW as of March 31, 2014.[461] As of September 9, 2014, an additional 1,935 MW of capacity is included in NYISO's interconnection queue.[462] In 2009, capacity factors for wind turbines in New York ranged from ten percent to approximately 36 percent. Since then, advancements in technology have increased turbine capacity factors. Expectations are that wind turbines built in 2014 will produce capacity factors ranging from 32 percent to 45 percent on land, and 35 percent to 50 percent offshore.[463]



Over time, the cost of wind turbine projects, accounting for capacity, has also decreased. The turbine transaction price fell from greater than $1,600/kW in 1997 to $1,140/kW in 2012. During this period, the price fell to a low of roughly $750/kW in 2001, rose to a high of roughly $1,500/kW on average in 2008, and again fell.[464][465] Several factors caused the price of wind energy to increase between 2002 and 2008, including an increase in labor costs, changes in turbine design to larger rotor diameters and hub heights, the decline in value of the U.S. dollar in comparison to the foreign currency of turbine-exporting countries, and increases in the prices of inputs, including energy and raw materials.[466]

Environmental Impact Overview

Environmental impacts from wind generation are driven primarily by the size and type of a facility's wind turbines. Wind turbines can be broadly divided into small and large sizes. Small wind turbines, designed for residential, agricultural,

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[461] NYISO. 2014 Load & Capacity Data 'Gold Book.' April 2014. Accessed September 18, 2014 at: http://www.nyiso.com/public/webdocs/markets_operations/services/planning/Documents_and_Resources/Planning_Data_and_Reference_Docs/Data_and_Reference_Docs/2014_GoldBook_Final.pdf.

[462] NYISO. 2014. Interconnection Queue. Accessed September 9, 2014 at:http://www.nyiso.com/public/markets_operations/services/planning/planning_resources/index.jsp

[463] Optimal Energy, Inc. et al., 2014. Energy Efficiency and Renewable Energy Potential Study of New York State. Prepared for the New York State Energy Research and Development Authority, Carl Mas, Project Manager. April. Accessed on September 26, 2014 at: https://www.nyserda.ny.gov/Energy-Data-and-Prices-Planning-and-Policy/Energy-Prices-Data-and-Reports/EA-Reports-and-Studies/EERE-Potential-Studies.aspx.

[464] U.S. DOE. 2012 Wind Technologies Market Report. August 2013.p. 33. Accessed December 29, 2014 at: http://www1.eere.energy.gov/wind/pdfs/2012_wind_technologies_market_report.pdf.

[465] 2012 U.S. dollars.

[466] Bolinger, M. and Wiser, R. Lawrence Berkeley National Laboratory. Understanding Trends in Wind Turbine Prices Over the Past Decade. Accessed December 29, 2014 at: https://escholarship.org/uc/item/4m60d8nt#page-6.

small commercial, and some industrial applications, are typically less than 50 kW in size, but can be as large as 300 kW. Such wind turbine applications are usually "customer-sited," providing electricity used to offset grid power. In contrast, large wind turbines typically consist of an array (or multiple arrays) of turbines, with rated capacities ranging from 660 kW to 3.6 MW for each unit. Large scale wind turbine installations, particularly land-based, introduce locational considerations (for instance agricultural land and/or avian impacts) that small turbine installations typically do not encounter. Such large-scale installations provide wholesale bulk electricity, delivered through local transmission systems. Large wind turbines installed in distributed generation applications can consist of a single turbine or several turbines connected directly to a distribution line.

To the right is an illustration of the primary components of a modern wind turbine. Design of the tower foundation varies based on attributes such as turbine weight and configuration, expected maximum wind speeds, and site-specific soil characteristics. In most cases, electricity generated by the turbines is passed through a substation where output is metered and the voltage increased to match the voltage of the utility grid. Overhead transmission lines may also be required to connect the substation to the grid. Roads, typically 18 to 20 feet wide, are required to access wind facilities. In hilly or complex terrain, access roads adhere to specified slopes and turning radii to allow delivery of large components such as blades and tower sections.

Offshore wind turbines, which are currently not in operation in the U.S. but represent a potential area of future development, are typically larger than onshore turbines, with nameplate capacity ratings of two to five MW. Water depths for most offshore wind turbines installed before 2005 were less than 10 meters and distance to shore of approximately 12 miles (or 20 kilometers). More recently, however, as technologies advance and experience builds, wind projects are installed at even deeper water depths and further distances to shore in order to harness higher winds. Offshore wind facilities also require the construction of underwater transmission lines to connect the facility and turbines to the grid.

Land Use[467]

Land permanently disturbed by construction of a wind project includes the areas where turbine pads, access roads, substations, service buildings, overhead transmission lines and other infrastructure are located, as well as additional land that requires clearing around such infrastructure. A survey by the NREL of large wind facilities in the U.S. found that wind projects use between 30 and 141 acres per MW of capacity. Despite a relatively large project area, the NREL study estimated permanent land disturbance at a much smaller level, less than one acre of permanent land disturbance per MW.

In New York, the majority of wind installations occur primarily on agricultural lands, with a smaller portion of installations occurring on deciduous and/or mixed forestland. In general, wind installation on agricultural land is less disruptive as compared to forestland. The NREL study found the greatest impacts associated with wind projects located in forested areas, which require clearing forested acreage (unlike pastureland or other agricultural land).

[467] Denholm, P., M. Hand, M. Jackson, and S. Ong. 2009. Land-use requirements of modern wind power plants in the United States. Golden, CO: National Renewable Energy Laboratory. Accessed August 14, 2014 at: http://www.nrel.gov/docs/fy09osti/45834.pdf.

The NREL study also compared the impacts of four site configuration alternatives: single string, multiple string, parallel string, and cluster. Based on this analysis, the total area disturbed by a cluster configuration is a greater than string-based configurations, likely due to the spacing required for irregular location of turbines. NREL's analysis included 13 wind facilities in New York, of which all but one are configured as clusters, with one facility configured as a multiple string.

Construction of access roads, storage and laydown areas can also result in temporary impacts in the area surrounding the site. The NREL study estimates a temporary impact area of less than 3.5 acres per MW during construction. While such impact areas will, with proper monitoring and maintenance, eventually return to their pre-disturbed condition, site regeneration can range from two to three years for grasslands, or up to decades for more complex environments like deserts.[468]

Terrestrial and Aquatic Impacts

Environmental impacts from large wind projects include direct mortality of birds and bats from collision as well as direct and indirect habitat loss and fragmentation from facility construction and operation. Wind facilities can also adversely affect a species population through reduced survival or reproductive output.[469] Bird collisions with the rotating blades of wind turbines are the most common cause of impacts to birds and bats. A recent National Wind Coordinating Committee (NWCC) review of peer-reviewed research found evidence that changes in air pressure caused by the spinning turbines may be a contributor to bird and bat deaths from turbine collisions.[470] Available data from 18 post-construction bird and bat surveys at 11 different projects in New York show 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.[471] Mortality rates for bats are higher than for birds; wind turbines are the largest, most pervasive known source of mortality for tree bats.[472] The same study calculated a bat mortality rate of 0.5 to 40.4 bats per turbine.[473]

In addition to the direct impacts during wind turbine installation, nearby species can experience indirect effects from facility operation. For example, habitat loss and fragmentation is a concern

[468] Arnett, E.B.; Inkley, D.B; Johnson, D.H.; Larkin, R.P.; Manes, S.; Manville, A.M.; Mason, R.; Morrison, M.; Strickland, M.D.; Thresher, R. Impacts of Wind Energy Facilities on Wildlife and Wildlife Habitat. September 2007. Wildlife Society Technical Review 07-2, 49 pp. The Wildlife Society, Bethesda, Maryland, USA. Accessed September 8, 2014 at: http://wildlife.org/wp-content/uploads/2014/05/Wind07-2.pdf.

[469] Arnett et al., 2007; Kuvlesky et al., 2007; NAS 2007; Strickland et al., 2011. Accessed September 8, 2014: at http://awwi.org/resources/summary-of-wind-wildlife-interactions-2/#section-summary-of-windwildlife-interactions.

[470] AWWI (American Wind Wildlife Institute). 2014. Wind turbine interactions with wildlife and their habitats: a summary of research results and priority questions. Accessed August 16, 2014 at: http://awwi.org/resources/summary-of-wind-wildlife-interactions-2/#section-summary-of-windwildlife-interactions.

[471] These mortality rates are generally consistent with predicted mortality prior to facility construction.

[472] Cryan, Paul M., and Barclay Robert M.L. Causes of Bat Fatalities at Wind Turbines: Hypothesis and Predictions. Journal of Mammalogy. 2009: 1330-1340. Accessed September 8, 2014 at: http://www.mammalsociety.org/uploads/Cryan%20and%20Barclay%202009.pdf.

[473] Wind turbines affect both migratory tree-roosting bats and cave bats, though three tree bat species constitute over 70 percent of the total bat kills. Of particular concern are the impacts from turbines that further exacerbate bat losses caused by white-nose disease. (NYSDEC, Division of Fish, Wildlife and Marine Resources. 2009. Guidelines for Conducting Bird and Bat Studies at Commercial Wind Energy Projects. August. Accessed September 8, 2014: at http://www.dec.ny.gov/docs/wildlife_pdf/finwindguide.pdf.)

for prairie chickens and sage grouse populations that occur around wind facilities.[474] The two species range in open grasslands and studies suggest that both species may avoid brooding or nesting in areas near wind turbines.[475] Concern also exists over the potential impact of wind facilities on big game and other larger terrestrial vertebrates; to date, however, no studies have evaluated such potential impacts.[476]

The area that a wind project may disturb usually radiates beyond the areas physically disturbed by a wind project. The size of this area, however, is site-specific, depending on such attributes as facility size, the speed of rotor revolutions,[477] ecosystem affected, local topography and soil conditions. Direct construction-related impacts associated with turbine placement and associated construction of interconnections and access roads may include incidental injury and mortality to plant and animal species, habitat destruction, temporary habitat disturbances, and increased silt and sedimentation in nearby water bodies. Among the habitats particularly vulnerable to such impacts are tracts of contiguous forest, wetlands and grasslands, and areas containing federal- and state-listed rare, threatened, or endangered plant and animal species. Offshore wind development may also adversely affect marine mammals, birds, and fish in surrounding areas.[478] Avian species may be adversely affected by or killed as a result of collisions with offshore wind turbine blades. Some studies suggest that offshore wind turbines may actually increase fish populations by acting as artificial reefs.[479]

Noise Pollution

The operation of a land or offshore wind facility, in particular the rotating blades, can become a source of noise pollution. Noise pollution is defined as any loud, discordant, or disagreeable sound or sounds. Variables that affect noise pollution include turbine design, wind direction and speed, atmospheric conditions, vegetation cover, topography, local background noise conditions,

[474] Shaffer, J.A.; Johnson, D.H. 2008. Displacement Effects of Wind Developments on Grassland Birds in the Northern Great Plains. Presented at the Wind Wildlife Research Meeting VII, Milwaukee, WI, October 28–29. Accessed September 8, 2014 at: http://www.npwrc.usgs.gov/staff/shafferj.htm.

[475] NWCC (National Wind Coordinating Collaborative). 2010. "Wind Turbine Interactions with Birds, Bats, and Their Habitats: A Summary of Research Results and Priority Questions." Accessed September 8, 2014 at: https://www.nationalwind.org/assets/publications/Birds_and_Bats_Fact_Sheet_.pdf.

[476] AWWI. 2014. Wind turbine interactions with wildlife and their habitats: a summary of research results and priority questions. Accessed August 15, 2015 at: http://awwi.org/resources/summary-of-wind-wildlife-interactions-2/#section-direct-and-indirect-habitatbased-effects-of-wind-energy-development-on-birds.

[477] According to the NWCC, the speed of rotor revolution has significantly decreased over time from 60-80 revolutions per minute (rpm) to 11 to 28 rpm, but blade tip speeds have remained about the same; ranging from 220-290 km/hr (140-180 mph) under normal operating conditions. (NWCC. 2010. Wind Turbine Interactions with Birds, Bats, and their Habitats: A Summary of Research Results and Priority Questions. Spring. Accessed September 30, 2014 at: http://www1.eere.energy.gov/wind/pdfs/birds_and_bats_fact_sheet.pdf.)

[478] 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 September 8, 2014 at: http://www.nyserda.ny.gov/-/media/Files/EIBD/Research/LI-NYC-offshore-wind-resources.pdf.

[479] Michel, J.; Dunagan, H.; Boring, C.; Healy, E.; Evans, W.; Dean, J.; McGillis, A.; Hain, J. 2007. Worldwide Synthesis and Analysis of Existing Information Regarding Environmental Effects of Alternative Energy Uses on the Outer Continental Shelf. MMS 2007-038. Prepared by Research Planning and ICF International. Herndon, VA: U.S. Department of the Interior, Minerals Management Service. Accessed August 17, 2014 at: http://safmc.net/Portals/6/Meetings/Council/BriefingBook/September%202007/Ecosystem/Attach8_MMSAltEnergysynthrptfinal.pdf.

as well as the person or place impacted by the noise. However, data from multiple studies indicate that the sound levels created by wind turbines are not sufficient to damage hearing or cause other adverse health effects.[480,481]

Impacts to Visual Aesthetics and Cultural Resources

A common area of concern is the potential for wind facilities to disrupt visual, scenic, cultural, and archeological resources. Such impacts depend on site-specific attributes such as project location, project footprint, turbine height, local topography and regional cultural resources.[482] The effect of wind turbines on the visual landscape can be controversial, and varies with the subjective preferences of affected individuals. While some may consider wind turbines "graceful sculptures," others believe wind turbines mar the beauty of historic or other cultural areas or a natural landscape. Offshore facilities may have other cultural resource considerations, particularly in locations where submerged archeological deposits, such as shipwrecks, may be present. Commercial and recreational fishing may be temporarily affected by offshore facility construction and potentially affected over longer periods due to locational impacts associated with facility siting in fishing areas.

Air Resources

While operation of a wind facility does not generate air emissions, emissions occur during other parts of a wind facility's life cycle. For instance, emissions may occur during materials production, materials transportation, on-site construction and assembly, operation and maintenance, and decommissioning and dismantlement. While estimates of the amount of all air emissions produced during a wind facility's life cycle are not available, emission estimates of a wind facility's contribution to global warming are available. For example, the Intergovernmental Panel on Climate Change (IPCC) estimates that a wind facility produces between 0.02 and 0.04 pounds of carbon dioxide equivalent per kilowatt-hour during its life cycle.[483]

Hydropower

New York State currently maintains a total hydropower capacity of 4,790 MW, with a capacity factor of approximately 60 percent.[484] In 2013, hydropower generated 25,631 GWh of electricity

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[480] Chief Medical Officer of Heath of Ontario. 2010. The potential health impact of wind turbines. Toronto, Ontario: Ontario Ministry of Health and Long Term Care. Accessed September 8, 2014 at: http://www.health.gov.on.ca/en/common/ministry/publications/reports/wind_turbine/wind_turbine.pdf.

[481] Massachusetts Department of Public Health and Department of Environmental Protection. 2012. Wind Turbine Health Impact Study: Report of Independent Expert Panel. January. Accessed September 8, 2014 at: http://www.mass.gov/eea/docs/dep/energy/wind/turbine-impact-study.pdf.

[482] Under certain lighting conditions, turbines equipped with lights for aviation safety can generate "shadow flicker," which may be disruptive to nearby residents and drivers.

[483] IPCC. 2011: IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation. Prepared by Working Group III of the Intergovernmental Panel on Climate Change [O. Edenhofer, R. Pichs-Madruga, Y. Sokona, K. Seyboth, P. Matschoss, S. Kadner, T. Zwickel, P. Eickemeier, G. Hansen, S. Schlömer, C. von Stechow (eds)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1075 pp. (Chapter 7 & 9). Available online at: http://srren.ipcc-wg3.de/report/.

[484] Optimal Energy, Inc. et al., 2014. Energy Efficiency and Renewable Energy Potential Study of New York State. Prepared for the New York State Energy Research and Development Authority, Carl Mas, Project Manager. April. Accessed on September 26, 2014 at: https://www.nyserda.ny.gov/Energy-Data-and-Prices-Planning-and-Policy/Energy-Prices-Data-and-Reports/EA-Reports-and-Studies/EERE-Potential-Studies.aspx.

within the NYCA, accounting for approximately 18 percent of all electricity generated in the State.[485,486] New York also has the capability to import 3,225 MW from two Canadian Hydroelectricity providers – Hydro-Québec and Ontario Hydro.[487]

While other forms of renewable energy, such as wind and solar, have greater potential for future expansion, hydropower is expected to remain (or grow slightly) as a mainstay of renewable power generation in New York. Future hydropower development is likely to come in one of two forms:

- Increased capacity from upgrades of infrastructure at existing facilities; or
- Small or low-head distributed hydroelectric generation that is deployed with energy storage and smart grid technologies.[488]

Hydropower projects vary greatly in size from small facilities that generate a few Watts to large facilities that generate several GW. The type and size of an individual hydropower project depends on two key factors: (1) the available volume of water, and (2) the distance the available volume of water is able to fall (also known as the available "head").

Conventional hydropower operates in one of two methods: "store-and-release" or "run-of-river." Store-and-release facilities impound water behind a dam, forming a reservoir. Electricity is generated by the cyclical process of filling and emptying the reservoir. When demand is low (nighttime, for instance), electrical generation is reduced or stopped by storing water in the reservoir. When demand increases, stored water is released in a controlled fashion. Consequently, the reservoir level, as well as downstream flow patterns, varies based on the particular operating characteristics of individual hydropower projects. Because store and release projects can be deployed relatively quickly, however, store and release hydropower represents a relatively cost-effective approach for meeting peak demand.

Run-of-river facilities are hydropower projects that typically operate without any impoundment, or only a relatively low dam. These rely on the available flow of the river itself to generate electricity while maintaining releases that match the inflow from the water body. Since water is typically not impounded and stored, the capacity (i.e., the amount of electricity that can be generated at any one time) depends substantially on the volume of river water that is naturally available.

In addition to conventional hydropower, newer technologies include pumped storage, and in-stream (or hydrokinetic) turbines. Pumped storage hydroelectricity is the largest-capacity form of

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[485] NYISO. 2014 Load & Capacity Data 'Gold Book.' April 2014. Accessed September 18, 2014 at: http://www.nyiso.com/public/webdocs/markets_operations/services/planning/Documents_and_Resources/Planning_Data_and_Reference_Docs/Data_and_Reference_Docs/2014_GoldBook_Final.pdf.

[486] According to the NYISO's 2014 "Load and Capacity Gold Book," this figure includes capacity from New York, New Jersey, and Pennsylvania.

[487] Hydro-Québec. 2014. "Hydro-Quebec at a Glance." Accessed August 25, 2014 at: http://www.hydroquebec.com/about-hydro-quebec/who-are-we/hydro-quebec-glance.html. Also, see, PJM. 2014. Renewable Energy dashboard. PJM Queued Generation Active and Under Construction. Accessed August 25, 2014 at: http://www.pjm.com/Home/about-pjm/renewable-dashboard.aspx.

[488] NYSDEC. Hydropower in New York. Accessed August 20, 2014 at: http://www.dec.ny.gov/energy/43242.html.

grid energy storage currently available. Pumped-storage units located at Blenheim-Gilboa and Niagara Falls-Lewiston use inexpensive off-peak electricity to pump water to a high elevation, from which it is released to generate power during times of peak demand. Pumped storage facilities use more power for pumping than they generate during operation, but the electricity they produce helps to balance power grid loads and reduce the total cost of electric power.[489]

In-stream or hydrokinetic systems are less-developed hydropower technologies. These systems involve placing turbines below the surface of fast moving water, for example, in tidal flows, rivers, canals and even wastewater treatment plants. Some systems use pivoting turbines to capture energy regardless of the direction that water may flow. While hydrokinetic energy is not yet operating at commercial scale, research, development, and demonstration initiatives are proceeding. In New York, new tidal kinetic hydropower technology installed in New York City's East River was recently connected to the electric grid; in the Niagara River, a proposal is under development to test the feasibility of in-stream hydrokinetic generation.[490]

Environmental Impact Overview

Hydropower creates no direct air pollutants or waste during operation.[491] All hydropower projects, however, introduce some level of disturbance to the continuity of a river's ecosystem. The magnitude and scope of such disruption depends on the type of hydropower project. As discussed previously, future development of hydropower may include upgrades at existing facilities or small or mini hydropower development. The environmental impacts of future hydropower will vary depending upon the type and size of the project and its location. Site-specific factors such as geology, river flows, and the aquatic or riparian ecology of an area will influence environmental impacts.

Conventional store-and-release hydropower projects have prominent impacts on water resources, including the diversion and impoundment of large volumes of river water, and from impediments to fish passage and protection. Impoundments can also cause significant changes and variation in water flow, temperature, nutrient levels, and the amount of dissolved oxygen (DO) in a river system.[492] Dams and reservoirs may create bypass reaches that also remove water from parts of water bodies needed for maintaining in-stream flows that are vital to the river ecosystem; insufficient flow levels can result in downstream sedimentation, habitat loss and degradation. These effects can inhibit the growth rate and survival of certain fish and other plant and animal

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489 *Ibid.*

490 *Ibid.*

491 As with other types of energy development, hydropower construction, operation and decommissioning generate some greenhouse gas emissions, but such emissions are relatively minor. (Source: IPCC. 2011. IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation, Chapter 5, Hydropower. Cambridge University Press, Cambridge, United Kingdom and New York, NY. Accessed August 25, 2014 at: http://srren.ipcc-wg3.de/report/IPCC_SRREN_Ch05.pdf.)

492 Significant reductions in DO levels can lead to hypoxic or anoxic conditions in aquatic organisms. (DPS. Final Generic Environmental Impact Statement in Case 03-E-0188 Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio Standard. Issued August 26, 2004. Accessed September 18, 2014 at: http://www.dps.ny.gov/NY_RPS_FEIS_8-26-04.pdf.)

species that rely on riparian ecosystems.[493] New store-and-release projects, however, are not anticipated under the REV and CEF programs. Additionally, under its CWA authority during FERC licensing proceedings, NYSDEC is able to ensure that more projects adhere to run-of-river flow regimes and provide fish protection and passage measures. Accordingly, the potential impacts to water resources described above are not likely to occur. Development of run-of-river, in-stream, and pumped storage will also result in some changes in hydrologic characteristics of the river ecosystems in which they operate, but such impacts are significantly lower than conventional store-and-release projects.

Biomass Energy[494]

Biomass is biological material derived from living or recently living organisms. In the context of energy, biomass typically refers to plant-based material, with wood being the most common biomass feedstock. The five basic categories of biomass materials include:[495]

- **Virgin wood** from forestry, arboricultural activities or from wood processing;
- **Energy crops** or high-yield crops grown specifically for energy applications;
- **Agricultural residues** from agriculture harvesting or processing;
- **Food waste** from food and drink manufacture, preparation and processing, and post-consumer waste; and
- **Industrial waste and co-products** from manufacturing and industrial processes.

In 2011, New York State had an installed capacity of 337 MW of biomass energy generation.[496] According to the EIA, the State of New York consumed 122.3 TBtu of energy generated by biomass in 2012, approximately 3.5 percent of all energy consumed statewide in that year.[497]

Environmental Impact Overview

The potential environmental impacts of utilizing biomass as a fuel source depend upon both the conversion technology employed (i.e., thermal or chemical conversion) and the class of biomass resource combusted. By its nature, combustion of biomass fuels releases sequestered carbon; when evaluating net impacts to greenhouse gases, the timeframe and method of resequestration must be considered. If biomass energy operations are managed sustainably, such previously

[493] For example, dams can block upstream migratory patterns of fish, which can in turn affect reproductive and survival rates for certain species. (Sources: DPS. Final Generic Environmental Impact Statement in Case 03-E-0188 Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio Standard. Issued August 26, 2004. Accessed September 18, 2014 at: http://www.dps.ny.gov/NY_RPS_FEIS_8-26-04.pdf; R.M. Baxter. 1977. Environmental Effects of Dams and Impoundments. *Annual Review of Ecology and Systematics* 8: 255-283).

[494] DPS. Final Generic Environmental Impact Statement in Case 03-E-0188 Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio Standard. Issued August 26, 2004. Accessed September 18, 2014 at: http://www.dps.ny.gov/NY_RPS_FEIS_8-26-04.pdf.

[495] NREL. Biomass Energy Basics. Accessed August 18, 2014 at: www.nrel.gov/learning/re_biomass.html.

[496] Optimal Energy, Inc. et al., 2014. Energy Efficiency and Renewable Energy Potential Study of New York State. Prepared for the New York State Energy Research and Development Authority, Carl Mas, Project Manager. April. Accessed on September 26, 2014 at: https://www.nyserda.ny.gov/Energy-Data-and-Prices-Planning-and-Policy/Energy-Prices-Data-and-Reports/EA-Reports-and-Studies/EERE-Potential-Studies.aspx.

[497] EIA. New York State Profile. Accessed September 8, 2014 at: http://www.eia.gov/state/?sid=NY.

sequestered CO_2 will be sequestered again.[498] Plant and ancillary facilities impose environmental effects, as does the production and procurement of the biomass resource used for the energy feedstock.

Land Use

In cases where biomass materials are a residual outcome of primary production, incremental impacts on land use are limited. Some crops, however, are grown solely or primarily for biomass energy production. Switchgrass, for example, is a commonly used biomass fuel crop. Biomass energy production may also indirectly affect commercial agricultural land patterns. For example, increasing use of corn for fuel rather than food could lead to an unintended increase in the price of foods containing corn.[499] Land use impacts due to forest biomass are more complex and highly site-specific. If forest biomass operations adhere to best management practices, research suggests that such operations "will not contribute to or create additional physical impacts on the soil productivity as compared to conventional harvesting."[500]

Water Use

As a thermoelectric generating technology, biomass requires water as part of its generation process. The average consumptive water use – meaning that water is withdrawn and not returned to the source – of a biopower facility is estimated at 1.741 m^3/MWh.[501]

Other water use impacts arise from direct fuel crop production. Cultivation of a fuel crop may change irrigation water demands in an agricultural land and on marginal lands resulting in changes in evapotranspiration and irrigation requirements.[502] Additionally, increased cultivation can increase sedimentation and nutrient runoff, affecting water quality.

Air Emissions

Combustion of biomass produces atmospheric emissions that vary according to the technology used and the properties of the fuel combusted. Generally, the emissions from traditional biomass facilities include particulate matter, carbon monoxide, volatile organic compounds, and nitrogen

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[498] IPCC. 2011. Special Report on Renewable Energy Sources and Climate Change Mitigation . Chapter 2, Bioenergy. http://srren.ipcc-wg3.de/report/IPCC_SRREN_Ch02.pdf.

[499] International Monetary Fund. World Economic Outlook 2007, Chapter 1, Global Prospects and Policies. Accessed September 26, 2014 at: http://www.imf.org/external/pubs/ft/weo/2007/02/pdf/text.pdf, and IPCC. 2011. IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation, Chapter 2, Bioenergy. Cambridge University Press, Cambridge, United Kingdom and New York, NY. Accessed August 25, 2014 at: http://srren.ipcc-wg3.de/report/IPCC_SRREN_Ch02.pdf.

[500] Manomet Center for Conservation Sciences. 2010. Massachusetts Biomass Sustainability and Carbon Policy Study: Report to the Commonwealth of Massachusetts Department of Energy Resources. Walker, T. (Ed.). Contributors: Cardellichio, P., Colnes, A., Gunn, J., Kittler, B., Perschel, R., Recchia, C., Saah D., and Walker, T. Natural Capital Initiative Report NCI-2010-03. Brunswick, Maine.

[501] Davis, R. and Tan, E. 2010. Comparison of Biomass Pathways for Vehicle Use. National Renewable Energy Laboratory Milestone Report (unpublished).

[502] Water lost to evaporation from the soil and transpiration from plants is called evapotranspiration. The rate of evapotranspiration varies by the type of crop. Grasses grown for cellulosic biofuels production, for example, have a higher rate of evapotranspiration than corn. (Source: National Research Council. 2007. Water Implications of Biofuels Production in the United States. Accessed September 26, 2014 at: http://www.nap.edu/catalog.php?record_id=12039.)

oxides. Amount of atmospheric emissions depend largely on the type and quality of emissions control technologies used and the operating conditions employed at a particular power plant.

Net emissions of criteria air pollutants when co-firing biomass with coal, relative to coal-only operation, are uncertain due to the wide variety of potential biofuels that may be utilized. In some cases, however, particulate matter and NO_x emissions may slightly increase depending on the generation facility's permitting criteria. As example, criteria air pollutant emissions from biomass gasification are substantially reduced in comparison to coal-fired power plants, co-firing applications, and direct-fire biomass applications. Criteria pollutant emissions from biomass gasification plants are similar to those from conventional natural gas turbine facilities, and may be slightly higher than those from natural gas combined-cycle applications. Biomass CHP results in emissions of SO_2, NO_x, particulates, mercury, CO, and CO_2. Mercury and SO_2 emissions from biomass CHP are also low in comparison to coal combustion.

Biomass combustion emits CO_2 when the organic carbon stored in biomass is released. If the amount of biomass combusted is replaced by the applicable amount of biomass growth (i.e., closed-loop), there are zero net CO_2 emissions in the lifecycle besides the CO_2 emissions resulting from collecting and transporting the biomass material. However, EPA is in the midst of developing an accounting framework on biogenic GHGs that may not assume zero net emissions.[503] Not all biomass combustion is closed-loop and it cannot be assumed that the GHGs released will be resequestered. In certain cases, re-growth of harvested biomass may sequester more CO_2 than released during biomass combustion, as compared to the CO_2 emitted from the use of fossil fuels to generate the same amount energy. Measuring the exact balance of atmospheric emissions from biomass, however, is complex and depends upon not only the conversion technology and the emissions control technologies employed, but also upon the biomass resource utilized, the condition of that resource from which the biomass was harvested and the fossil fuel technology replaced.[504]

Health Impacts

Increased biomass energy generation could have adverse health implications. Combustion of biomass can release particulate emissions in the form of wood smoke.[505] Adverse health effects associated with exposure to wood smoke are consistent with those identified for fine particulate matter – a major component of wood smoke – including exacerbation of respiratory and

[503] EPA. Accounting Framework for Biogenic CO2 Emissions from Stationary Sources. Accessed September 12, 2014 at: http://www.epa.gov/climatechange/Downloads/ghgemissions/Biogenic-CO2-Accounting-Framework-Report-Sept-2011.pdf.

[504] Manomet Center for Conservation Sciences. 2010. Massachusetts Biomass Sustainability and Carbon Policy Study: Report to the Commonwealth of Massachusetts Department of Energy Resources. Walker, T. (Ed.). Contributors: Cardellichio, P., Colnes, A., Gunn, J., Kittler, B., Perschel, R., Recchia, C., Saah D., and Walker, T. Natural Capital Initiative Report NCI-2010-03. Brunswick, Maine.

[505] Heller, M., G. Keoleian, M. Mann, and T. Volk. 2003. Life cycle energy and environmental benefits of generating electricity from willow biomass. *Renewable Energy* 29, 1023-1042; and EPA. 2009. Technical Assistance Services for Communities (TASC) Biomass Power Plant Informational Summary. Prepared by E^2 Inc. August 2009. Accessed September 26, 2014 at: http://www.epa.gov/superfund/community/tasc/pdfs/biomass-report.pdf.

cardiovascular symptoms.[506] The elderly, people with heart and lung diseases, and children are particularly vulnerable to the effects of fine particles in wood smoke.[507]

Biomass Feedstocks

Unique to biomass energy is the potential for impacts to arise during the production of biomass feedstock. **Exhibit 5-6** identifies common biomass feedstocks and the potential environmental impacts associated with each.

EXHIBIT 5-6 SUMMARY OF BIOMASS FEEDSTOCKS

FEEDSTOCK	FEEDSTOCK DESCRIPTION AND POTENTIAL ENVIRONMENTAL IMPACTS
Wood Energy Crop	In New York State, several wood energy plantations (predominately fast-growing willow trees) are managed as agricultural crops, grown exclusively to produce biomass fuel and used in co-firing applications at coal-fired plants. These trees are harvested once every three to four years and resprout after cutting. As with any vegetation, willow trees grown in energy plantations sequester CO_2, and production per acre exceeds that of traditional biofuel crops such as corn.[508] The environmental impacts of wood energy plantations are complex and highly site-specific. If poorly sited, managed, and harvested, wood energy plantations decrease biodiversity, increase the risk of soil erosion, result in pesticide runoff, deplete the soil of nutrients and increase the pressures of disease and competition of limited resources with non-native or invasive species. Depending on the condition of an area prior to its conversion to a wood energy plantation, the environmental impacts of such operations can be minimized. For example, relative to un-forested or certain agricultural plantations, properly sited and managed wood energy plantations can support wildlife diversity, protect riparian habits, and improve landscape aesthetics and soil nutrient levels.[509] If large, un-forested areas are converted into biomass plantations, the overall increase in vegetation cover will contribute to lower CO_2 levels.
Forest Resources	Forests represent a potential source of biomass energy resources, however, if large forested areas are not properly managed for sustainability, CO_2 levels will increase because those levels will not be sequestered at an equal amount.[510,511] Additionally, poorly managed timber harvesting operations can result in significant impacts to forest ecosystems, including the destruction of significant habitats, adverse impacts on soil structure and site productivity, stream sedimentation, water quality issues, and visual blight on the landscape. Careful site selection and adherence to best management

[506] EPA. Particle Pollution and Health. Accessed September 26, 2014 at: http://www.epa.gov/air/particlepollution/health.html; EPA. 2007. Health Effects of Breathing Woodsmoke. Accessed September 26, 2014 at: http://www.epa.gov/burnwise/pdfs/woodsmoke_health_effects_jan07.pdf.

[507] DPS. Final Generic Environmental Impact Statement in Case 03-E-0188 Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio Standard. Issued August 26, 2004. Accessed September 18, 2014 at: http://www.dps.ny.gov/NY_RPS_FEIS_8-26-04.pdf.

[508] IPCC. 2011. IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation, Chapter 2, Bioenergy. Cambridge University Press, Cambridge, United Kingdom and New York, NY. Accessed August 25, 2014 at: http://srren.ipcc-wg3.de/report/IPCC_SRREN_Ch02.pdf.

[509] Dauber, J., M. Jones, and J. Stout. 2010. The impact of biomass crop production on temperate biodiversity. *GCB Bioenergy* (2010) 2, 289-309.

[510] CO_2 sequestration differs based on the age and scale evaluated. That is, younger, dense, faster growing forests sequester more CO_2 than older forest stands, with a slower annual growth rate. In contrast, an individual older tree sequesters more than an individual young tree because older trees are bigger and use more carbon.

[511] NYSDEC. Trees: The Carbon Storage Experts. Accessed September 26, 2014 at: http://www.dec.ny.gov/lands/47481.html.

FEEDSTOCK	FEEDSTOCK DESCRIPTION AND POTENTIAL ENVIRONMENTAL IMPACTS
	practices during harvesting operations are essential to minimize adverse impacts to forest health and associated ecosystems services.[512]
Wood Waste	With the exception of biomass gasification technologies, waste wood that is considered "clean" or "unadulterated" is eligible as a biomass fuel in the RPS program. Using clean biomass residues as fuel, rather than disposing of them in landfills, can reduce the need for additional landfill space and could avoid production of GHG emissions (methane) from the decaying waste wood.[513]

Another emerging conversion technology is the gasification of biomass into a synthesis gas that can be burned to produce electricity or further processed into other useful chemical products. Gasification is a process by which any carbon-based material – such as municipal solid waste –is heated to temperatures varying between 1,100 to 1,800 degrees Fahrenheit in a chamber with limited amounts of oxygen (or air) to create a mixture of combustible gases called synthesis gas (or syngas), which includes hydrogen, carbon monoxide, carbon dioxide and other trace compounds.[514] Syngas typically has a heating value of 200 to 500 Btu per cubic foot and can be used as a fuel for energy production or further processed into a wide variety of other chemical compounds. The figure to the right illustrates the basic stages of the gasification process.[515]

Syngas can be combusted to produce thermal energy as heat, steam, or electricity. Heat generated by syngas combustion can be used for heating buildings, or for cooling other energy generating applications. Syngas can also be converted into liquid fuel products, which can be further refined into different types of fuels, from crudes and diesel to kerosene, gasoline and naptha. When converted into hydrogen, syngas can serve as an input for fuel cells or further transformed into other fuel substances such as transportation fuels. Syngas can also be further processed into a wide variety of chemical substances. For example, after being converted to methanol, syngas can

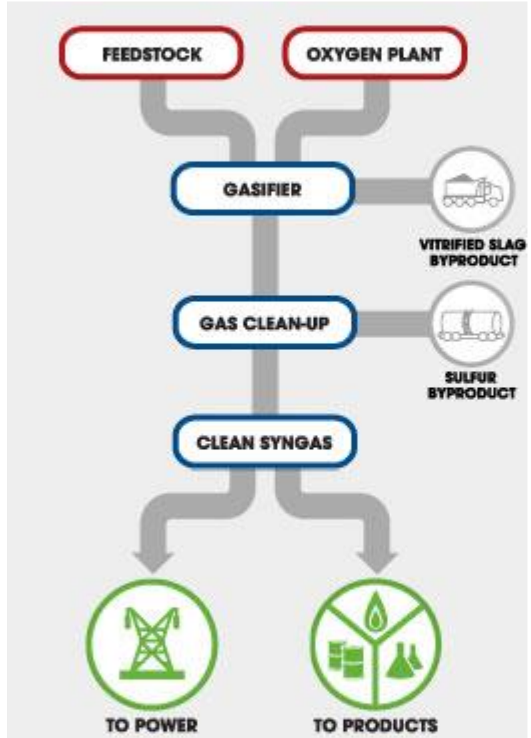
[512] The Massachusetts Department of Energy commissioned a study in 2010 to evaluate the potential impacts of increased biomass harvesting in the forests of Massachusetts and offer recommendations for mitigating any negative outcomes identified. Among its recommendations, the study suggested different mechanisms to minimize the potential adverse impacts of forest biomass operations, including requiring bioenergy facilities to purchase wood from forests with approved forest management plans, policies that foster sustainable wood procurement practices, wood supply impact criteria, and/or requiring bioenergy facilities to submit wood supply impact assessments. (Manomet Center for Conservation Sciences. 2010. Massachusetts Biomass Sustainability and Carbon Policy Study: Report to the Commonwealth of Massachusetts Department of Energy Resources. Walker, T. (Ed.). Contributors: Cardellichio, P., Colnes, A., Gunn, J., Kittler, B., Perschel, R., Recchia, C., Saah D., and Walker, T. Natural Capital Initiative Report NCI-2010-03. Brunswick, Maine.)

[513] Although carbon dioxide released in combustion and methane released from landfills are both greenhouse gases, the warming potential and potential climate change impacts from methane are much higher. Avoided methane from landfills is thus commonly cited in scientific literature. (Source: IPCC. 2011. IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation, Chapter 2, Bioenergy. Cambridge University Press, Cambridge, United Kingdom and New York, NY. Accessed August 25, 2014 at: http://srren.ipcc-wg3.de/report/IPCC_SRREN_Ch02.pdf.)

[514] American Chemistry Council. 2013. Gasification of Non-Recycled Plastics From Municipal Solid Waste In the United States. Prepared by Gershman, Brickner & Bratton, Inc. Last Updated September 2013. Accessed October 8, 2014 at: http://plastics.americanchemistry.com/Sustainability-Recycling/Energy-Recovery/Gasification-of-Non-Recycled-Plastics-from-Municipal-Solid-Waste-in-the-United-States.pdf.

[515] Gasification Technologies Council. The Gasification Process. Accessed October 10, 2014 at: http://www.gasification.org/what-is-gasification/how-does-it-work/the-gasification-process/.

be further processed into formaldehyde, methyl acetate, ethyl propylene and dimethyl ether (DME), all of which serve as inputs for other industrial and commercial processes.[516]



Commercial scale gasification of MSW and industrial waste has been achieved in Japan, South Korea and Europe. While there were no commercial scale facilities in the U.S., according to the American Chemistry Council there are over 20 pilot and demonstration projects and 17 commercial-scale facilities under development and/or under construction as of September 2013.[517] It is reported that syngas processes may offer comparative benefits when contrasted with other waste conversion technologies. For example, by limiting the amount of oxygen present during decomposition, gasification technologies limit oxidation as a primary source of gaseous pollutants in thermal conversion. Facilities that utilize gasification technologies also use a smaller amount of air relative to conventional waste combustion which may result in higher energy recovery efficiency, reduced boiler fouling and corrosion, and lower air pollutant emissions, including nitrogen oxides.[518]

Biogas Energy[519]

Biogas is produced when bacteria decompose manure anaerobically (i.e., without the presence of oxygen) into a gas mixture composed of about 60 to 70 percent methane, 30 to 40 percent carbon dioxide and trace amounts of other gases.[520] This mixture can serve as a fuel to generate heat, hot water, or electricity. In New York State, there are 33 operating anaerobic digester systems, with an installed capacity of 171 MW.[521] Biogas production, collection, and burning do not create new waste. Rather, biogas energy production can improve the effectiveness of managing manure by reducing air emissions and odors, as well as reducing pathogens and runoff from manure spread on fields.

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[516] American Chemistry Council. 2013. Gasification of Non-Recycled Plastics From Municipal Solid Waste In the United States. Prepared by Gershman, Brickner & Bratton, Inc. Last updated September 2013. Accessed October 8, 2014 at: http://plastics.americanchemistry.com/Sustainability-Recycling/Energy-Recovery/Gasification-of-Non-Recycled-Plastics-from-Municipal-Solid-Waste-in-the-United-States.pdf.

[517] *Ibid.*

[518] *Ibid.*

[519] EPA. AgSTAR: Anaerobic Digestion. Accessed August 27, 2014 at: http://www.epa.gov/agstar/anaerobic/.

[520] *Ibid.*

[521] *Ibid.*

Air Emissions

Biogas energy projects can significantly reduce emissions of methane and CO_2, and other odorous compounds emanating from landfill sites, wastewater treatment facilities, and farms.[522] Seven percent of methane emissions in the U.S. come from livestock and poultry manure, most of which in turn comes from swine and dairy operations.[523] Anaerobic biodigesters help to mitigate the environmental impacts of CAFOs.[524]

As with the combustion of biomass, the type and quantity of emitted criteria pollutants and trace amounts of other HAPs depends on the composition of the biogas, the combustion technology, and the air pollution controls employed. HAP emissions from biogas combustion are relatively small compared with other fossil fuels, and pose a less significant health and environmental risk than the release of methane, CO_2 and other HAPs from uncontrolled methane gas emitted from landfills, large farms, and wastewater treatment facilities.[525]

Water Resources

The primary water quality benefit of utilizing manure digestion systems on large dairy farms is the control of non-point source pollution caused by the runoff of manure into surface and subsurface waters. The traditional practice of storing and spreading manure over fields can often result in runoff of pathogens into nearby watercourses and groundwater. In contrast, controlled high temperature decomposition in a digester will reduce pathogens found in manure. Processed manure from a digester can be separated into liquid and solid byproducts. When the digested liquid is spread on fields, vegetation absorbs much of the available nitrogen, reducing runoff into groundwater and surface waters.

Odors

Odors released from both uncontrolled landfills and livestock farming operations are a common community complaint. Compounds found in landfill gas are associated with strong, pungent odors and can be transmitted off-site to residential areas, potentially lowering the quality of life for individuals who live adjacent to landfills. Along with reducing emissions of GHGs and other non-methane compounds, landfill gas (LFG) energy projects can also reduce odors through the collection of gas for combustion.

Odors emitted from manure on farms can also be reduced through the use of manure digesters. An odor control system collects the biogas to fuel a boiler that, in turn, heats the digester. Heating a digester decreases the volume needed to stabilize manure by accelerating the biological (anaerobic) process that destroys odor-producing compounds in the manure.

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[522] See also, Calrecycle. 2011. Final Program Environmental Impact Report (EIR) for Anaerobic Digestion Facilities. http://www.calrecycle.ca.gov/swfacilities/compostables/AnaerobicDig/PropFnlPEIR.pdf.

[523] NRDC. Biogas Energy. Accessed September 14, 2014 at: http://www.nrdc.org/energy/renewables/biogas.asp.

[524] EPA. AgSTAR: Anaerobic Digestion. Accessed August 27, 2014 at: http://www.epa.gov/agstar/anaerobic/.

[525] DPS. Final Generic Environmental Impact Statement in Case 03-E-0188 Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio Standard. Issued August 26, 2004. Accessed September 18, 2014 at: http://www.dps.ny.gov/NY_RPS_FEIS_8-26-04.pdf.

Geothermal Energy Technologies

The capture of geothermal energy in the form of heat from within the earth provides an effective energy source for both electricity generation and direct use. A variety of mature geothermal energy technologies, including geothermal heat pumps, allow for direct use in heating and cooling, and geothermal power generation that converts heat to electricity. As of 2011, there was 3.1 GW of installed nameplate capacity of geothermal energy technologies in the United States. In the same year, the EIA estimated 2.4 GW of net summer electrical generation capacity.[526] In 2012, there were more than 100 operational geothermal energy technology projects in New York City.[527]

Geothermal heat pumps (also known as ground source heat pumps, or GHP) tap the constant temperature of the ground to provide efficient heating and cooling. [528,529] These systems operate using in-ground heat exchangers containing a circulating fluid, which can be distributed throughout a building, or integrated with a buildings HVAC system. Heat energy extracted from the earth during the winter can be used to power the building. This process is reversed during the summer – that is, unwanted heat is extracted from the building and added to the earth.[530,531]

A geothermal heat pump includes three principal components: an earth connection subsystem, heat pump subsystem, and heat distribution subsystem. The earth connection subsystem typically consists of closed loop of pipes buried underground at a sufficient depth to access a relatively constant ground or groundwater temperatures ranging from 4 degrees Celsius (39 degrees Fahrenheit) to 30 degrees Celsius (86 degrees Fahrenheit).[532] The fluid (typically water or a water/anti-freeze mixture) is then circulated through the pipes, allowing heat (but not fluid) to be transferred between the building and the ground. Less common GHP systems are open loop, in

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[526] Augustine, C.; Bain, R.; Chapman, J.; Denholm, P.; Drury, E.; Hall, D.G.; Lantz, E.; Margolis, R.; Thresher, R.; Sandor, D.; Bishop, N.A.; Brown, S.R.; Cada, G.F.; Felker, F.; Fernandez, S.J.; Goodrich, A.C.; Hagerman, G.; Heath, G.; O'Neil, S.; Paquette, J.; Tegen, S.; Young, K. (2012). Renewable Electricity Generation and Storage Technologies. Vol 2. of Renewable Electricity Futures Study. NREL/TP-6A20-52409-2. Golden, CO: National Renewable Energy Laboratory. Accessed Sept ember 28, 2014 at: http://www.nrel.gov/docs/fy12osti/52409-2.pdf.

[527] Gregor, A. Geothermal Designs Arise as a Stormproof Resource. New York times. 11/6/2012. Accessed January 14, 2015 at: http://www.nytimes.com/2012/11/07/business/geothermal-energy-advocates-hope-systems-get-a-second-look.html?pagewanted=all&_r=1&.

[528] NREL. Geothermal Heat Pump Basics. Last updated July 25, 2014. Accessed January 1, 2015 at: http://www.nrel.gov/learning/re_geo_heat_pumps.html.

[529] GHPs can be considered high-efficiency space conditioning technology as well as energy efficiency systems. Because these systems capture energy for the purposes heating and cooling, this discussion is included in **Section 5.2.2** "Low-Carbon and Carbon-Free Energy Resources," rather than **Section 5.2.1** "Optimizing Energy Consumption."

[530] NYSDEC. Geothermal Energy. Accessed September 3, 2014 at: http://www.dec.ny.gov/energy/43303.html. Also see, NYSDERA. Geothermal Heat Pumps. Accessed September 3, 2014 at: http://www.nyserda.ny.gov/Energy-Efficiency-and-Renewable-Programs/Renewables/Geothermal-Heat-Pumps.aspx.

[531] There is some debate whether geothermal heat pumps represent a "true" application of geothermal energy or whether they are partially using stored solar energy. For purposes of this analysis, we assume that geothermal heat pumps are a form of direct geothermal use. (International Panel on Climate Change. 2011. Special Report on Renewable Energy Sources and Climate Change Mitigation . Chapter 4, Geothermal Energy. http://srren.ipcc-wg3.de/report/IPCC_SRREN_Ch04.pdf.)

[532] IPCC. 2011. Special Report on Renewable Energy Sources and Climate Change Mitigation . Chapter 4, Geothermal Energy. http://srren.ipcc-wg3.de/report/IPCC_SRREN_Ch04.pdf.

which groundwater or surface water is pumped directly from the earth, used once for the purposes of heat exchange, and then discharged to the surface or underground. A final GHP form is standing column, where groundwater is pumped up through a central pipe, used once for heat exchange, and then discharged into the upper casing of the same well.

Geothermal energy can also be converted to electricity for general use. Geothermal electricity generation converts fluids originating deep below the earth's surface, typically ranging from zero to 10 kilometers, into steam that rotates a turbine.[533,534] Energy can be captured from hot water that either naturally wells up under pressure or escapes upon using engineering techniques to release it from below the ground.

Flash steam geothermal energy generation captures the stored energy in geothermal reservoir water, which naturally flows up wells in the earth and becomes steam as the pressure decreases. Power plant facilities powered by flash steam geothermal technology utilize reservoirs of water with temperatures greater than 182 degrees Celsius (360 degrees Fahrenheit), and generally range from 20 to 110 MW in power capacity.[535]

Enhanced geothermal systems (EGS) create fracture networks to provide fluid pathways for hot, pressured water that comes from subterranean reservoirs or is injected into the ground.[536] The heat energy can be captured through binary steam cycle plants, which use the heated water of approximately 107 to 182 degrees Celsius (225 to 360 degrees Fahrenheit) to boil another fluid that is vaporized in a heat exchanger to turn the facilities turbines.[537] After the energy is captured, the water is injected back into the ground where it is reheated.

Environmental Impact Overview[538]

In comparison to traditional fossil fuel energy sources, geothermal technologies (e.g., GHP systems, flash steam generation, and EGS) have relatively benign environmental implications because geothermal technologies lack combustion processes. Geothermal electricity generation results in varying amount of GHGs depending on the technology and system design, with CO_2 the primary greenhouse gas emission released from geothermal fluids. Direct GHG emissions from geothermal electricity average 122 g CO_2/kWh. However, certain technologies, such as closed-loop binary cycle power plants, produce zero direct operational CO_2 emissions.[539] In the literature, studies have estimated lifecycle GHG emissions to range from 180 to 202 g CO_2e/kWh

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533 *Ibid.*

534 NREL. Geothermal Electricity Production Basics. Last updated July 25, 2014. Accessed January 1, 2015 at: http://www.nrel.gov/learning/re_geo_elec_production.html.

535 IPCC. 2011. Special Report on Renewable Energy Sources and Climate Change Mitigation . Chapter 4, Geothermal Energy. http://srren.ipcc-wg3.de/report/IPCC_SRREN_Ch04.pdf.

536 *Ibid.*

537 NREL. Geothermal Electricity Production Basics. Last updated July 25, 2014. Accessed January 1, 2015 at: http://www.nrel.gov/learning/re_geo_elec_production.html.

538 Menhert, E. 2004. The Environmental Effects of Ground Source Heat Pumps – A Preliminary Overview. Illinois State Geological Survey (ISGS). Open-Files Series Report 2004-2. Accessed September 1, 2014 at: http://library.isgs.uiuc.edu/Pubs/pdfs/ofs/2004/ofs2004-02.pdf.

539 IPCC. 2011. Special Report on Renewable Energy Sources and Climate Change Mitigation . Chapter 4, Geothermal Energy. http://srren.ipcc-wg3.de/report/IPCC_SRREN_Ch04.pdf.

for GHP systems, less than 50 g CO_2e/kWh for flash steam electricity generation, and less than 80 CO_2e/kWh for ESG electricity generation.[540] The range of lifecycle emissions for GHP systems depends substantially on the mix of electricity sources that power them.[541]

Another potential effect of GHP systems is the release of anti-freeze solutions into the environment, either by accident (e.g., a spill) or via corrosion of system components. Antifreeze solutions are required in colder climates to prevent the fluid from freezing inside system pipes during cold seasons. Antifreeze chemicals include methanol, ethanol, potassium acetate, propylene glycol, calcium magnesium acetate (CMA), and urea. These chemicals are generally mixed with water when used as a heat exchange fluid. Likewise, antifreeze leakage due to improperly constructed or maintained boreholes may contaminate groundwater, which in turn may pose public health risks.[542, 543] However, barring accidental release, when properly designed and maintained, GHP systems are unlikely to contaminate groundwater with antifreeze.

As with any activity that involves drilling wells below the earth's surface, EGS geothermal electricity generation activities create a potential for groundwater contamination from surface water infiltration, or interaquifer flow. In New York, NYSDEC Division of Mineral Resources regulates the drilling, construction, operation and plugging of geothermal wells drilled deeper than 500 feet below the earth's surface. The NYSDEC Division of Water regulates registration and certification of geothermal contractors for certain wells drilled at depths of 500 feet or less.[544]

In addition, geothermal electricity generation may have minor effects on other resource categories. For example, geothermal energy uses water for during drilling and well completion, and may use water for cooling systems in the case of hydrothermal facilities. While geothermal generation facilities are relatively unobtrusive in comparison to other energy generation facilities, land requirements for geothermal facilities range from 160 to 900 m^2/GWh/yr.[545] Flash steam hydrothermal plants produce carbon dioxide, nitrous oxide, sulfur oxides, and hydrogen sulfide, at rates of 0-6.4 kg/MWh.[546] Finally, concerns exist regarding the potential for geothermal operations to induce seismicity.[547]

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[540] IPCC. 2011. Special Report on Renewable Energy Sources and Climate Change Mitigation . Chapter 4, Geothermal Energy. http://srren.ipcc-wg3.de/report/IPCC_SRREN_Ch04.pdf. Estimates for lifecycle GHG emissions of low-temperature district heating systems can be much lower, but specific to that technology, ranging from 14 to 58 g CO2eq/kWh.

[541] *Ibid.*

[542] GHP boreholes are typically grouted with bentonite, neat cement, or a mixture of these materials.

[543] Menhert, E. 2004. The Environmental Effects of Ground Source Heat Pumps – A Preliminary Overview. Illinois State Geological Survey (ISGS). Open-Files Series Report 2004-2. Accessed September 1, 2014 at: http://library.isgs.uiuc.edu/Pubs/pdfs/ofs/2004/ofs2004-02.pdf.

[544] GHP systems are typically built down to a depth between 50 to 250 meters (165 to 820 feet). (Source: International Panel on Climate Change. 2011. Special Report on Renewable Energy Sources and Climate Change Mitigation. Chapter 4, Geothermal Energy. http://srren.ipcc-wg3.de/report/IPCC_SRREN_Ch04.pdf.)

[545] IPCC. 2011. Special Report on Renewable Energy Sources and Climate Change Mitigation . Chapter 4, Geothermal Energy. http://srren.ipcc-wg3.de/report/IPCC_SRREN_Ch04.pdf.

[546] Augustine, C.; Bain, R.; Chapman, J.; Denholm, P.; Drury, E.; Hall, D.G.; Lantz, E.; Margolis, R.; Thresher, R.; Sandor, D.; Bishop, N.A.; Brown, S.R.; Cada, G.F.; Felker, F.; Fernandez, S.J.; Goodrich, A.C.; Hagerman, G.; Heath, G.; O'Neil, S.; Paquette, J.; Tegen, S.; Young, K. (2012). Renewable Electricity Generation and Storage Technologies.

Ocean Energy

The renewable energy resource in the ocean comes from six distinct sources: (1) waves; (2) tidal range; (3) tidal currents; (4) ocean currents; (5) ocean thermal energy conversion (OTEC); and (6) salinity gradients.[548] Converting less than one-tenth of one percent of the earth's renewable energy contained within oceans could satisfy more than five times current worldwide electricity demand.[549] With more than 120 miles of Atlantic Ocean coastline, New York could benefit from any technology that generated electricity from any or all forms of ocean energy.

Ocean energy technologies, however, are still in the conceptual, pre-commercial prototype, or demonstration phase; additional research and development is required before such technologies are able to provide sustainable sources of renewable energy. The IPCC estimates that ocean energy technologies are unlikely to be available for commercial deployment before 2020.[550]

Environmental Impact Overview

The potential impacts from ocean energy are largely unknown because of the technology's emerging status. Ocean energy projects may be long-lived, more than 25 years in general and over 100 years for tidal barrages. As such, the long-term effects of ocean development require careful consideration. One area of ongoing investigation is the potential injury and mortality of fish and other aquatic life due to underwater rotating turbine blades. Because visual monitoring is difficult, the impacts of underwater turbines may need to be assessed through controlled laboratory experiments or, where appropriate, pilot projects. Impacts to be examined include: blade strikes from rotating blades; blade avoidance by larger fish; blade avoidance by juvenile forage fish that could make them more vulnerable as prey; and the ability of fish to navigate a field of turbines where elevated current speeds exist.

Ocean energy structures are likely to affect wave height, tidal current flow patterns, and sediment transport. Such structures may also affect marine wildlife through electromagnetic fields, chemical emissions, acoustic emanations, or simply its presence as foreign, physical underwater structure. Depending on its location, ocean energy structures may affect marine-based recreational activities (such as boating, fishing, and swimming); in most cases access to areas near the facility would be restricted to prevent injuries to people or damage to the machines.

Vol 2. of Renewable Electricity Futures Study. NREL/TP-6A20-52409-2. Golden, CO: National Renewable Energy Laboratory. Accessed Sept ember 28, 2014 at: http://www.nrel.gov/docs/fy12osti/52409-2.pdf.

[547] Majer, E., Baria, R. and Stark, M. 2008. Protocol for induced seismicity associated with enhanced Report produced in Task D Annex I (9 April 2008), International Energy Agency-Geothermal Implementing Agreement (incorporating comments by: C. Bromley, W. Cumming, A. Jelacic and L. Rybach). Available at: http://iea-gia.org/category/publications/.

[548] IPCC. 2011. IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation, Chapter 6, Ocean Energy. Cambridge University Press, Cambridge, United Kingdom and New York, NY. Accessed August 25, 2014 at: http://srren.ipcc-wg3.de/report/IPCC_SRREN_Ch06.pdf.

[549] NYSDEC. Hydropower in New York. Accessed August 20, 2014 at: http://www.dec.ny.gov/energy/43242.html.

[550] IPCC. 2011. IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation, Chapter 6, Ocean Energy. Cambridge University Press, Cambridge, United Kingdom and New York, NY. Accessed August 25, 2014 at: http://srren.ipcc-wg3.de/report/IPCC_SRREN_Ch06.pdf.

Structures would also require review by the US Coast Guard. Safety markings and symbols can be used to identify ocean energy structures as potential obstructions to marine navigation.[551]

Depending on the type of technology, possible land-based impacts of ocean energy include visual and social impacts to coastal communities. Offshore facilities may have other cultural resource considerations, particularly in locations where submerged archeological deposits, such as shipwrecks, may be present. Commercial and recreational fishing may also experience similar restrictions. Ocean energy, however, does not create any direct air pollutants or waste during operation. As with other types of energy development, if ocean energy were to become viable, construction, operation and decommissioning of such facilities will generate some greenhouse gas emissions, but such emissions are relatively minor.[552]

5.3 INDIRECT EFFECTS

The core policy outcomes of the REV and CEF include customer knowledge, market animation, system-wide efficiency, and fuel and resource diversity. Taken together, these outcomes are 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. Such changes in New York's energy industry will evolve over long periods of time in response to numerous separate individual initiatives. Therefore, in aggregate, the clean energy technologies and resources discussed in this chapter serve and generate one common long-term, indirect effect: reducing the use of energy generated from fossil fuels.

The environmental impact of a reduction in the use of fossil-fuel based energy generation on the human environment is generally positive, but will occur over longer time horizons. For example, by reducing energy consumption, energy efficiency resources and technologies may avoid the adverse environmental impacts associated with fossil fuel-based energy generation. The extent to which EE avoids adverse impacts and generates benefits, however, is complex. A variety of factors influence potential outcomes, including the mechanism by which energy consumption is reduced, the location on the grid at which changes in energy consumption occur, and the current mix of fuel sources used in generation. The "dirtier" the fuels used for generation, the greater the benefits from energy efficiency or demand response programs. Adverse impacts avoided may also change over time, reflecting the dynamic nature of the electric grid and the energy market itself. That is, adverse impacts over the next three to five years may differ from adverse impacts avoided in ten to 15 years.

Smart grid technologies, energy storage, and reliability demand response programs improve the ability of various energy market participants to understand, control, and manage energy supply and demand. These technologies and programs reduce energy losses by improving how the system operates, including reducing renewable energy potentially lost due to overgeneration. More importantly, smart grid technologies enable other clean energy technologies, programs and

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[551] DOE, Offices of Electricity Delivery and Reliability and Energy Efficiency and Renewable Energy. 2014. Hawai'i Draft Clean Energy. Programmatic Environmental Impact Statement. April.

[552] IPCC. 2011. IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation, Chapter 6, Ocean Energy. Cambridge University Press, Cambridge, United Kingdom and New York, NY. Accessed on August 25, 2014 at: http://srren.ipcc-wg3.de/report/IPCC_SRREN_Ch06.pdf.

resources to achieve greater impacts on the electric grid in terms of stability, resilience and efficiency. Without smart grid technologies, the full benefits of energy management tools like economic demand response programs, variable charging rates, GVI, and renewable generation are difficult to realize. In this capacity, smart grid development may be considered as a form of mitigation, providing a means by which the environmental impacts of other technologies and processes can be avoided.

In aggregate, the greatest indirect environmental impacts of the REV and CEF stem from reductions in the generation of energy from fossil fuel power plants. Such plants are the second largest source of emissions, and most concentrated source, accounting for approximately 16 percent of all greenhouse gas emissions in New York State.[553] Below we summarize the potential environmental benefits indirectly generated by increases in the penetration of clean energy technologies, programs and other resources discussed in this chapter.

Criteria Air Pollutants

Fossil fuel electric generation is a major source of criteria air pollutants. In New York State, electric generation from fossil fuel-based resources produced 29,682 tons of NO_x and 54,627 tons of SO_2.[554] The release of SO_2 and NO_x, from fossil fuel generated power plants, also leads to the formation of particulate matter $PM_{2.5}$, ozone, and other acidic compounds.[555] Mercury (Hg) compounds are another pollutant from fossil fuel energy generation, particularly from coal-powered plants.[556] Criteria air pollutants are particularly important factors influencing local and regional air quality. These pollutants can negatively affect air quality, visibility, and public health.

While the REV and CEF are intended to reduce criteria air pollutant emissions from large-scale fossil-fuel generation, to the extent that the REV increases the use of distributed fossil-fuel generation (e.g., backup generators or CHP), the net effect of the REV on criteria air pollutants in certain localities is uncertain. **Sections 5.2 and 5.3** provide further discussion of the potential impacts of such distributed fossil-fuel generation on local air quality. **Chapter 6** includes discussion of measures to mitigate such impacts. If increased use of distributed fossil-fuel generation is inadequately mitigated, local air quality could deteriorate which, in turn, could adversely affect the efficacy of State or Regional Implementation Plans submitted to EPA under the CAA or the recently proposed Clean Power Plan.[557]

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[553] 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.

[554] EPA. e.GRID. Last updated August 5, 2014. Accessed September 8, 2014 at: http://www.epa.gov/cleanenergy/energy-resources/egrid/.

[555] EPA. Human Health and Environmental Effects of Emissions from Power Generation. Last updated May 6, 2014. Accessed September 8, 2014 at: http://www.epa.gov/captrade/documents/power.pdf.

[556] EPA. How does electricity affect the environment? – Coal. Last updated September 25, 2013. Accessed September 8, 2014 at: http://www.epa.gov/cleanenergy/energy-and-you/affect/coal.html.

[557] Case 14-M-0101. Columbia University's Sabin Center for Climate Change Law, Environmental Advocates of New York, New York Public Interest Research Group, the Pace Energy and Climate Center, the Sierra Club, and the Vermont Energy Investment Corporation. Response to New York State Department of Public Service Staff Straw Proposal on Track One Issues. Filed September 22, 2014.

Greenhouse Gases

A key long-term outcome of the REV and CEF is to significantly reduce the emissions of greenhouse gases form the State's energy sector.[558] In New York State, electric generation emitted 43.4 million tons of carbon dioxide equivalent gas (CO_2e) in 2010.[559] As discussed in **Chapter 3**, greenhouse gases such as carbon dioxide contribute to the global trend of rising average temperatures, changes in precipitation patterns and rising sea levels. As temperatures continue to rise and climate change further intensifies, the negative impacts of climate change on New York State's residents, economy and natural ecosystems will also increase.[560] Actions (like the REV and CEF) that stem the further rise of atmospheric greenhouse gas levels and prepare the State for the impact of climate change can reduce the magnitude of such impact both within New York State and globally.

Public Health

Emissions from fossil fuel based electric generation can negatively affect human health. Exposure to ozone can aggravate lung diseases including asthma, emphysema, and chronic bronchitis, as well as increase the risk of premature mortality from heart or lung disease. Health effects from $PM_{2.5}$ include aggravated asthma, irregular heartbeat, decreased lung function, nonfatal heart attacks, and premature mortality in those with heart or lung disease.[561] NO_x can increase the risk of respiratory diseases and exacerbate existing respiratory symptoms, especially in children, elderly, and the poor. Individuals with asthma may experience aggravated symptoms when exposed to NO_x.[562] Additionally, exposure to NO_x can cause irreversible structural changes to the lungs. One study estimated health impacts from fossil fuel energy sources at $362 to 886 billion in economic value annually, based on premature mortality, workdays missed, and direct costs to the U.S. healthcare system resulting from $PM_{2.5}$, NO_x, and SO_2.[563] The same study estimated that the economic value of negative health impacts was equal to approximately $0.14 to $0.31 per kWh.[564] These costs may be even higher if greenhouse gas emissions are included.[565]

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558 NYSERDA. 2014. Case 14-M-0094 – Proceeding on the Motion of the Commission to Consider a Clean Energy Fund. Clean Energy Fund Proposal. Issued September 23, 2014.

559 EPA, e.GRID. Last updated August 5, 2014. Accessed September 8, 2014 at: http://www.epa.gov/cleanenergy/energy-resources/egrid/.

560 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-synthesis-report.pdf.

561 EPA. Particulate Matter (PM): Health. Accessed September 8, 2014 at: http://www.epa.gov/airquality/particlepollution/health.html.

562 EPA. Nitrogen Dioxide: Health. Last updated August 15, 2014. Accessed September 8, 2014 at: http://www.epa.gov/airquality/nitrogenoxides/health.html.

563 Machol, Ben and Rizk, Sarah. 2013. "Economic Value of U.S. Fossil Fuel Electricity Health Impacts." Environment International. February 2013. Volume 52. Pp 75-80.

564 Gerdes, Justin. Forbes.com. How Much Do Health Impacts From Fossil Fuel Electricity Cost The U.S. Economy. April 8, 2013. Accessed September 26, 2014 at: http://www.forbes.com/sites/justingerdes/2013/04/08/how-much-do-health-impacts-from-fossil-fuel-electricity-cost-the-u-s-economy/.

565 *Ibid.*; EPA. How does electricity affect the environment? – Coal. Last updated September 25, 2013. Accessed September 8, 2014 at: http://www.epa.gov/cleanenergy/energy-and-you/affect/coal.html.

Water, Land and Ecological Resources

Avoided fossil fuel and nuclear generation should also reduce water demand and improve the health of aquatic ecosystems. Both coal combustion in power plants and nuclear plants use significant quantities of water for producing steam and cooling.[566] For natural gas combustion, boilers and combined cycle systems also require water for cooling processes.[567] If process or cooling water comes from a surface water source, water intake structures are required to withdraw the necessary water for the plant's operation. Such intake structures can stress or directly take aquatic organisms held against or passed through intake screens.[568]

Coal-fired generation, natural gas boilers, and natural gas combined cycle systems all release wastewater with excess heat and hazardous chemicals during plant operation. Thermal water discharges elevate water temperatures, which can harm organisms, destroy or degrade habitat, or form barriers to existing migratory routes. Hazardous substances in wastewater can impair water quality, as can deposition of acidic air pollutants (i.e., acid rain).[569]

Coal combustion generates significant amounts of solid waste. Much of this waste is disposed of in abandoned mines or landfills, potentially allowing pollutants to leach to ground or surface water. Soil contaminated by pollutant deposition near coal-fired power plants can require years to recover.[570] Acid rain due to emissions of NO_X and SO_2also impairs the growth of and causes death in trees.[571,572]

Aesthetic, Visual, Cultural, and Historical Resources

Reduced emissions of NO_X and SO_X and associated reductions in particulate matter due to avoided fossil fuel use would improve visual and cultural resources in New York.[573] Fine particles are the primary cause of reduced visibility in some areas in the U.S., including national parks and wilderness areas. Reduced particle pollution will also help to protect stonework, including culturally important monuments, from staining and other damage.[574]

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[566] Kenny, J.F., Barber, N.L., Hutson, S.S., Linsey, K.S., Lovelace, J.K., and Maupin, M.A., 2009, Estimated use of water in the United States in 2005: U.S. Geological Survey Circular 1344, 52 p. Accessed September 30, 2014 at: http://pubs.usgs.gov/circ/1344/.

[567] EPA. Clean Energy. Water Resource Use. Last updated September 25, 2014. Accessed September 8, 2014 at: http://www.epa.gov/cleanenergy/energy-and-you/affect/water-resource.html.

[568] NYSDEC. Aquatic Habitat Protection. Accessed September 30, 2014 at: http://www.dec.ny.gov/animals/32847.html.

[569] EPA. Clean Energy. Water Discharge. Last updated September 25, 2013. Accessed September 26, 2014 at: http://www.epa.gov/cleanenergy/energy-and-you/affect/water-discharge.html.

[570] EPA. Clean Energy. Coal. Last updated September 25, 2013. Accessed September 26, 2014 at: http://www.epa.gov/cleanenergy/energy-and-you/affect/coal.html.

[571] EPA. Acid Rain. Effects of Acid Rain. Forests. Last updated December 4, 2012. Accessed September 26, 2014 at: http://www.epa.gov/acidrain/effects/forests.html.

[572] EPA. Air Trends. Last Updated October 8, 2014. Accessed October 9, 2014 at: http://www.epa.gov/airtrends/sixpoll.html.

[573] *Ibid*.

[574] EPA. Particulate Matter. Health. Accessed September 1, 2014 at: http://www.epa.gov/airquality/particlepollution/health.html.

5.4 OTHER UNANTICIPATED TECHNOLOGIES

As the REV and CEF programs are further developed, there is potential for these programs to spur innovation and the development currently unanticipated clean energy technologies. As envisioned under the CEF, the continuation and enhancement of any number of programs currently supported by NYSERDA , such as the Emerging Technologies and Accelerated Commercialization program, could lead to development and commercialization of new clean energy technology. New York State ranks second nationally in cleantech patents and the number of cleantech patents registered each year is on the rise.[575] 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 displace 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

SEQRA Section 617.9(b)(5)(iii)(a) requires agencies to consider the "reasonably related short-term and long-term impacts, *cumulative impacts*, and other associated environmental impacts" of actions on the environment and existing natural resources. SEQRA does not expressly define "cumulative impacts"; however, it is useful to note that NEPA regulations at 40 CFR §1508.7 define cumulative impacts as the impacts on the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions.

Several court cases in the late 1980s and early 1990s provide additional direction on the appropriate approach for assessing cumulative impacts. Of particular relevance, *North Fork Environmental Council, Inc. v. Janoski* (196 AD2d 590 (2d Dept. 1993)) holds that: "in evaluating the potential environmental effect of a project before it, the lead agency must consider cumulative impacts of other simultaneous or subsequent actions which are included in any long-range plan of which the action under consideration is a part."

In this case, the REV and CEF initiatives are part of and related to other, ongoing, State energy initiatives, including, but not necessarily limited to: (1) the draft 2014 New York State Energy Plan; (2) the New York Energy Highway Blueprint; (3) the Renewable Portfolio Standard (Case 03-E-0118); (4) the Energy Efficiency Portfolio Standard (Case 07-M-0548); (5) the New York Green Bank (Case 13-M-0412); and (6) the Technology and Market Development Portfolio (Case 10-M-0457). In addition to State-level clean energy initiatives, a number of energy-related efforts at the federal level may interact with the REV and CEF. **Exhibit 5-7** summarizes the past, present and reasonably foreseeable future actions that are likely to interact with the CEF and REV.

[575] 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.

EXHIBIT 5-7 SUMMARY OF PAST, PRESENT AND REASONABLY FORESEEABLE FUTURE ACTIONS THAT INTERACT WITH THE PROPOSED REV AND CEF PROCEEDINGS

	PAST	PRESENT/NEAR-TERM
STATE/REGIONAL	• Office Petroleum Overcharge Restitution Fund • 1988 System Benefit Charge • New York Energy $mart Program • Electricity Restructuring • Revenue Decoupling • Energy Efficiency Portfolio Standards (EEPS) • Renewable Portfolio Standard (RPS) • Climate Action Council	• New York State Energy Plan • Regional Greenhouse Gas Initiative (RGGI) • Executive Order 24 (Goals and Climate Action Plan) • Energy Efficiency Portfolio Standards (EEPS) • Renewable Portfolio Standard (RPS) • Technology and Market Development Program • NY-Sun Initiative • Green Bank • NY Energy Highway • Climate Smart Communities • Smart Growth Public Infrastructure Policy Act • Transportation and Climate Initiative • ReCharge NY; Charge NY • Five Cities Energy Master Plans • Build Smart NY; ReBuild NY • Cleaner Greener Communities
FEDERAL	• Energy Policy Act (1992, 2005, 2007) • Kyoto Protocol • Energy Independence and Security Act of 2007 • Emergency Economic Stabilization Act of 2008 • Production, Investment ,and Advanced Energy Manufacturing Tax Credits	• President's Climate Action Plan • CAA Section 111(d) Clean Power Plan • EPA Greenhouse Gas Reporting Rule • Renewable Fuel Standard (RFS) • EPA Energy Star • Executive Order 13653: Preparing the U.S. for the Impacts of Climate Change

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:

- As indicated by the modeling of alternative scenarios in Chapter 4 and the assessment of broader impacts in Chapters 4 and 5, the REV and CEF are anticipated to engender overall positive environmental impacts, primarily by reducing the State's use of, and dependence on, fossil fuels.
- As noted in this chapter, certain cumulative negative impacts (e.g., aesthetic effects of wind energy), however, may constrain the overall positive impacts of the REV and CEF proceedings. 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 REV and CEF proceedings.
- In general, the State and Federal policies and initiatives identified in this section as likely to interact with the REV and CEF proceedings 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 REV and CEF are not known at this time and are beyond the scope of this GEIS. This GEIS provides a generic description of the potential environmental impacts of the REV/CEF portfolio of initiatives 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. Specifically, this chapter discusses mitigation in two parts:

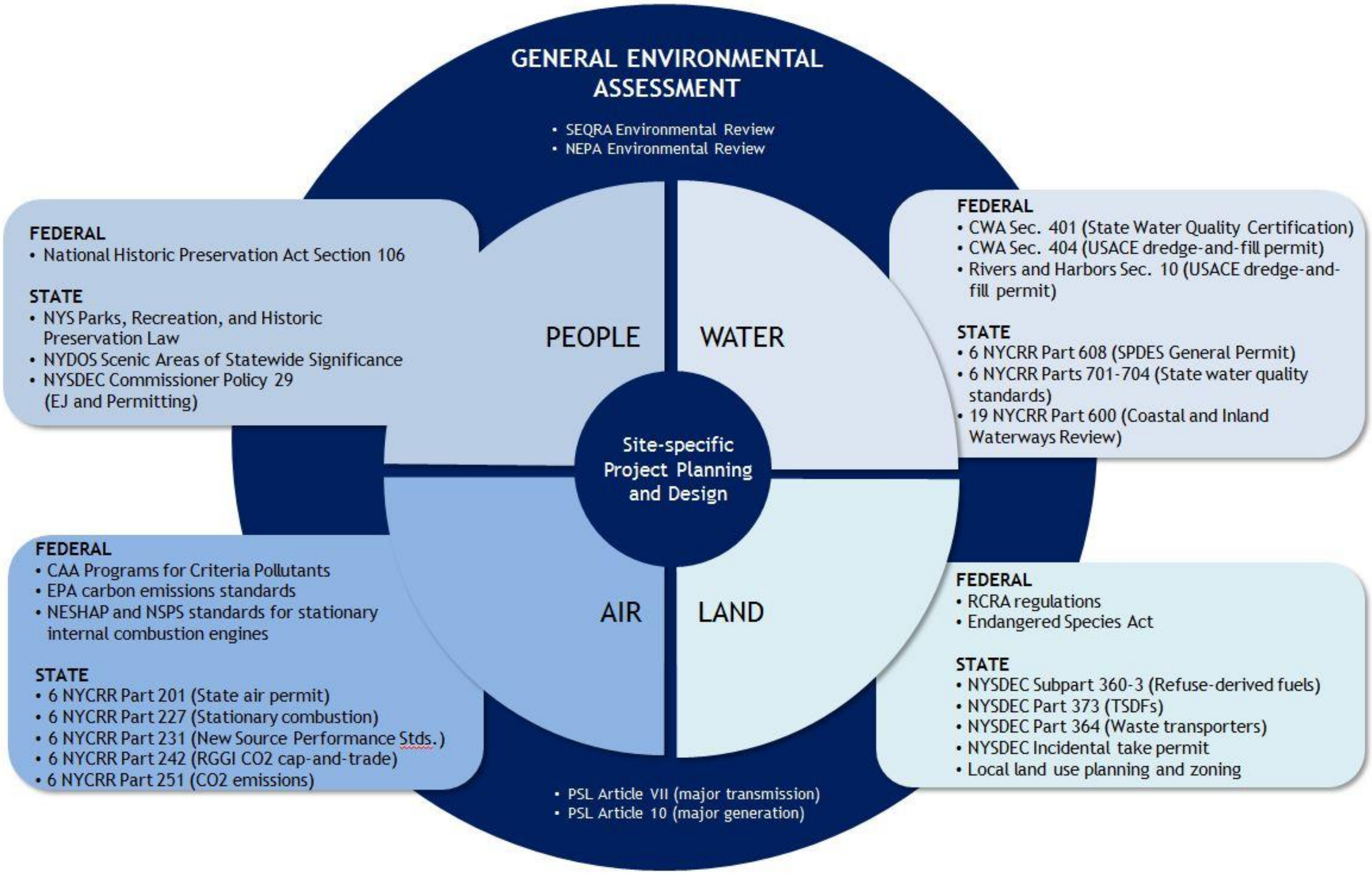
- Section 6.1 introduces key federal and State regulations that may apply to clean energy activities during construction, operation, and closure of a specific project, and
- Section 6.2 provides an overview of site-specific project design and planning which serves as a primary mitigation measure for many site-specific issues.

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.

6.1 POTENTIALLY APPLICABLE FEDERAL AND STATE REGULATIONS

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. In the following sections we briefly discuss potentially applicable federal and State regulations for key resource areas that may be affected by REV- and CEF-related activities. On the following page, **Exhibit 6-1** summarizes potentially applicable permits and regulations, by resource area and type of review. At the end of this section, **Exhibit 6-2** provides greater detail on federal, State, and local regulations, permits, and review processes that may be applicable to clean energy projects implemented under the REV and CEF programs.

EXHIBIT 6-1 SUMMARY OF POTENTIALLY APPLICABLE REGULATIONS



Air Resources

A number of federal and State regulations address air pollution, including hazardous air pollutants as well as greenhouse gas emissions. As electricity generation has historically been the largest source of air pollution, clean energy initiatives designed to transition the State's energy sources away from fossil fuels complement the existing regulatory framework, which mitigates air pollution and seeks to achieve compliance with and adhere to ambient air quality standards established under the CAA. However, the extent to which air quality will benefit from REV and CEF actions depends on the type of renewable energy implemented and, in some instances, site-specific characteristics. For example, while solar PV, hydropower, and wind do not generate any air emissions when producing electricity, electricity generated through CHP systems and/or biomass, biogas and geothermal sources involve some air emissions, although at levels lower than traditional fossil fuels. In addition, for renewable energy resources that emit air pollutants, potential impacts to air quality may be of greater concern in areas where concentrations of air pollutants already exist.[576]

In the following sections, we provide an overview of the key federal and State regulations designed to mitigate, control and reduce air pollutants and greenhouse gases.

Clean Air Act

The primary federal statute governing air quality and air pollution is the CAA.[577] Air quality is defined by ambient air concentrations of specific pollutants that the EPA has identified as potentially harmful to public health and the environment.[578] Specifically, EPA has defined primary (and in some cases secondary) standards for six "criteria" pollutants, including: (1) particulate matter (PM10 and PM2.5); (2) carbon monoxide; (3) SO_2; (4) NO_2; (5) lead Pb; and, (6) ozone. National primary ambient air quality standards define levels of air quality that EPA has determined necessary to provide an adequate margin of safety to protect public health, including the health of sensitive populations such as children and the elderly. National secondary ambient air quality standards define levels necessary to protect the public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. **Exhibit 6-2** on the following page presents applicable National Ambient Air Quality Standards (NAAQS) for the six identified criteria air pollutants.

Air Quality Attainment Status

Areas that do not meet NAAQS for specific criteria pollutants are designated as being in "nonattainment" for specific criteria pollutant standard(s). For some criteria pollutants, nonattainment status is further defined by the extent to which the applicable standard is exceeded. For example, there are five classifications of ozone nonattainment status— marginal, moderate, serious, severe, and extreme—and two classifications of CO and PM10 nonattainment status—moderate and serious. The remaining criteria pollutants have designations of either attainment, nonattainment, or unclassifiable. Areas re-designated from nonattainment to attainment are commonly referred to as maintenance areas. These areas are in attainment but subject to an EPA-

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[576] For further discussion of measures available to mitigate the potential impacts of demand response programs on air quality, refer to the demand response section in **Section 5.2.1**.

[577] 42 U.S.C. 7401 et seq., amended in 1977 and 1990.

[578] The surrounding atmosphere, usually the outside air, as it exists around people, plants and structures.

approved maintenance plan for a specific pollutant, to ensure continued compliance with the standard.

EXHIBIT 6-2 NAAQS CRITERIA POLLUTANTS

POLLUTANT [FINAL RULE CITATION]		PRIMARY/ SECONDARY	AVERAGING TIME	LEVEL	FORM
Carbon Monoxide (CO) [76 FR 54294, August 31, 2011]		Primary	8 hours	9 ppm	Not to be exceeded more than once per year
			1 hour	35 parts per million (ppm)	
Lead (Pb) [73 FR 66964, November 12, 2008]		Primary and Secondary	Rolling 3-month average	0.15 μg/m^3	Not to be exceeded
Nitrogen Dioxide (NO_2) [75 FR 6474, Feb 9, 2010] [61 FR 52852, Oct 8, 1996]		Primary	1 hour	100 ppb	98th percentile, averaged over 3 years
		Primary and Secondary	Annual	53 ppb(1)	Annual Mean
Ozone (O3) [73 FR 16436, Mar 27, 2008]		Primary and Secondary	8 hour	0.075 ppm (2)(3)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particulate Pollution [78 FR 3086, January 15, 2013] (4)	$PM_{2.5}$	Primary	Annual	12 μg/m^3	Annual mean, averaged over 3 years
		Secondary	Annual	15 μg/m^3	Annual mean, averaged over 3 years
		Primary and Secondary	24 hour	35 μg/m^3	98th percentile, averaged over 3 years
	PM_{10}	Primary and Secondary	24 hour	150 μg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2) [75 FR 35520, Jun 22, 2010] [38 FR 25678, Sept 14, 1973]		Primary	1 hour	75 ppb(4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Secondary	3 hour	0.5 ppm	Not to be exceeded more than once per year

Key: μg/m^3= Micrograms per cubic meter.

Notes:

(1) The official level of the annual NO2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.

(2) Final rule signed March 12, 2008. The 1997 ozone standard (0.08 ppm, annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years) and related implementation rules remain in place. In 1997, the EPA revoked the 1-hour ozone standard (0.12 ppm, not to be exceeded more than once per year) in all areas, although some areas have continued obligations under that standard ("anti-backsliding"). The 1-hour ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is less than or equal to 1.

(3) On November 25, 2014, EPA released its proposed revisions to the NAAQS for ozone; the proposed rule was also formally published in the Federal Register on December 17, 2014 (79 FR 75234). EPA is proposing to revise the primary and secondary standards to a level within the range of 0.065 to 0.070 ppm.

(4) Final rule signed June 2, 2010. The 1971 annual and 24-hour SO2 standards were revoked in that same

POLLUTANT [FINAL RULE CITATION]	PRIMARY/ SECONDARY	AVERAGING TIME	LEVEL	FORM
rulemaking. However, these standards remain in effect until one year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.				

Most air quality control regions in New York are in attainment with NAAQS. Only two regions are designated 2008 ozone NAAQS nonattainment areas—Chautauqua County and the New York, Northern New Jersey, Long Island, NY-NJ-CT (partial) metropolitan statistical area (NYMA MSA).[579] All of New York State is considered part of the Ozone Transport Region (OTR) and is required at a minimum to implement measures required in moderate ozone nonattainment for areas. The NYMA is required to implement severe ozone nonattainment measures by virtue of its earlier designation under the former 1-hour ozone standard.

Greenhouse Gases

EPA and NYSDEC have also developed regulations for GHGs. EPA issued a final rule for Mandatory Reporting of Greenhouse Gases on September 22, 2009. Under this rule, suppliers of fossil fuels or industrial GHGs, manufacturers of mobile sources and engines, and facilities that emit 25,000 metric tons or more per year of GHG emissions (as CO_2 equivalents) are required to submit annual reports to the EPA. EPA also proposed carbon emissions standards for new power plants in September 2013 pursuant to Section 111(d) of the Clean Air Act. Carbon emissions from existing power plants are the subject of the Clean Power Plan (CPP) proposed rule, released by EPA in June 2014. Under the CPP, EPA would set state-specific emissions goals based on current electricity systems. States would develop compliance plans by June 2016 that contain the exact policies to be used to achieve emissions targets. Once promulgated, these regulations could result in potential impacts on REV and CEF implementation.

New York already regulates carbon dioxide emissions from power plants and includes greenhouse gases in SEQRA environmental reviews. Specifically, 6 NYCRR Part 251 establishes limits on carbon dioxide emissions from new electric generating facilities with a capacity of at least 25 MW, or for increases in the capacity of an existing facility by at least 25 MW. This works in conjunction with 6 NYCRR Part 242, which established a cap-and-trade mechanism to regulate carbon dioxide emissions from existing sources with a capacity of at least 25 MW. For environmental reviews, NYSDEC issued instructions for staff on how to assess and mitigate GHG and energy use in a SEQRA EIS.[580] These instructions can also serve as guidance for other lead agencies.

Air Emissions Regulations

Sources of air pollution can range in size from large industrial facilities and power plants to small commercial operations such as auto body shops. NYSDEC regulates owners and operators of stationary sources of air pollution under their Air Pollution Control regulations, specifically 6

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[579] EPA. Greenbook. Nonattainment Status for Each County by Year for Criteria Pollutants as of July 02, 2014. Accessed August 22, 2014 at: http://www.epa.gov/airquality/greenbook/index.html.

[580] NYSDEC. 2009. Assessing Energy Use and Greenhouse Gas Emissions in Environmental Impact Statements: DEC Policy. July. Accessed August 20, 2014 at: http://www.dec.ny.gov/docs/administration_pdf/eisghgpolicy.pdf.

NYCCR Part 201 (Part 201). Other than sources exempted in Part 204-3, all facilities with generators that operate in circumstances other than a strictly black-out situation are required to be registered or permitted with NYSDEC.[581] Permits for these sources are categorized as either major or minor according to the location of the source and their potential emissions. According to both the federal Clean Air Act and Part 201, those sources that exceed the relevant air pollution thresholds in the affected area are considered major sources and need to obtain a Title V permit; all others are minor sources. State facility permits are issued to those sources that are not considered to be major, but meet the criteria of 6 NYCRR Subpart 201-5. Non-major facilities that meet the criteria of 6 NYCRR Subpart 201-4 need to register with the Department but are not required to obtain a permit. Such registrations require facilities to self-attest that the facility will not exceed the thresholds applicable for criteria pollutants.[582] New facilities may also be subject to New Source Review for New and Modified Facilities, based on the type and size of the emission(s) source under 6 NYCRR Part 231.[583]

EPA has established regulations that manage generation sources at the federal level. In particular, 40 CFR Part 63 Subpart ZZZZ (Reciprocating Internal Combustion Engines, or the "RICE MACT" rule) regulates hazardous air pollutants from affected sources. New source Performance Standards (NSPS) such as, 40 CFR Part 60 Subpart JJJJ (for Stationary Spark Ignition Internal Combustion Engines), 40 CFR Part 60 Subpart IIII (Stationary Compression Ignition Internal Combustion Engines) and 40 CFR 60 Subpart KKKK (Stationary Combustion Turbines) regulate criteria pollutants from new sources. These EPA regulations apply to distributed generation sources used as emergency and non-emergency (including demand response) sources. At the State level, NYSDEC has been considering emissions standards and capacity limits for distributed generation sources (6 NYCRR Part 222) at minor facilities. Although the course of this regulatory initiative is uncertain at this time, a State-level rule could serve as an effective means of mitigating the adverse effects of distributed generation.

Specific regulations may cover particular distributed energy technologies. For example, solid fuel-fired stationary combustion facilities (such as direct fired wood biomass plants) are regulated under 6 NYCRR Part 227 (Stationary Combustion Installations) by NYSDEC and would be required to control pollutants such as nitrogen oxides and particulate matter. Such facilities must also meet New Source Performance Standards (NSPS), Prevention of Significant Deterioration (PSD) permitting requirements, and NAAQS for criteria pollutants under the federal CAA and state regulations. Under Section 129 of the CAA, EPA is required to set numerical emissions limitations on nine pollutants for both small and large municipal waste combustion units, including cadmium, carbon monoxide, total mass basis dioxins/furans and toxic equivalency basis dioxins/furans, hydrogen chloride, lead, mercury, nitrogen oxides, particulate matter, and sulfur. Section 129 further requires that all such standards reflect federal maximum achievable control technology (MACT) standards for hazardous air pollutants.

[581] Data on the number of facilities registered and permitted in New York, however, is not readily available.

[582] Generally, the thresholds for minor facility registrations are 50 percent of the level of any criteria pollutant that would trigger the permitting requirement under Title V of the federal Clean Air Act.

[583] NYSDEC. 2013. State Implementation Plans. Accessed August 20, 2014 at: http://www.dec.ny.gov/chemical/8403.html.

NSPS also outline the requirements for landfill gas combustion, a type of biogas, at large municipal solid waste facilities. NSPS and National Emission Standards for Hazardous Air Pollutants (NESHAP) require the combustion of non-methane organic compounds (e.g., hazardous air pollutants and volatile organic compounds). Further, the Resource Conservation and Recovery Act (RCRA) Subtitle D requires landfills to monitor methane levels to reduce explosion risk. At the State level, 6 NYCRR Part 208 requires landfills with capacity of over 2.5 million cubic meters to install technologies to collect and control landfill gas.

Distributed generation used by facilities participating in demand response programs may be subject to the permitting and registration regulations under Part 201 described above.[584] As part of its proceedings, the Commission also considers measures to address and limit the impacts of small-scale fossil fuel-based generation. For example, in past orders approving existing demand response programs operated by utilities, the Commission relied on site-specific emissions analyses to develop mitigating provisions, such as participation limits on diesel-based distributed generation and preclusion of distributed generation in proximity to current generating sites identified to pose accumulative emissions risk to nearby EJ communities.[585] The Commission also established technological requirements for engines participating in demand response programs to further mitigate the potential adverse environmental impacts on local air quality. As discussed in Chapter 5, the Commission is considering measures to mitigate the impacts from small-scale distributed generation as development of the REV portfolio continues. In addition to the types of project-specific review and participation described earlier in this chapter, the REV proceeding is also considering such measures as incorporating environmental characteristics into market pricing, establishing emissions limits for participating technologies,[586] and conducting periodic portfolio-wide review to ensure that the goals of the REV and CEF are being met.

Water Resources

Potential adverse impacts to water resources may occur at varying levels across many types of clean energy technologies and infrastructure, which may result from implementation of the REV and CEF. Similar to air resources, a number of federal and State regulations have been designed to protect the State's water resources. In the following sections, we discuss key federal and State regulations that may mitigate impacts to water resources from activities implemented under the REV and CEF programs.

The primary federal statute governing water quality and water resources is the CWA. Projects that discharge dredged or fill material into water bodies, including wetlands, must obtain a permit

[584] Demand response participants that rely on curtailment rather than generation, however, would not contribute to local emission levels.

[585] State of New York Public Service Commission. 2009. Case 09-E-0115 – Order Adopting in Part and Modifying in Part Con Edison's Proposed Demand Response Programs. Issued October 23, 2009; and State of New York Public Service Commission. 2014. Case 14-E-0302 – Order Establishing Brooklyn/Queens Demand Management Program. Issued December 12, 2014.

[586] For example, the State of California requires manufacturers of distributed generation technologies otherwise exempt from district permit requirements to certify that their products meet specific emissions standards before they can be sold in California. The distributed generation certification program applies to both fossil fuel technologies and non-fossil fuel technologies, such as microturbines and fuel cells. For more information, see: California Air Resources Board. 2010. "Distributed Generation Program." Accessed January 12, 2015 at: http://www.arb.ca.gov/energy/dg/dg.htm.

from the U.S. Army Corps of Engineers (USACE) under Section 404 of the CWA. Complementary to CWA Section 404 permits, projects for which construction occurs near navigable waters, or could otherwise obstruct or alter navigable waters must obtain a permit from USACE under Section 10 of the River and Harbors Act. Any new infrastructure, including infrastructure associated with development of renewable energy, that either crosses or occurs near navigable water may trigger the aforementioned federal review and permitting requirements under the CWA.[587] As part of such processes, project developers are required to propose and implement measures to avoid impacts to wetlands, streams, and other regulated water resources in accordance with the environmental criteria from CWA Section 404(b)(1). In cases where impacts are unavoidable, 33 CFR Parts 325 and 332 and 40 CFR Part 230 govern the framework under which developers may be able to compensate for (or offset) permanent impacts. EPA and USACE require compensatory mitigation to replace the loss of wetland, stream, and other aquatic resource functions from unavoidable impacts, which is usually accomplished through prior restoration or enhancement projects ("mitigation banks"), fee payments, or new restoration, establishment, enhancement, or preservation activities required in the permitting process.

Under CWA Section 401, projects applying for any federal licenses or permits must obtain New York State certification that any discharges into navigable waters will comply with New York State water quality standards. In most cases, NYSDEC reviews and issues state certifications, while the New York PSC or the NYDPS Siting Board may perform certifications for utilities projects under state Public Service Law.

Regulations at the State level provide further protection for New York's water resources. For example, clean energy projects whose activities disturb stream banks, impound water, require the construction (or reconstruction or repair) of docks or mooring, or excavate and fill navigable waters or wetlands are required to obtain permits from NYSDEC under 6 NYCRR Part 608. Activities occurring in coastal areas are overseen by New York's Coastal and Inland Waterways Program, which is responsible for implementing the Federal Coastal Zone Management Act (FCZMA) and state-level coastal regulations under 19 NYCRR Part 600. While neither program requires permits or licenses for activities occurring in coastal areas, proposed activities must be consistent with the state's coastal policies that guide the appropriate use and protection of the State's coasts and waterways. An assessment of the potential impacts of such activities is required as part of project planning. Such assessments are designed to support economic development, but in a manner that avoids or minimizes, to the extent possible, loss or degradation of the unique natural and cultural resources that exist along New York's coastline. These include marine resources and wildlife, open space, shoreline erosion, and scenic beauty through the consideration of Significant Costal Fish and Wildlife Habitats and Scenic Areas of Statewide Significance designations.

In some cases, federal and State regulations work cooperatively to protect water resources. In particular, some federal programs require permittees to maintain compliance with applicable state regulations. As noted above, projects that require a Section 404 permit from the USACE for dredge-and-fill activities are also required to first obtain a State water quality certification.

[587] CWA Section 404(f) provides exemptions for some activities associated with ongoing farming, ranching, and forestry activities that do not represent new uses of water that result in flow reduction.

Another example is a key state regulatory program: the New York State Pollutant Discharge Elimination System (SPDES). This program, established under Article 17 of the ECL, is authorized by EPA for the control of wastewater and stormwater discharges in accordance with the CWA. Broader in scope than the CWA, New York's SPDES program controls point source discharges to both surface water and groundwater, including, for example, Concentrated Animal Feeding Operations (or CAFOs). SPDES permits are required for any activity discharging wastewater into surface water or ground water.[588] For example, wastewater produced during construction dewatering or from biomass production would require a SPDES permit.

Waste Management

Electricity generation facilities, including clean energy projects, may generate hazardous waste during construction or decommissioning processes. The manufacture and use of electricity generation and storage technologies, such as fuel cells and batteries, may also involve generation and disposal of federal- and State-regulated wastes. The primary federal waste management regulation is the Resource Conservation and Recovery Act (RCRA), which regulates the transport and management of solid and hazardous wastes. EPA delegated authority to implement and enforce hazardous waste regulations under RCRA in New York. Through Part 373 permits, NYSDEC ensures that environmentally protective design and operational standards are maintained at facilities that treat, store or dispose of hazardous waste materials.[589] Anyone that transports regulated waste on the roads of New York State, if the waste originates or is disposed in the state, must have a New York State Part 364 waste transporter permit.[590]

Projects that use advanced conversion technologies to create synthetic gas (Syngas) may also fall under federal and State waste management oversight.[591] NYSDEC regulates refuse-derived fuel processing facilities under 6 NYCRR Subpart 360-3. These requirements manage the disposal of spent fuel and ash, and establish safety procedures for chemicals that facilities use and store.

Ecological Resources

The Federal Endangered Species Act and State Endangered Species Act of New York (Article 11 of the New York ECL) require the protection of federally or state-listed threatened or endangered species and their habitats. State regulations are further clarified in 6 NYCRR Part 182, requiring that activities that may result in the "incidental take" of a listed species must obtain a permit and provide NYSDEC with a mitigation plan wherein the applicant commits to undertake measures resulting in a "net conservation benefit" to any protected species that may be impacted by the proposed activity. Examples of projects to which these regulations may apply include

[588] SPDES permits are not required for a facility whose treatment system discharges less than 1,000 gallons/day and does not contain any industrial or other non-sewage waste streams. Those systems, such as a septic system, may still require local approval.

[589] NYSDEC. Hazardous Waste Management. Accessed August 28, 2014 at: http://www.dec.ny.gov/chemical/8486.html.

[590] NYSDEC. Waste Transporter FAQs. Accessed August 28, 2014 at: http://www.dec.ny.gov/chemical/8785.html.

[591] New York's RPS program permits Urban Wood and Related Waste from municipal solid waste or construction and demolition debris as an eligible feedstock under certain conditions. See: NYSERDA. 2014. RPS: Biomass Power Guide. July 22. Accessed August 28, 2014 at: http://www.nyserda.ny.gov/Energy-Innovation-and-Business-Development/Research-and-Development/Biomass-Research.aspx.

aboveground transmission or wind projects, which may cause impacts to listed birds and some bats during project construction and operations.

Public Service Law

New York Public Service Law (PSL) established the Department of Public Service and the PSC in 1907, with primary missions to ensure the safe and reliable access to utility services, including electricity, gas, steam, telecommunications, and water, while protecting the natural environment. Through the PSL, the PSC also seeks to stimulate innovation, infrastructure investment, consumer awareness, and competitive markets in utility provision, including electric utilities. Articles VII and 10 of the PSL discuss requirements for electricity transmission and generation facility siting. We discuss each article in more detail below.

Article VII requires review of siting, construction, and operation of major electricity transmission facilities.[592] Specifically, this article requires project developers to obtain a Certificate of Environmental Compatibility and Public Need from the PSC before a new facility may be constructed. Major electric transmission facilities include systems greater than 125 kV and extend a distance of one mile or longer. Applicants for such major facilities must publish notice of the proposed construction, and discuss in the application any environmental impact studies and consideration of alternate routes. Transmission lines that intersect the boundaries of a critical environmental area also require a specific environmental review.

While Article VII does not cover small electric or distribution lines, substation additions, or simple upgrades, these minor projects may require local permits as well as selected State approvals under other regulations.

PSL Article 10 establishes a regulatory framework for reviewing the siting of certain new and repowered or modified major electric generating facilities in New York State by the Board on Electric Generation Siting and the Environment (Siting Board). The PSL defines major electric generating facilities as those with a new or increased capacity of 25 MW or more. These may include some large scale renewable energy development under the REV and CEF programs. PSL Article 10 requires review of environmental and public health impacts, environmental justice issues, and public safety. Article 10 also outlines procedures for undertaking an analysis of environmental issues that may result from siting a major electric generating facility.[593]

General Environmental Review Requirements

Under the National Environmental Policy Act (NEPA), federal agencies must consider environmental impacts when making permitting decisions. When a project may have significant potential impacts, agencies must also prepare an EIS that discusses the significant environmental impacts and reasonable alternatives that would avoid or mitigate such adverse impacts. Thus, projects requiring other federal approvals may also trigger review under NEPA, such as wind energy projects involving federal agency authority over federal lands or federal waters (e.g., offshore wind facilities).

[592] Article VII also sets forth a review process for major natural gas transmission facilities; the REV and CEF proceedings are not, however, expected to affect natural fuel transmission infrastructure.

[593] WTE facilities are exempted from Article 10, with environmental review usually coordinated under SEQRA procedures. Wind-powered generation facilities are specifically covered under Article 10.

Similarly, SEQRA requires an environmental review for action that is directly undertaken, *funded,* approved or permitted by State or local government agencies. SEQRA requires the sponsoring or approving governmental authority to identify and avoid or minimize any significant or adverse environmental impacts generated by the proposed action. That agency may avail itself of mitigation measures if actions cannot otherwise be avoided or minimized, and under 6 NYCRR §617.11(d)(5), must present a findings statement certifying that all other reasonable alternatives have been considered. After completing an initial environmental assessment, the lead agency determines the significance of an action's environmental impacts and then decides whether a full EIS and/or public hearing are required.

Accordingly, any projects under the REV or CEF requiring federal, State, or local approvals, including those below the 25 MW threshold defined in Article 10, may trigger further environmental review under SEQRA or NEPA.[594] For example, in New York State, the environmental impacts of a proposed wind energy project are typically assessed in accordance with SEQRA by the authorized town board, regional planning commission, county agency, or other local authority. Even small-scale wind projects will likely involve some level of SEQRA review because these projects must be approved by town zoning or planning boards. Planning and permitting requirements vary depending on whether or not local land use or zoning rules exist for the land on which a project will be located. Some areas within New York do not currently have zoning or comprehensive plans in place. Residential rooftop projects, such as solar, generally only require county-level permits for electrical and plumbing work. Ground solar installations frequently must go through siting approvals from local government, which would trigger further environmental review.

Minor sources of pollutants that do not exceed thresholds under other statutes may be permitted under SEQRA administrative procedures that serve to coordinate impact assessments, permits and local requirements. For example, minor sources seeking permits in the jurisdiction of New York City are permitted under joint or coordinated SEQRA and City Environmental Quality Review (CEQR) requirements.

As discussed in Chapter 1 (SEQRA and Description of the Proposed Action), the Governor signed the CRRA into law on September 22, 2014. This new legal framework will require local and State funding and permitting decisions to consider risks from climate change and extreme weather impacts, such as storm surges and flooding, for proposed projects.

Environmental Justice

Environmental justice (EJ) communities, characterized by low-income and minority residents, have historically been overburdened by a high density of air pollution sources, particularly those associated with transportation and energy. To minimize disproportionate environmental impacts on EJ communities, community involvement is required as part of energy siting and permitting review processes and in the development of transportation projects. 6 NYCRR Part

[594] "Type II" actions listed in statewide and agency SEQR regulations do not require review, as they have been specifically determined not to have a significant adverse impact on the environment. As details of future activities under REV and CEF are not known at this time, it is possible that the type, small size, or location of certain renewable generation may not trigger any discretionary environmental review process (i.e., a generator proposed at a site already zoned to allow such generation).

487establishes a regulatory framework for incorporating environmental justice issues into proceedings before the Siting Board for determining whether to approve a major electric power plant pursuant to Article 10 of the Public Service Law.[595]

NYSDEC Commissioner Policy 29 on Environmental Justice and Permitting (CP-29) provides further direction to NYSDEC staff on screening projects for possible EJ issues. When NYSDEC staff receives an application under SEQRA, NYSDEC conducts a preliminary screen to identify: (1) whether the proposed action is in or near a PEJA, and (2) whether potential adverse impacts are likely. Depending on the outcome of the screening, NYSDEC may provide additional guidance to the applicant to address identified EJ concerns. Such guidance may include the development of an enhanced public participation plan, or provisions for an analysis to ensure that impacts do not disproportionately affect PEJAs.

Consultation with the local community during the project planning and siting is an essential part of any successful development project. Engaging in an open dialogue with affected communities can help developers understand and proactively address community concerns. Greater transparency and active participation of community leaders can strengthen relationships between affected communities and project developers.

Additional Regulations

The discussion above summarizes the main regulations that serve to mitigate environmental impacts from potential energy projects in New York. **Exhibit 6-3** provides a more extensive list of potentially applicable regulations, permits, and review. Site-specific characteristics and project-specific details will ultimately determine the regulations that will apply to each potential development.

[595] NYSDEC. 2014. Environmental Justice. Accessed August 20, 2014 at: http://www.dec.ny.gov/public/333.html.

EXHIBIT 6-3 POTENTIALLY APPLICABLE REGULATIONS, PERMITS, AND REVIEW PROCESSES

RESOURCE AREA	LEVEL	REGULATION, PERMIT, OR REVIEW	RELEVANT LAWS AND STATUTORY AUTHORITY	POTENTIALLY APPLICABLE TECHNOLOGIES
Air	Federal	CAA Programs for Criteria Pollutants	USC 7401-7671; PL 91-604, 41 (CAA); PL 101-549 (CAA Amendments)	CHP, Biomass, Geothermal
	Federal	NESHAP for Reciprocating Internal Combustion Engines	40 CFR Part 63 Subpart ZZZZ	CHP
	Federal	NSPS for Stationary Spark Ignition Internal Combustion Engines	40 CFR Part 60 Subpart JJJJ	CHP
	Federal	NSPS for Stationary Compression Ignition Internal Combustion Engines	40 CFR Part 60 Subpart IIII	CHP
	State	EPA Clean Power Plan *(Proposed)*	Clean Air Act (CAA) section 111(d)	CHP, Biomass, Biogas Geothermal
	State	Title V facility permit, state facility permit, general permit, or registration	6 NYCRR Part 201	CHP, Biomass, Geothermal
	State	NYSDEC landfill gas collection and control requirements	6 NYCRR Part 208	Biomass, Biogas
	State	NYSDEC Regulations for Stationary Combustion Installations	6 NYCRR Part 227	Biomass
	State	NYSDEC New Source Review for New and Modified Facilities	CAA New Source Review; 6 NYCRR Part 231	CHP, Biomass, Biogas, Geothermal
	State	New York CO2 Performance Standards for Major Electric Generating Facilities (for generation >25 MW)	6 NYCRR Part 251	CHP, Biomass, Biogas, Geothermal
	State	New York State component of the CO2 Budget Trading Program (RGGI)	6 NYCRR Part 242	CHP, Biomass, Biogas, Geothermal
Water	Federal	CWA Section 404 Permit (discharge of dredged or fill material)	CWA Section 404	Wind, Hydroelectric, Ocean Energy
	Federal	Estuary Protection Act	16 USC 1221-1226; PL 90-454	Wind, Hydroelectric, Ocean Energy
	Federal	Clean Water Act DA permits	33 CFR Part 323, CWA Section 303 (30 USC. 1344)	Wind, Hydroelectric, Ocean Energy
	Federal	Rivers and Harbors Act Section 10 permit	33 CFR Part 322, 33 USC. 403.	Wind, Hydroelectric, Ocean Energy

RESOURCE AREA	LEVEL	REGULATION, PERMIT, OR REVIEW	RELEVANT LAWS AND STATUTORY AUTHORITY	POTENTIALLY APPLICABLE TECHNOLOGIES
	Federal or State	Federal Power Act, New York Water Power Law	Federal Power Act, Title 16 Chapter 12 (and subsequent amendments) New York Water Power Law, Article 15, Title 17	Hydroelectric
	State	New York State water quality standards	6 NYCRR Parts 701-704	CHP, Wind, Hydroelectric, Biomass, Biogas, Geothermal, Ocean Energy
	State	NYSDEC State Water Quality Certification	CWA Section 401 (PL-95-217)	Wind, Hydroelectric, Ocean Energy
	State	SPDES General Permit	6 NYCRR Part 608, CWA Section 402 (PL-95-217)	CHP, Hydroelectric, Biomass, Biogas, Geothermal
	State	NYSDEC water withdrawal permit	6 NYCRR Part 601	CHP, Hydroelectric, Biomass, Geothermal
	State	NY Coastal and Inland Waterways Program Consistency Review	Federal Coastal Zone Management Act, 19 NYCRR Part 600 (New York Waterfront Revitalization and Coastal Resources Act)	Wind, Hydroelectric, Ocean Energy
	State	NYOGS Review (Grants of Underwater Land)	9 NYCRR Subdivision G, Parts 270 and 271	Wind, Hydroelectric, Ocean Energy
	State	NYDOS Coastal Assessment Form	16 USC 1456; NY	Wind, Hydroelectric, Ocean Energy
	State	NYSDEC Freshwater Wetlands Act permits	6 NYCRR Part 663, ECL Sections 3 -0301and 24-0301)	Wind, Hydroelectric, Ocean Energy
	State	NYSDEC Coastal Erosion Management permits	6 NYCRR Part 505, ECL 3-0301, 34-0108	Wind, Hydroelectric, Ocean Energy
	State	NYSDEC Protection of Waters Permit	ECL Article 15, Title 5	Wind, Hydroelectric, Ocean Energy
	State	NYSDEC Wild, Scenic, and Recreational Rivers Permit	6 NYCRR, Part 666, ECL Article 15, Title 27	Hydroelectric
Land	Federal	Federal Land Management and Policy Act	PL 94-579	*Siting specific*
	Federal	Resource Conservation and Recovery Act	42 USC Section 6901	CHP, Solar, Fuel cell, Biomass, Biogas, Geothermal
	Federal	Endangered Species Act of 1973	PL 93-205	Wind, Hydroelectric, Ocean Energy
	Federal	Fish and Wildlife Coordination Act of 1958	PL 95-624	Wind, Hydroelectric, Ocean Energy

RESOURCE AREA	LEVEL	REGULATION, PERMIT, OR REVIEW	RELEVANT LAWS AND STATUTORY AUTHORITY	POTENTIALLY APPLICABLE TECHNOLOGIES
	Federal	Fish and Wildlife Act of 1956	16 USC 742a-742j	Wind, Hydroelectric, Ocean Energy
	Federal	Migratory Bird Treaty Act of 1918	16 USC 703-712	Wind
	Federal	Bald and Golden Eagle Protection Act	50 CFR Part 22	Wind
	Federal	Magnuson-Stevens Fishery Conservation and Management Act	16 USC Sections 1801-1884	Wind, Hydroelectric, Ocean Energy
	Federal	Marine Mammal Protection Act of 1972	PL 92-522	Wind, Hydroelectric, Ocean Energy
	Federal	Wilderness Act	PL 88-577	*Siting specific*
	State	Mined Land Reclamation Permit	ECL Article 23, Title 27	Hydroelectric, Geothermal
	State	NYSDEC Regulations for Solid Waste Incinerators or Refuse-Derived Fuel Processing Facilities Or Solid Waste Pyrolysis Units	ECL (multiple sections) 6 NYCRR, Part 360-3	Biomass,
	State	NYSDEC Regulations for Hazardous Waste Treatment, Storage and Disposal Facilities	ECL, Section 27-09000 6 NYCRR, Part 373	CHP, Solar, Fuel cell, Biomass, Biogas, Geothermal
	State	NYSDEC State Endangered Species Act, Incidental Take Permit	ECL, Section 11-0535, 6 NYCRR, Part 182	Wind, Hydroelectric, Ocean Energy
People	Federal	FAA determination (navigable airspace)	33 CFR Parts 62, 64	Wind
	Federal	USCG consultation (private aids to navigation)	33 CFR Part 66	Wind, Hydroelectric, Ocean Energy
	Federal	Abandoned Shipwreck Act of 1987	PL 100-298	Wind, Hydroelectric, Ocean Energy
	Federal	Flood Insurance Act	42 USC Sections 4001-4127	*Siting specific*
	State	NYDOS Scenic Areas and Statewide Significance Review	19 NYCRR Part 602.5	*Siting specific*
	State	NYS Parks, Recreation, and Historic Preservation Law	ECL Section 45.0101	*Siting specific*
	State	NYSDOT special use permit (oversized vehicles on state highways)	NYS Vehicle and Traffic Law Title 3 Article 10 Title 5 Article 21-C Section 52	*Multiple, during project construction*
	State	NYSDAM notification (state certified agricultural zones)	NY Agriculture and Markets Law, Article 25AA	*Siting specific*
	State	New York State Office of Parks, Recreation and Historic Preservation. NYSOPRHP	PL 89-665 (National Historic Preservation Act)	*Siting specific*

RESOURCE AREA	LEVEL	REGULATION, PERMIT, OR REVIEW	RELEVANT LAWS AND STATUTORY AUTHORITY	POTENTIALLY APPLICABLE TECHNOLOGIES
	Local	Local Noise and Nuisance Ordinances	Various	*Multiple, during project construction and operation*
General Environmental Assessment	Federal	NEPA Environmental Review	PL 91-190	Wind, Hydroelectric, Ocean Energy
	State	SEQRA Environmental Review	6 NYCRR Part 617	CHP, Solar, Fuel cell, Wind, Hydroelectric, Biomass, Biogas, Geothermal, Ocean Energy
	State	Public Service Law Article VII (major transmission lines >125 KV)	NYS PSL Article VII	*Multiple*
	State	Public Service Law Article 10 (major electric generating facilities >25 MW)	NYS PSL Article 10, Section 68	*Multiple*
	Regional and Local	Regional and Local Zoning, Permitting, and Review Requirements	Various	*Multiple*

6.2 SITE-SPECIFIC MITIGATION AND BEST MANAGEMENT PRACTICES

The REV and CEF may result in actions that fall outside the scope of existing federal, State and local regulatory review, permitting and licensing programs. In such cases, proper project planning design and siting, and application of best management practices during all project phases will serve to mitigate environmental impacts not addressed by existing regulatory programs. This section discusses general best practices with regards to project siting, design, and operation.

Appropriate project planning and siting have the ability to avoid or minimize many environmental impacts. For example, proper siting considerations should avoid placing structures in sensitive resources such as mature forests, wetlands and other important wildlife or critical environmental areas. Early consultation with the appropriate resource protection agency should take place to develop plans to protect resources such as soils, streams and wetlands, agricultural lands, and cultural, archeological or scenic resources. In instances where siting of distributed energy resources may require facilities near population centers and residential development, adhering to appropriate setbacks from houses, property lines, roads, and other structures will help to avoid or minimize operational noise and visual concerns. Projects and associated transmission and distribution infrastructure can also reduce visual impacts by using existing transmission corridors, minimizing clearing, incorporating vegetative screening, and using low profile structures. Additionally, projects can use appropriately colored transmission towers, non-reflective finishes, vegetative screens, and context-sensitive architectural treatments to address site-specific impacts. Pre- and post-construction studies can be used to monitor for potential operational impacts on wildlife, ecological resources, and communities.

During the design phase, project planners should consider a project's compatibility with local land use and zoning ordinances, comprehensive plans, and the character of the host community. Project planners should also consider incorporating inherent project elements that can reduce environmental impact during operation.

Project planning and design can also consider upstream and downstream impacts. Biomass and biogas projects, for example, may use agricultural or forest products as source fuel. Engagement with facility owners and suppliers can be used to implement agricultural and forestry practices to provide for a sustainable yield while reducing the ecological and land use impacts. For example, the current RPS rules require that biomass facility owners/operators must have and be in compliance with an approved forest management plan (FMP), prepared by a qualified forester, to make use of biomass feedstock that fits under the definitions of "Harvested Wood" and/or "Silvicultural Waste Wood." The FMP is required to address the overall management goals and performance standards that need to be used during the procurement of the biomass resource for the biomass energy facility. The FMP is required to include: standards and guidelines for sustainable forest management and requires the adherence to management practices that conserve biological diversity, productive forest capacity, and promote forest ecosystem health.[596]

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[596] NYSERDA. 2014. RPS: Biomass Power Guide. July 22. Accessed August 28, 2014 at: http://www.nyserda.ny.gov/Energy-Innovation-and-Business-Development/Research-and-Development/Biomass-Research.aspx.

Projects should also employ Best Management Practices (or BMPs) throughout project construction and operation. In addition to consultation with relevant resource agencies, project planners should engage with local communities to develop BMPs that are appropriate and compatible with the local land use context. During construction, projects should limit construction activity at specific times (e.g., rush hour, daytime hours) or specific seasons/months to reduce impacts on vegetation, sensitive habitats, and/or seasonal recreational activities. Reducing slopes near wetland areas will minimize grading effects and protect aquatic habitat. Utilizing existing access roads when possible and locating new roads along field edges can help to avoid impacts on agricultural and natural resources. Post-construction re-vegetation of disturbed areas with native species can speed recovery and reduce the potential for long-term impacts on plants and animals. Other practices can minimize impacts from dust associated with construction activities, including: using a truck wash station at the project fence line; periodic spraying of haul roads with water; or street cleaning to control dirt and dust on public roadways, depending on local site conditions. Following EPA's Clean Air Non-road Diesel Emissions Rule will reduce the sulfur content of diesel fuel used during construction activities. To reduce light pollution at night, projects can minimize illumination during facility operations. Designating an environmental monitor during construction can further help ensure compliance with all permit requirements and environmental protection commitments.

CHAPTER 7 | UNAVOIDABLE ADVERSE IMPACTS

Chapter 5 discusses the potential generic impacts that may result from implementation of the REV and CEF proceedings. The purpose of the GEIS is not to evaluate specific energy projects and their site-specific impacts. As previously discussed, significant environmental impacts could result from individual but as yet unidentified projects implemented in the future pursuant to the REV and CEF. 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 (i.e., where New York's energy industry continues to develop along its existing market and regulatory pathways and the REV and CEF are not implemented to increase penetration of DER, EE and DM to address peak load demand) are discussed in Chapters 1 and 4.

CHAPTER 8 | IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Approval of the REV and CEF proceedings by the PSC would not, in itself, result in irreversible or irretrievable commitment of resources because no particular clean energy project, project site, or regulatory modification will be approved or endorsed by approval of the action. Potential commitment of resources related to different clean energy mechanism is discussed in Chapters 4 and 5. However, actual impacts and resource commitments are currently and will remain unknown until specific projects are proposed.

CHAPTER 9 | GROWTH-INDUCING ASPECTS AND SOCIOECONOMIC IMPACTS

This chapter discusses the potential growth-inducing aspects and socioeconomic impacts of the proposed REV and CEF proceedings. Specifically, the chapter proceeds through the following sections:

- Section 9.1: Analytic Framework;
- Section 9.2: Potential Benefits Categories;
- Section 9.3: Potential Cost Categories;
- Section 9.4: Impacts on Growth and Community Character; and
- Section 9.5: Environmental Justice Impacts.

9.1 ANALYTIC FRAMEWORK

This chapter provides qualitative information on the types of changes expected to occur from implementation of the REV and CEF proceedings and the potential resulting growth-inducing aspects and socioeconomic impacts. As previously discussed, the mechanisms by which the REV and CEF will achieve their goals are still under development, and the exact mix of clean energy resources and technologies that will be implemented under the REV and CEF programs has some uncertainty, although the general direction is known. As such, this review is being conducted generically based on what is reasonably foreseeable.

Project-specific impacts analysis will be required only when specific actions are proposed that trigger applicable federal, state, or local approval processes and that exceed thresholds that trigger site-specific environmental impact reviews. REV and CEF programs that may result from these proceedings are currently in the planning stages and no specific projects resulting from the REV and CEF programs have yet been proposed. This chapter, therefore, does not attempt to predict or speculate on the possible impacts of project-specific actions but focuses instead on qualitative descriptions of overall potential growth-inducing aspects and socioeconomic impacts.

9.2 POTENTIAL BENEFITS CATEGORIES

As discussed in Chapter 1, the purpose of the REV and CEF initiatives is to modernize New York State's energy industry by shifting the State away from a system characterized by large, discrete supply resources with limited flexibility and resilience to threats to a market that values a more diverse and resilient electric system. The REV and CEF proceedings collectively seek to achieve the following outcomes:

- Greater penetration of DG, EE, DR, and distributed storage measures to address base and peak load demand on New York's electric system;

- Modifications in regulatory provisions and practices that align with and promote the goals and objectives of the REV and CEF proceedings; and
- A more sustainable, market-based clean energy program, as opposed to the current ratepayer surcharge-funded program portfolio.

Benefits from the REV Program

Successful implementation of the REV program will generate a wide array of public benefits. **Exhibit 9-1** provides examples of the anticipated types of benefits. For each benefit category, **Exhibit 9-1** also identifies the perspective by which the benefits should be considered, either directly or indirectly.

EXHIBIT 9-1 SUMMARY OF POTENTIAL BENEFIT CATEGORIES TO BE CONSIDERED IN THE REV PROGRAM

	PERSPECTIVE		
BENEFIT CATEGORY	RATE IMPACT MEASURES (RATES)	UTILITY COST (BILL)	SOCIETAL
Bulk System			
Avoided Generation Capacity (Installed Capacity Market (ICAP)) Costs, including Installed Reserves and Losses	✓	✓	✓
Avoided Energy (Location-based marginal price (LBMP)) Costs, including Losses	✓	✓	✓
Avoided Ancillary Services (e.g. operating reserves, regulation, etc.)	✓	✓	✓
Wholesale Market Price Impacts	✓	✓	
Distribution System			
Avoided T&D Capacity Costs	✓	✓	✓
Avoided O&M Costs	✓	✓	✓
Avoided Distribution Losses	✓	✓	✓
Reliability/Resiliency			
Avoided Restoration Costs	✓	✓	✓
Avoided Outage Costs*			✓
External (net)*			
Avoided GHG*			✓
Avoided Criteria Air Pollutants*			✓
Water*			✓
Land*			✓
Non-Energy Benefits (e.g. health impacts, employee productivity, property values)			✓

*Note: only the portion not already included above, net of any added external costs.
Source: DPS. Case 14-M-0101. Proceeding on the Motion of the Commission in Regard to Reforming the Energy Vision. Developing the REV Market in New York: DPS Staff Straw Proposal on Track One Issues. Filed August 22, 2014. Page 46.

Other potential benefits include increased customer choice and opportunity; fuel diversity, reduced fossil fuel dependence, and reduced price volatility; increased value of energy efficiency investments resulting from targeting programs to system needs; reduced average customer bills versus a "business as usual" alternative; and securing the long-term viability of universal affordable service.

Although it is premature to develop precise figures at this time, illustrative examples of potential savings and avoidable costs indicate the scope of the value of potential benefits. Illustrative examples include:[597, 598]

- Increasing system efficiency such that if the 100 hours of greatest peak demand were flattened, long-term avoided capacity and energy savings would range between $1 billion and $2 billion per year. [599]
- Merely increasing the system load factor from 55% to 56% would produce potential gross benefits of $220 million to $330 million per year.
- Increasing fuel diversity will make customers less vulnerable to price spikes; the estimated total cost to New York customers from the gas-driven price spikes of the winter of 2013-2014 was over $1.0 billion.
- Carbon emissions reductions if valued at $50 per ton, for example, would provide an annual carbon value of New York's Renewable Portfolio Standard that would exceed $127 million.

Benefits from the CEF Program

Successful implementation of the CEF program could generate a wide array of public benefits. **Exhibit 9-2** provides examples of the anticipated types of benefits. [600]

Also, one of the anticipated benefits of the NYGB is its ability to drive value for ratepayers by continuously leveraging multiples of private capital while preserving its capital base for redeployment as investments mature. According to NYSERDA, NYGB investments will generate public benefits, such as a cleaner environment, a more resilient energy system, economic benefits (e.g. creation of well-paying jobs), and lowered costs of energy.

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[597] DPS. Case 14-M-0101. Proceeding on the Motion of the Commission in Regard to Reforming the Energy Vision. Developing the REV Market in New York: DPS Staff Straw Proposal on Track One Issues. Filed August 22, 2014.

[598] These numbers slightly revised from the DPS Staff Straw Proposal to reflect the most recent results of Staff's studies.

[599] We note that while the calculation of long-term avoided capacity and energy savings are based on data from an unusually warm summer in 2013 and may be overstated, these savings are still indicative of potential benefits of reducing peak demand.

[600] Note that the benefits cited in Exhibit 9-2 may not align specifically with the emissions reductions forecast in Chapter 4. This is due to the fact that the alternatives discussed in Chapter 4 are focused solely on a reduction in peak demand, whereas Exhibit 9-2 presents lifetime benefits of the Market Development and NY-Sun programs under the CEF.

EXHIBIT 9-2 EXAMPLES OF POTENTIAL BENEFITS RESULTING FROM THE CEF PROGRAM 2016-2025

LIFETIME BENEFITS					
	ELECTRIC SAVINGS (MILLION MWH)	RENEWABLE ENERGY PRODUCTION (MILLION MWH)	OIL/GAS SAVINGS (MILLION MMBTU)	EMISSIONS REDUCED (MILLION TONS CO2)	ELECTRIC BILL SAVINGS (MILLION $)
Market Development	180	15-20	620	45	$3,400
NY-Sun		35-40		10	$600
Total	180	55	620	55	$4,000
Source: NYSERDA. 2014. Clean Energy Fund Proposal. September 23.					

Reduced Transmission and Distribution Losses

The implementation of REV and CEF could reduce T&D line losses. Approximately five to eight percent of the energy produced by power plants is lost before it reaches the customer.[601] Increased penetration of DG is expected to result in generation sited at or near the load. When compared to typical line losses experienced within centralized generation systems, improved proximity translates to reduced line losses. The extent to which losses are reduced depends on the relative location of the central generating stations to the load and on the equipment operating between these two points. For example, CHP technologies can reduce T&D losses because electricity is generated onsite. [602]

Optimized Electricity Network

Under the REV and CEF programs, increasing the appropriate amounts and types of EE, DG, DR, and storage, combined with a Distributed System Platform, and the increased recognition of these in operation and planning, will allow for better attempted optimization of generation systems and the T&D network. For example, adding suitably-located small generators at optimal locations could benefit the T&D delivery system. Increased use of energy storage can lead to increases in grid efficiency and lower T&D losses. In addition, smart grid and distributed storage could help users to realize the benefits of DER by enabling more complex transactions, such as electricity being sold back to the grid, and addressing variability in generation through better storage. Finally, DER measures could also help to reduce the use of New York's most expensive generation options.

[601] DOE. 2007. The Potential Benefits of Distributed Generation and Rate-Related Issues That May Impede Its Expansion. June. Note that this information was derived from Table 7.2, Table 1.1, and Table 6.3 from the Energy Information Administration website data for net generation, net imports, and direct customer use of electricity from 1993 to 2004, which is available at: http://www.eia.doe.gov/cneaf/electricity/epa/epa_sum.html.

[602] US EPA Environmental Technology Verification (ETV) Program Case Studies: Demonstrating Program Outcomes Volume II. September 2006. Accessed December 30, 2014 at: http://nepis.epa.gov/Adobe/PDF/600003MA.pdf

Reduced or Avoided T&D Infrastructure

Actions taken as a result of REV and CEF may allow utilities to defer or avoid adding grid capacity. The value of this benefit will depend on where DER resources are installed; the further downstream, the more capacity that is freed up for other uses. Recent analysis has been conducted on avoided T&D costs for networks in New York City. These studies focused on examining the cost effectiveness of EE and DR programs in Con Edison's many networks. [603] REV intends to use similarly granular estimates of avoided cost to value resources such as EE, DG, CHP, DR and storage in each utility service territory, to the extent a given utility's system complexities warrant. This will result in fuller and more precise estimates of the avoided cost benefits provided by such resources, reflecting the time and location of the specific resources in question. Due to the uncertainty underlying the specific type and location of DER installed under the REV/CEF, information is not available to understand the extent to which investment required to connect new DER resources to the grid may offset T&D infrastructure avoided by decentralizing New York State's electricity system.

Reduced Ancillary Service Costs

The REV and CEF programs could result in reduced ancillary service costs. Ancillary services are those functions "necessary to support the transmission of electric power from seller to purchaser given the obligations of control areas and transmitting utilities within those control areas to maintain reliable operations of the interconnected transmission system."[604] In the past, ancillary service prices have tended to be volatile, due to a shortage of market participants during periods of crisis.[605] One objective of the CEF is to foster "a more dynamic 'supply side' of clean energy service providers, including energy service companies, financing institutions, product suppliers, and contractors/installers who develop new models for providing energy services and solutions to customers."[606]

Currently, only larger-scale generators are allowed to participate in the ancillary services market. Removing barriers and allowing distributed energy resources to participate in the ancillary services market will improve market liquidity and overall system reliability, ultimately lowering ancillary service costs. Installation of microgrids, for example, could offer ancillary services including voltage support, frequency regulation, and black start capability.[607] As more

[603] Freeman, Sullivan & Co. 2013. Cost Effectiveness of CECONY Demand Response Programs. Prepared for Consolidated Edison Company of New York. November.

[604] FERC. 1995. Promoting Wholesale Competition Through Open Access Non-discriminatory Transmission Services by Public Utilities, Docket RM95-8-000, Washington, DC, March 29.

[605] Lovins, A., K. Datta, T. Feiler, A. Lehmann, K. Rabago, J. Swisher, and K. Wicker, 2002. Small is Profitable: The Hidden Economic Benefits of Making Electrical Resources the Right Size. Rocky Mountain Institute, Snowmass, Colorado. Accessed on September 4, 2014 at: http://www.rmi.org/Knowledge-Center/Library/U02-09_SmallIsProfitableBook.

[606] NYSERDA. 2014. Case 14-M-0094 – Proceeding on the Motion of the Commission to Consider a Clean Energy Fund. Clean Energy Fund Proposal. Issued September 23, 2014.

[607] NYSPSC. 2014. Case 14-M-0101 Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision. Ruling Modifying Process for Filing Comments on Track One Staff Straw Proposal. Issued August 25, 2014. Accessed September 1, 2014 at: http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={1CD5DE12-F84B-4E0E-B63A-994A204B4B5E}.

participants are able to enter the market and provide ancillary services, cost for these services will likely drop, benefitting customers.

Reduced Congestion Costs

Congestion occurs when transmission facilities are not adequate to deliver available, least-cost energy to all loads during a certain period. Transmission congestion can be caused by several constraints including thermal, voltage, or stability limits of particular transmission lines. Inefficiencies develop when power cannot move freely from one location to another across the grid. In such cases, the physical and technological limitations inherent in the grid drive how load is met. Transmission congestion leads to higher costs incurred by customers on the downstream side of the transmission constraint.

DER projects proposed under the REV and CEF programs have the potential to reduce congestion. Locating DER projects near congested areas can alleviate the T&D constraints causing congestion. This is especially true for distribution equipment-related congestion because such congestion may occur in very limited areas. In addition, as discussed in the "Increased Customer Choice" section below, if rate-setting and consumer education initiatives under REV and CEF lead to a greater adoption of TOU rates, this could also further reduce congestion.

Increased Reliability and Power Quality

The CEF will work synergistically with the REV proceeding and other State resiliency efforts to promote clean, distributed energy resources that strengthen the grid and create a more reliable supply of electricity, benefitting consumers, utilities, and society as a whole.[608] The potential benefits of the REV and CEF include improved service to consumers from more reliable transmission, distribution, and generation, fewer power interruption events and faster facility repairs following extreme weather events.

Increased reliability will also enhance the State's ability to adapt to the potential adverse impacts of climate change. As discussed in Chapter 3, various studies discuss the potential for climate change to result in sea level rise, storm surge, inland flooding, extreme precipitation, and extreme heat, all factors that could challenge New York's existing electricity system. Relative to the period from 1971 to 2000, annual air temperatures could increase by as much as two to three degrees Fahrenheit by the 2020s; in contrast mean annual air temperature increased 4.4 degrees between 1900 to 2011.[609] Significant increases in average air and water temperatures will in turn lead to more frequent and more intense heat waves.[610] By the year 2100, sea levels along the New York State coast and the Hudson River estuary are projected to rise between 12 and 55 inches. Increased use of renewable energy and reduced greenhouse gas emissions under the REV and CEF also has the added benefit of slowing or reducing the effects of climate change. A report

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[608] NYSERDA. 2014. Clean Energy Fund Proposal. September 23.

[609] New York City Panel on Climate Change. Climate Risk Information 2013. Observations, Climate Change Projections, and Maps. June 2013.

[610] New York State Climate Action Council. Climate Action Plan Interim Report. November 2010. Accessed on January 2, 2015 at: http://www.dec.ny.gov/energy/80930.html.

by the U.S. Global Change Research Program suggest that significant reductions in global emissions can lead to reductions in currently projected warming trends in the Northeast.[611]

The transmission system in New York is reliable and designed with redundancies and safety factors to generally avoid creating customer outages.[612] The structure envisioned under REV would not eliminate the need for integrated reliability planning or the existing need for new reliability and resilience approaches in response to the increased likelihood of severe storms and heat waves associated with climate change.[613]

Increased Customer Choice[614]

One objective of REV is to create customer choices, and facilitate multiple, competing, enhanced energy product and service offerings that improve people's lives. New customer engagement opportunities are arising all the time – often in forms not previously thought of as directly related to energy. Energy management is already bundled with fee-based services such as security, entertainment, internet, telecommunications, and others. Demand management can expand customer choices by providing options for managing their electricity costs. Providing customers with the option of TOU rates can result in consumer savings benefits, as customers gain knowledge of their rates, existing usage patterns, and the availability of interval meters or alternatives. Various studies provide evidence of customer acceptance of utility initiatives such as variable and TOU rates. [615]

Major market participants have recently introduced versions of a home energy management system and/or smart thermostat and are vying to gain traction in the increasingly competitive field of home connectivity. Energy savings, while often an ancillary benefit of these products, are achievable through application of this technology. Market interventions through REV and CEF that take advantage of innovations in this sector could address the market gaps to increased adoption of these technologies. [616]

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[611] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program, 841 pp. doi:10.7930/J0Z31WJ2.

[612] New York's distribution infrastructure is somewhat more unreliable than its transmission system. See, DPS. Final Generic Environmental Impact Statement in Case 03-E-0188 Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio Standard. Issued August 26, 2004. Accessed September 18, 2014 at: http://www.dps.ny.gov/NY_RPS_FEIS_8-26-04.pdf.

[613] DPS. Case 14-M-0101. Proceeding on the Motion of the Commission in Regard to Reforming the Energy Vision. Developing the REV Market in New York: DPS Staff Straw Proposal on Track One Issues. Filed August 22, 2014.

[614] *Ibid*.

[615] Faruqui, Ahmad and Sergici, Sanem. Household Response to Dynamic Pricing of Electricity – A Survey of the Experimental Evidence. January 10, 2009. See also: DOE. 2012. Demand Reductions from the Application of Advance Metering Infrastructure, Pricing Programs, and Customer-Based Systems – Initial Results. Smart Grid Investment Program. December 2012; and, Sacramento Municipal Utility District (SMUD). 2013. SMUD SmartPricing Options Interim Evaluation. October 23, 2013. Accessed January 2, 2015 at: https://www.smartgrid.gov/sites/default/files/MASTER_SMUD%20CBS%20Interim%20Evaluation_Final_SUBMITTED%20TO%20TAG%2020131023.pdf.

[616] NYSERDA. 2014. Clean Energy Fund Proposal. September 23.

Another program that could provide increased customer choice is Community Choice Aggregation (CCA). CCA programs offer the opportunity to vastly expand the number of customers receiving energy supply from energy service companies while also providing those customers with more stable fixed rates and the potential for development of community-owned distributed energy resources. REV aims to facilitate adoption of a regulatory framework that removes market barriers for such competitive opportunities, while providing sufficient oversight and consumer protections to allow for consumers to engage the energy markets in a robust and effective manner.

Improved Security and Safety

It is expected that the REV and CEF will lead to the addition of new renewable electricity supplies, energy storage facilities and energy efficiency investment. These additions could, in turn, result in the displacement of existing generation supplies, including those fueled by oil and natural gas. Such changes would increase the diversity of New York's energy portfolio, thereby reducing the State’s exposure to the security challenges and supply interruptions typically associated with increased dependence on fossil fuels.

Regional Economic Benefits

Energy infrastructure investments and policy changes related to the REV and CEF may create regional benefits in New York State through economic development. Although the REV and CEF policies do not endorse or approve any specific clean energy projects, they do provide a framework for developing incentives for, and recognizing the benefits of, clean resources.

As discussed in Chapter 4, in order to meet the objectives of the REV and CEF, various mechanisms, improvements, and resources will be implemented including: energy efficiency, main-tier renewable energy development, CHP, DR, DG (including customer-sited renewable resources), vehicle-to-grid, other storage, and rate structure changes. The potential for each type of clean energy resource or technology to generate regional economic benefits varies.

The net impact on regional development will depend upon many dynamic, unknown factors as technology continues to change and the economy grows and shifts. However, REV’s emphasis on better recognizing the full value of distributed and clean resources will lead to policy, utility, consumer, and business decisions that better reflect the public interest. This improved recognition of the values of alternative resources in meeting consumer needs will likely lead to incremental growth in those enterprises that reflect those values and decremental growth in enterprises that do not reflect, or negatively impact, those values. Further, the incorporation of technologies to better address behind-the-meter resources and consumer demand, and the elimination of barriers to the efficient adoption of potentially innovative products and/or services, can lead to new and unpredictable product and service markets that satisfy future consumer demands that, today, are untapped. The resulting employment and tax impacts (real property, sales and income tax impacts) of such dynamic changes are too speculative to predict. However, societal benefits are likely to result from aligning resource valuation with the public interest, and removing barriers to potential innovation.

DPS Staff proposed that the REV proceeding should include a public process to develop the appropriate benefit-cost framework, which would be subject to approval by the New York Public Service Commission. This would be followed by public filings, by each utility, of implementation plans and companion rate cases. The ultimate impact of REV on consumers and businesses in the NY economy, as always, would derive from the rates and tariff rules that are established in each rate case.

9.3 POTENTIAL COST CATEGORIES

This section discusses costs that may occur as a result of the REV and CEF programs. As discussed in Chapter 4, various resources are expected to contribute towards meeting the REV and CEF initiatives' goals. Specifically, this GEIS considers an upper and lower bound of alternatives for potential peak reduction. While Chapter 4 presents cost estimates associated with "targeted" levels of peak reduction, these reductions and the total costs associated with these scenarios are uncertain because specific actions have not yet been proposed.

Costs of the REV Program

Costs to achieve the benefits described above are established in part by existing programs for energy efficiency, demand response, renewable resources and distributed generation. These costs will be affected as REV is implemented, by the monetization and consideration of value streams, streamlining of delivery systems, reduction of barriers to customer participation, and economies of scale. In addition to the cost-to-achieve of specific measures, implementation of REV will involve investments to create DSP functionalities. As discussed in the REV Straw Proposal, DSP technical functionalities are reasonably achievable with existing technology. **Exhibit 9-3** provides examples of the anticipated types of costs on a generic basis. For each cost category, **Exhibit 9-3** also identifies the perspective by which the costs should be considered, either directly or indirectly.

EXHIBIT 9-3 GENERIC POTENTIAL COST CATEGORIES - REV PROGRAM

COSTS	PERSPECTIVE		
	RATE IMPACT MEASURE (RATES)	UTILITY COST (BILL)	SOCIETAL
Program administrative costs (including M&V)	✓	✓	✓
Added Ancillary Service Costs	✓	✓	✓
Incremental T/D/DSP Costs (Including Incremental Metering and Communication)	✓	✓	✓
Participant DER Cost			✓
"Lost" Utility Revenues	✓		
Incentives	✓	✓	
Non-Energy Costs (e.g. indoor emissions, noise disturbance)			✓

Source: DPS. Case 14-M-0101. Proceeding on the Motion of the Commission in Regard to Reforming the Energy Vision. Developing the REV Market in New York: DPS Staff Straw Proposal on Track One Issues. Filed August 22, 2014. Page 46.

In the REV proceeding, DPS Staff has recommended the development of a framework for the REV analysis of benefits and costs to be used as a guide by DSPs in assessing the costs and benefits of their implementation actions.[617] DPS Staff has recommended the following principles for a cost-benefit framework that:

- Is transparent about assumptions, perspectives considered, sources, and methodologies;
- Assesses portfolios, rather than individual measures or investments;
- Includes all identified costs and benefits borne by all parties while also listing and explaining why any costs or benefits were not included;
- Considers the potential for and ways to minimize unnecessary combinations or conflation of different costs and benefits;
- Applies full-life (or whole-life) investment analysis;
- Conducts analyses to test the sensitivity of key assumptions;
- Compares costs and benefits to an appropriate business-as-usual case (e.g., baseline) in which current programs are maintained and the electricity system develops in reasonably anticipated ways; and
- Provides qualitative assessments of non-quantified benefits.

The proposal recommends categories of costs and benefits that should be considered and recommends a process to develop the guidance about how to assess economic impacts.

It is expected that a sound benefit-cost analysis (BCA) framework will be required to support policy, investment, and pricing choices as the implementation of REV moves forward, including in rate cases. It is further expected that the costs to be incurred by individual utilities will be proposed in implementation plans and weighed against estimated benefits.

Costs of the CEF Program

In the CEF proceeding, NYSERDA has proposed a 10-year CEF budget, broken into two five-year cycles. The proposed budget reflects continued investment in clean energy programs, a cap on total ratepayer contributions for those programs, a restructuring of those programs to make them more customer-centric, strategic and impactful, and a transition from almost entirely ratepayer funded programs to more market- and tariff-based activities. With the exception of RPS contracts that will extend until their respective expirations, the proposed budget eliminates the existing cash balance of accumulated ratepayer funds in three years. NYSERDA has also identified the need to reallocate funds between certain existing EEPS programs and from uncommitted SBC funds to ensure that the transition to the CEF will preserve services to consumers in certain sectors, as well as avoid program interruptions and market dislocations.

According to NYSERDA, its proposed CEF collection cap reduces ratepayer collections substantially. This collections level will provide an immediate reduction in ratepayer collections of $225 million to $700 million, sustained over three years and then dropping to $650 million in 2019. By 2020, total annual ratepayer collections would be reduced by 32 percent from current levels, to approximately $625 million; by 2021 and continuing through 2025, overall collections are proposed at a level of $400 million, or a reduction of 57 percent from current levels. To fully

[617] DPS. Case 14-M-0101. Proceeding on the Motion of the Commission in Regard to Reforming the Energy Vision. Developing the REV Market in New York: DPS Staff Straw Proposal on Track One Issues. Filed August 22, 2014.

realize the program impacts and expenditure schedule for authorized programs through 2025, collections in the amount of $400 million in 2026 and $174 million in 2027 are also necessary.

Currently, NYSERDA's Administration and Program Evaluation budgets are capped at eight percent and five percent respectively of total authorized funds for most programs. NYSERDA anticipates some economies can be achieved as the programs change to more market-based approaches, and requests that in a subsequent "Program Investment Plan" filing with the Commission, it will identify and allocate administrative costs necessary to achieve the desired initiative outcomes, within the total budget levels requested. NYSERDA also requests authorization to use a portion of the CEF funding to fund a proportionate share of the annual New York State Cost Recovery Fee (CRF) assessed to NYSERDA under Section 2975 of the Public Authorities Law.

Exhibit 9-4 provides NYSERDA's anticipated CEF expenditures for 2016-2025.

EXHIBIT 9-4 SUMMARY OF NYSERDA'S ANTICIPATED CEF EXPENDITURES FOR 2016-2025 (MILLION$)

(MILLION$)	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	TOTAL
Previously approved program expenditures											
Subtotal Projected program expenditures for already launched initiatives	**$574**	**$448**	**$168**	**$111**	**$91**	**$79**	**$66**	**$47**	**$34**	**$28**	**$1,646**
Projected program expenditures for already launched initiatives											
NY-Sun	$121	$149	$149	$150	$139	$99	$61	$33	$-	$-	$901
NYGB	$195	$195	$195	$-	$-	$-	$-	$-	$-	$-	$586
Subtotal	**$316**	**$344**	**$344**	**$150**	**$139**	**$99**	**$61**	**$33**	**$-**	**$-**	**$1,487**
Projected Program expenditures for new NYSERDA Programs											
Market Development	$43	$181	$234	$265	$265	$264	$250	$245	$240	$240	$2,225
Innovation Programs	$-	$14	$41	$68	$68	$68	$68	$68	$68	$68	$530
Subtotal	**$43**	**$194**	**$274**	**$333**	**$333**	**$332**	**$317**	**$312**	**$308**	**$308**	**$2,755**
Total Anticipated Program Expenditures	**$934**	**$986**	**$787**	**$594**	**$563**	**$510**	**$444**	**$392**	**$342**	**$336**	**$5,888**

Source: NYSERDA. 2014. Case 14-M-0094 – Proceeding on the Motion of the Commission to Consider a Clean Energy Fund. Clean Energy Fund Proposal. Issued September 23, 2014.

9.4 IMPACTS ON GROWTH AND COMMUNITY CHARACTER

REV and CEF policies and investments may affect growth and community character in a number of ways. Subsections of this GEIS detail potential impacts to many of the individual attributes that collectively define community character: land use, aesthetic resources, historic resources, open space, and socioeconomics. Further, investments made due to the REV and CEF may affect growth opportunities for residents and businesses in New York State. These opportunities stem from primarily from two sources: changes in local economies and changes in the visual and physical condition of local communities.

Economic impacts will vary by community and by the type of investment made in that community. Communities may also be impacted differently based on whether they are a community hosting new infrastructure or, conversely, a community that is home to traditional infrastructure (i.e., fossil fuel sources of energy generation). For example, new investments may bring income and jobs into communities while concurrently increasing energy reliability. On the other hand, the shutdown of older power plants formerly used to meet peak demand may reduce economic growth in other communities. Community character may also be changed by increased localization of energy generation, which can lead to reduced congestion and greater transmission and distribution capacity. In aggregate, however, investments and policy changes made due to the REV and CEF are expected to make energy cleaner, more reliable, and locally-sourced.

Economic changes due to REV and CEF projects could also affect public services, population and housing. To the extent that projects require highly specialized labor, construction crews may primarily be imported from outside of the community. These workers would likely be temporary in nature and, therefore, not be accompanied by households. Such importation would cause an increase in demand for motels/hotels along with a small increase in local spending. Local schools would likely not need to accommodate additional children during construction activities, and it is unlikely that the temporary increase in population would place significant additional demands on local hospitals, emergency responders, or police services.

Visual and physical impacts will vary by community affected, the nature and extent of the viewshed, and by the type of investment made. These changes may be a welcome addition to the character of some communities, while in others the impact may be less positive or even negative. In some communities, industrial infrastructure may already exist and new infrastructure might be consistent with the existing landscape. In other communities, projects arising out of the REV or CEF policies may create visual disamenities that conflict with adjacent land uses. For example, DG projects such as solar PV could impact the historic character of certain communities. In order to address these types of conflicts, NREL has published guidance on how best to integrate solar PV installations on historic buildings.[618] At the same time, successful implementation of REV could obviate the need for additional energy infrastructure (such as transmission) and thereby help to preserve existing community character.

However, all of these potential effects are similar to the impacts that result continuously over time in the economy as individuals and businesses seek out and respond to changing incentives and opportunities and older, less efficient plants and businesses are replaced by more efficient, or more customer-engaging, plants and businesses.

9.5 ENVIRONMENTAL JUSTICE

Actions taken in response to the REV and CEF proceedings 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

[618] Kandt, A, et. al. 2011. Implementing Solar PV Projects on Historic Buildings and in Historic Districts. NREL Technical Report NREL/TP-7A40-51297. September. Accessed on September 25, 2014 at: http://www.nrel.gov/docs/fy11osti/51297.pdf.

electric generating facility pursuant to PSL Article 10. Environmental justice issues are also addressed on a case-by-case basis as part of NYSDEC's environmental permit review process as well as its application of SEQRA. In 2003, NYSDEC issued Commissioner Policy 29 (CP-29), which defines Environmental Justice as:

> "…the fair treatment and meaningful involvement of all people regardless of race, color, or income with respect to the development, implementation, and enforcement of environmental laws, regulations and policy. Fair treatment means that no group of people, including a racial, ethnic or socio economic group should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local and tribal programs and policies."[619]

CP-29 specifies the process for analyzing environmental justice impacts in the context of SEQRA. When NYSDEC is the lead agency in a SEQRA review, NYSDEC staff will first conduct a preliminary screen to identify whether a proposed action(s) is in or near a PEJA. If the screening indicates that the proposed action(s) occurs in or near a PEJA, the EIS will then need to identify and evaluate the additional burden of any significant adverse impact on the PEJA.[620] The detail and depth of analysis will vary depending on the project. In addition, if the proposed action occurs in or near a PEJA, the permit applicant must create and implement a plan for public participation. If the EIS includes an evaluation of additional burdens on a PEJA, public hearings will also be conducted.

While the REV and CEF proceedings do not result in the approval of any specific projects, the proceedings are expected to result in the development of a new energy paradigm in which greater value is placed on clean energy investments and technologies. As discussed in Chapter 1, overall, the REV and CEF are designed to reduce the proportion of energy generated by fossil-fuels, and in so doing, is expected to reduce the environmental impacts associated with fossil-fuel energy generation.

In addition, the CEF proposal outlines the following high-level strategic objectives that will be pursued to drive significant and sustainable impact on energy use practices in the low and moderate income (LMI) sector:[621]

- Provide direct end-user incentives to increase energy efficiency and distributed generation adoption;
- Fully integrate administration and delivery of the portfolio of New York State programs designed to assist LMI consumers (e.g., NYSERDA's EmPower Program, Division of Housing and Community Renewal Weatherization Assistance Program, Home Energy Assistance Program, United States Department of Housing and Urban Development).

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[619] NYSDEC. 2014. Environmental Justice Policy Commissioner Policy 29. Accessed on August 29, 2014 at: http://www.dec.ny.gov/regulations/36951.html.

[620] If NYSDEC is not the lead agency, CP-29 directs that the lead agency implement the same process "to the extent permitted by law."

[621] NYSERDA. 2014. Case 14-M-0094 – Proceeding on the Motion of the Commission to Consider a Clean Energy Fund. Clean Energy Fund Proposal. Issued September 23, 2014.

Take advantage of complementary outreach efforts and information sharing opportunities, and reduce unnecessary duplication;

- Help service providers enhance capabilities to better serve LMI customers by minimizing supplier soft costs such as customer acquisition (e.g., through targeted audit improvement and targeted outreach) and combining energy retrofits with other public and private LMI initiatives to promote health and safety, arrearage reduction, affordability (e.g., incentivize roof repairs with high insulation);
- Drive education and awareness on the low cost steps and behaviors LMI residents and building owners can take to save on utility bills. Leverage social norming/ behavioral insights to influence decisions (e.g., community based outreach). Minimize consumer pain/friction through easy-to-use tools to choose providers and widespread access to efficient products, and help consumers avoid or reduce the need to take on debt. Benchmark and track energy and water use for public housing;
- Educate and convince affordable housing property owners/managers and their tenants of the financial benefits of energy efficiency investments (e.g., demonstration projects with performance guarantees). Facilitate on-site training for building managers. Target landlords with portfolios of multiple affordable housing properties to drive scale. Facilitate execution of deep energy retrofit projects (potentially incorporating both efficiency and distributed generation measures) at points of refinancing/recapitalization;
- Drive greater penetration of clean energy attributes in new affordable housing projects by providing technical support and advocacy for the benefits of clean/efficient building technologies (e.g., coordinate with New York City Housing Authority (NYCHA) on new building designs in NYC);
- Leverage resources like the “Center for Active Design” to drive innovation in housing development. Encourage owners or funders of affordable housing to implement high-efficiency standards, and provide technical assistance to developers to ensure they can achieve it at reasonable costs.

However, it is possible that the environmental impacts of individual projects implemented in response to the REV and CEF could be located in a PEJA, which could result in the lead agency performing an EIS assessing, among other things, whether the action under consideration would disproportionately affect PEJA populations, and whether alternative actions would have less impact. Below we discuss an area in which environmental justice may be particularly relevant to the REV and CEF proceedings: site-specific patterns of clean energy development.

Site-Specific Patterns of Clean Energy Development

While the likelihood is unknown, it is possible that the environmental impacts of individual projects implemented in response to the REV and CEF could result in site-specific environmental justice concerns. For example, if generating plants are located in PEJAs, this may cause environmental justice concerns for these areas. Similarly, siting small-scale distributed generation can result in environmental justice concerns.

For areas where air quality is an issue, such as New York City and its surrounding metropolitan areas which are currently designated as in moderate nonattainment for several NAAQSs, emissions from hydrocarbon fueled DER such as CHP systems can contribute to this issue, as they are often located near population centers and have shorter smokestacks than power plants.[622] However, as discussed in Chapter 6, a variety of measures exist to minimize potential impacts.

[622] NYISO. 2014. A Review of Distributed Energy Resources. Accessed September 14, 2014 at: http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Other_Reports/Other_Reports/A_Review_of_Distributed_Energy_Resources_September_2014.pdf.

CHAPTER 10 | EFFECTS ON ENERGY CONSUMPTION

Consistent with 6 NYCRR §617.9(b)(5)(iii)(e) of the SEQRA, this chapter considers the potential impacts of the REV and CEF on the use and conservation of energy. The net impact of the REV and CEF on energy consumption is uncertain. As discussed in Chapter 4, one key outcome of the REV and CEF that is the focus of this GEIS is the reduction in peak demand. However, while reductions in peak demand may affect the timing of energy use, changes in overall energy use are less clear.

A second key outcome of the REV and CEF is increased penetration and adoption of DER, EE and DM measures. As discussed in Chapter 5, there are numerous types of DER and the impact of DER, EE and DM on energy use and conservation will vary depending on the technology installed as well as the location and timing of the installed technology, and in some cases, the behavioral response elicited from energy consumers. Moreover, the REV and CEF represent policies designed to engender the development of not one single type or category of clean energy mechanism, but rather a series of transactions that can serve to transform the entire energy industry. As such, the net impact of the REV and CEF on energy use and conservation will be equal to the sum of changes across a number of different individual actions, some of which may also interact with one another in ways that could further amplify the impact on system-wide energy use and conservation (e.g., PEVs and V2G).

Because of the uncertainty inherent in how the REV and CEF will be implemented and the response to the REV and CEF by New York's utilities, ESCOs, industries, businesses and consumers thereafter, the net impact of REV and CEF on energy use and consumption is not quantifiable with a reasonable level of certainty. In the remainder of this section, the effect upon energy use and conservation by each of the major categories of clean energy technologies is discussed.

- **Energy Efficiency**. As EE measures are adopted more broadly across the residential, commercial and industrial sectors, this will directly affect energy consumption in the State. In general, EE measures would be expected to lower energy consumption. For example, as older less efficient appliances are replaced with newer more efficient models, less energy will be consumed. Net energy consumption, however, may be affected by a behavioral phenomenon known as the "rebound effect." The rebound effect suggests that EE measures do not necessarily lead to a decrease in energy consumption, because, as energy prices effectively decrease, customers increase energy consumption.[623] Empirical studies indicate that "rebound effects" are likely to be very limited, ranging from five to

[623] Gillingham, K et al. The Rebound Effect and Energy Efficiency Policy. 2013. Yale University School of Forestry & Environmental Studies. University of California Davis, Department of Economics, Environmental Defense Fund. Accessed on September 10, 2014 at: http://www.yale.edu/gillingham/ReboundEffectLongForm.pdf.

30 percent of the original efficiency gain, and subject to diminishing returns.[624] For example, decreased heating costs may lead households to increase their residence's temperature, but there is likely a limit to how much of a temperature increase would be desirable. A related implication is that rebound effects may be higher for low-income customers, who are likely further from energy consumption satiation.[625]

- **Renewable Energy**. Increased penetration of whole-sale grid-connected renewable energy is not expected to influence energy consumption levels. One of the goals of the CEF is to encourage a greater proportion of renewables, but this is not likely to increase or decrease the amount of electricity consumed by customers.
- **Distributed Generation**. As additional DG (e.g., CHP, PV, and fuel cells) comes online, consumption of grid-supplied power is likely to fall. For example, some customers will use DG to maintain near-normal operations while they reduce their use of grid-supplied power as part of DR programs, thereby lowering consumption of grid-supplied power.
- **Demand Response**. DR entails a reduction or shift in time, related to end-use customer consumption. DR programs employ a combination of price signals and automated technology (e.g. programmable, controllable thermostats) to reduce load during specific periods (daily or only in critical periods). Increased participation in DR programs, as a result of financial incentives and/or price signals provided to customers, will likely reduce electricity consumption during peak periods. As DR programs shift energy production away from the bulk generation system, additional benefits result as the use of inefficient generation methods are curtailed and transmission and distribution-related losses are avoided. However, as previously discussed, reductions in peak demand may only shift the timing, and not the total amount of end-user energy consumption.
- **Electricity Rates**. TOU rates may lead to higher rates in some locations or during certain peak periods, similar to DR. Various studies provide evidence of customer acceptance of utility initiatives such as variable and TOU rates, as well as evidence that these rate schemes result in reduced peak period consumption.[626] Such price signals, however, may work to only shift, rather than reduce, total energy consumption or may lead to an increase in consumption as customers are incentivized to consume cheaper electricity during off-peak times. At least one pilot study suggests that customers on TOU rates do not shift consumption; this study found minimal changes in electricity use

[624] *Ibid*. Also, see, UK Energy Research Center. *The Rebound Effect: An Assessment of the Evidence for Economy-wide Energy Saving from Improved Energy Efficiency*. Accessed on September 11, 2014, at: http://www.ukerc.ac.uk/Downloads/PDF/07/0710ReboundEffect/0710ReboundEffectReport.pdf.

[625] Boardman, B. and G. Milne. 2000. "Making cold homes warmer: the effect of energy efficiency improvements in low-income homes." Energy Policy, 218(6-7), 411-24.

[626] Faruqui, Ahmad and Sergici, Sanem. Household Response to Dynamic Pricing of Electricity – A Survey of the Experimental Evidence. January 10, 2009. See also: DOE. 2012. Demand Reductions from the Application of Advance Metering Infrastructure, Pricing Programs, and Customer-Based Systems – Initial Results. Smart Grid Investment Program. December 2012; and, Sacramento Municipal Utility District (SMUD). 2013. SMUD SmartPricing Options Interim Evaluation. October 23, 2013. Accessed January 2, 2015 at: https://www.smartgrid.gov/sites/default/files/MASTER_SMUD%20CBS%20Interim%20Evaluation_Final_SUBMITTED%20TO%20TAG%2020131023.pdf.

outside the TOU peak period.[627] Also, for customers who are unable to shift demand to off-peak periods, as rates increase, these consumers may decrease consumption.

[627] Sacramento Municipal Utility District (SMUD). 2013. SMUD SmartPricing Options Interim Evaluation. October 23, 2013. Accessed January 2, 2015 at: https://www.smartgrid.gov/sites/default/files/MASTER_SMUD%20CBS%20Interim%20Evaluation_Final_SUBMITTED%20TO%20TAG%2020131023.pdf.

CHAPTER 11 | REFERENCES

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APPENDIX A | SUPPLEMENTAL ANALYSIS OF POTENTIAL ENVIRONMENTAL IMPACTS ASSOCIATED WITH CEF ACTIVITIES

Appendix A presents a supplemental analysis of the potential environmental impacts of additional activities identified in the CEF proposal.[628] For each activity, **Exhibit A-1** identifies the CEF outcome(s) that the activity is designed to support and then considers the potential environmental impacts of each activity. In many cases, the proposed activity entails efforts that by themselves are unlikely to produce any direct environmental impacts, for example activities designed to educate and raise awareness among service providers and energy consumers. To the extent that such activities (individually or in aggregate) contribute to or facilitate greater use and adoption of clean energy resources and technologies, indirect environmental impacts (both positive and negative) may result. However, because the exact mix of clean energy resources and technologies that will be realized through the CEF is uncertain, this appendix does not evaluate these types of potential long-term, indirect environmental impacts. For further analysis of the environmental, social and economic impacts of specific clean energy resources and technologies, see **Chapters 5, 9 and 10**. Measures to mitigate the environmental impacts identified in this GEIS and appendix are presented in **Chapter 6.**

[628] NYSERDA. 2014. Case 14-M-0094 – Proceeding on the Motion of the Commission to Consider a Clean Energy Fund. Clean Energy Fund Proposal. Issued September 23, 2014. Available at: http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={DABF6A8A-17A5-441F-AC44-48587105CF6D}.

EXHIBIT A-1 EVALUATION OF POTENTIAL ENVIRONMENTAL IMPACTS OF ACTIVITIES IDENTIFIED IN NYSERDA'S SEPTEMBER 2014 CEF PROPOSAL

ACTIVITY	CEF OUTCOMES			POTENTIAL ENVIRONMENTAL IMPACTS					ANALYSIS
	Increased Adoption of DG and RE	Reduced energy demand	Increased EE and grid capability	GHG Emissions	Criteria Pollutant Emissions	Waste Generation	Water Pollution and Use	Social and Economic Impacts	
MARKET DEVELOPMENT ACTIVITIES									
Prioritize market segments, end-uses, and approaches with the greatest potential to unlock energy efficiency and distributed generation/renewable energy adoption.	✔		✔						Activities are unlikely to generate any direct environmental impacts. To the extent that such activities contribute to or facilitate greater use and adoption of clean energy resources and technologies, indirect environmental impacts may result. For further analysis of the environmental, social and economic impacts of specific clean energy resources and technologies, see Chapters 5, 9 and 10.
Direct intervention at specific and evidence-based barriers to adoption.	✔		✔						
Address fear of performance that the technology or the installation will not deliver as promised.	✔		✔						
Address lack of awareness of the benefits of superior energy performance, such as economic, health, safety, and resiliency.	✔		✔						
Address lack of "solution providers" that can make opaque and complex projects straightforward for the customer.	✔		✔						
Stimulate market solutions by enabling solutions for other market actors.	✔	✔	✔						
Stimulate market solutions by coordinating and facilitating market transactions where immature or fragmented market conditions prevent transactions today, and increase the ease of customer acquisition (including targeting, aggregation, and enabling new solutions integrators and new "marketplaces").	✔		✔						
Stimulate market solutions by Aggregating, certifying, and sharing information where opacity, fragmentation, or complexity prevents adoption (including useful credible usage information, successful providers, credible track records, best practices and operational approaches, etc.), and potentially developing new useful asset ratings.	✔		✔						

ACTIVITY	CEF OUTCOMES			POTENTIAL ENVIRONMENTAL IMPACTS					ANALYSIS
	Increased Adoption of DG and RE	Reduced energy demand	Increased EE and grid capability	GHG Emissions	Criteria Pollutant Emissions	Waste Generation	Water Pollution and Use	Social and Economic Impacts	
Stimulate market solutions by working with local government and private partners to reduce EE and DG/RE project costs by streamlining, standardizing and clarifying market rules and tackling financing and soft costs (standardizing permits and inspections, standardizing contracts, tested tools and methodologies, tech-enabling assessments and M&V, etc.).	✔		✔						
Stimulate market solutions by creating awareness and a predisposition among customers to decide to invest in clean energy, through education, outreach and marketing activities aimed at decision-makers, through credible and objective analyses documenting the costs and benefits of clean energy measures from a customer perspective, and through demonstration projects that provide tangible evidence of success.	✔								
Address lack of prioritization or attention by customers to energy performance.		✔	✔						
Address "Soft costs" that are too high, in the absence of inexpensive, robust tools and methodologies, including clear and publicly accessible data ets.	✔		✔						
Address frustration and annoyance with even small energy projects .	✔								
Stimulate market solutions by providing direct financial incentives to directly stimulate more robust demand and ensure there is adequate supply to meet latent demand, NYSERDA will continue to provide incentives to end users and/or suppliers where necessary, and in doing so will aim to use market-mobilizing mechanisms (e.g., auctions, step-downs). There are three situations when incentives are most appropriate: 1) As a temporary bridge to an incentive-free market solution; 2) Where the incentive creates public accessible infrastructure (e.g., a "pilot", or a beta-version); 3) Where market gaps occur even in efficient markets and a subsidy may be necessary (e.g. Low/Moderate Income (LMI), rural).	✔		✔						Direct financial incentives are likely to lead to greater adoption of customer-sited DER. Impacts, however, are uncertain because the exact mix of clean energy resources and technologies realized through the CEF is uncertain. For further analysis of the environmental, social and economic impacts of specific clean energy resources and technologies, see Chapters 5, 9 and 10.
Continue to lead on policies such as building codes, mandates, appliances standards, state legislative initiatives, and local laws - partnering with all levels of government, as they represent significant opportunities for leverage and impact.	✔	✔	✔						These activities may directly or indirectly lead to greater investment of energy efficiency in different types of buildings. If such investments result in significant

ACTIVITY	CEF OUTCOMES			POTENTIAL ENVIRONMENTAL IMPACTS					ANALYSIS
	Increased Adoption of DG and RE	Reduced energy demand	Increased EE and grid capability	GHG Emissions	Criteria Pollutant Emissions	Waste Generation	Water Pollution and Use	Social and Economic Impacts	
Target new interventions at high-potential events and decision points in the lifecycle of a building (i.e. building acquisition, renovation, refinancing) in order to more easily incorporate and embed energy efficiency and distributed generation/renewable energy into ongoing capital planning processes and ownership events.	✔		✔						upgrades of existing buildings, such activities could generate some amount of hazardous waste.
Address inconsistent, weak or lightly enforced State or municipal-level building codes and regulations.		✔	✔						
RESIDENTIAL SINGLE FAMILY									
Help service providers enhance their capabilities and grow energy efficiency and distributed generation business by driving down soft costs through supporting demand generation efforts, training and tools to further improve business models and workforce skills, and by enabling integration across service categories (HVAC, insulation, building envelop and on-site generation, such as PV).	✔		✔						Activity may generate regional economic benefits; such benefits, however, vary depending on the type of clean energy resource or technology.
Better integrate energy offerings into products/services that consumers consider more frequently than energy products (e.g., home automation, roof repairs, landscaping). Work with manufacturers and service providers outside of the energy supply chain to increase adoption of these products given their potential to expand energy savings in the home.		✔	✔						Activity may generate regional economic benefits; such benefits, however, vary depending on the type of clean energy resource or technology. To the extent that such activities lead to EE upgrades of existing homes, such upgrades could generate some amount of hazardous waste.
Engage all sides of the homeowner transaction to further embed home energy performance into the value of a home during a sale. This entails efforts to incorporate energy considerations into regular home sales/purchase channels to leverage the actions of existing players and processes (e.g., realtors and appraisers, property listing websites, mortgage property appraisals/reports etc.).			✔						Activities are unlikely to generate any direct environmental impacts. To the extent that such activities contribute to or facilitate greater use and adoption of clean energy resources and technologies, indirect environmental impacts may result. For further analysis of the environmental, social and economic impacts of specific clean energy resources and technologies, see Chapters 5, 9 and 10.
Drive the new home construction market towards the next frontier of efficiency (e.g., Net Zero homes) by generating end-user demand and demonstrating the societal and business case to end-users, builders and the architectural community		✔	✔						

ACTIVITY	CEF OUTCOMES			POTENTIAL ENVIRONMENTAL IMPACTS					ANALYSIS
	Increased Adoption of DG and RE	Reduced energy demand	Increased EE and grid capability	GHG Emissions	Criteria Pollutant Emissions	Waste Generation	Water Pollution and Use	Social and Economic Impacts	
Accelerate the move to Net-Zero in new multifamily buildings by engaging engineers, architects and designers early to ensure vanguard projects succeed, and by supporting marketing efforts to communicate the benefits of these buildings. Build structure for information sharing among early adopters of these projects (e.g., forum to share best practices and business case examples).		✔	✔						
Change the mindset on energy efficiency and distributed generation among residents by driving widespread awareness of the impact on energy use and costs that can be achieved via behavioral changes and the installation of often simple technologies. Increase demand by associating clean and efficient technologies with increased comfort, convenience reliability, aesthetics and safety.	✔		✔						
Link better economic results with improved building energy performance in order to change decision making for building owners/landlords. Clearly and simply demonstrate the business case for improved cost flow resulting from energy efficiency. Create transparency by offering easy to interpret building energy performance ratings.		✔	✔						
Provide tenants with information that makes salient the benefits of renting in more efficient buildings. Create a positive public perception of the favorable externalities to drive demand. Leverage innovative marketing strategies, tools, social norming/behavioral insights to influence opinions and decisions (e.g., publicly available apartment/condo building ratings, web based ad campaigns, post participant lists in common spaces).		✔	✔						
Reduce soft costs by building platforms and market infrastructure for multi-family service providers (e.g., contractors, software providers) with improved data/analytics to target potential customers (both unit owners and building managers) and deliver a compelling business case in order to close deals.		✔	✔						
Improve transparency and awareness by offering compelling, user-friendly information for repair vs. replace decisions, retail purchases, and similar decisions.		✔	✔						

ACTIVITY	CEF OUTCOMES: Increased Adoption of DG and RE	CEF OUTCOMES: Reduced energy demand	CEF OUTCOMES: Increased EE and grid capability	POTENTIAL ENVIRONMENTAL IMPACTS: GHG Emissions	POTENTIAL ENVIRONMENTAL IMPACTS: Criteria Pollutant Emissions	POTENTIAL ENVIRONMENTAL IMPACTS: Waste Generation	POTENTIAL ENVIRONMENTAL IMPACTS: Water Pollution and Use	POTENTIAL ENVIRONMENTAL IMPACTS: Social and Economic Impacts	ANALYSIS
LMI RESIDENTIAL									
Provide direct end-user incentives to increase energy efficiency and distributed generation adoption.	✔		✔						Direct financial incentives may lead to greater adoption of EE and DG. Impacts, however, are uncertain because the exact mix of clean energy resources and technologies realized through such activities is uncertain. For further analysis of the environmental, social and economic impacts of specific clean energy resources and technologies, see Chapters 5, 9 and 10.
Help service providers enhance capabilities to better serve LMI customers by minimizing supplier soft costs such as customer acquisition (e.g., through targeted audit improvement and targeted outreach) and combining energy retrofits with other public and private LMI initiatives to promote health and safety, arrearage reduction, affordability (e.g., incentivize roof repairs with high insulation).		✔	✔						
Educate and convince affordable housing property owners/managers and their tenants of the financial benefits of energy efficiency investments (e.g., demonstration projects with performance guarantees). Facilitate on-site training for building managers. Target landlords with portfolios of multiple affordable housing properties to drive scale. Facilitate execution of deep energy retrofit projects (potentially incorporating both efficiency and distributed generation measures) at points of refinancing/recapitalization.	✔	✔	✔						Activities are unlikely to generate any direct environmental impacts. To the extent that such activities contribute to or facilitate greater use and adoption of clean energy resources and technologies, indirect environmental impacts may result. For further analysis of the environmental, social and economic impacts of specific clean energy resources and technologies, see Chapters 5, 9 and 10.
Fully integrate administration and delivery of the portfolio of New York State programs designed to assist LMI consumers (e.g., NYSERDA's EmPower Program, Division of Housing and Community Renewal (HCR) Weatherization Assistance Program (WAP), Home Energy Assistance Program (HEAP), United States Department of Housing and Urban Development (HUD)). Take advantage of complementary outreach efforts and information sharing opportunities, and reduce unnecessary duplication.		✔	✔						
Drive education and awareness on the low cost steps and behaviors LMI residents and building owners can take to save on utility bills. Leverage social norming/ behavioral insights to influence decisions (e.g., community based outreach). Minimize consumer pain/friction through easy-to-use tools to choose providers and widespread access to efficient products, and help consumers avoid or reduce the need to take on debt. Benchmark and track energy and water use for public housing.		✔	✔						

ACTIVITY	CEF OUTCOMES			POTENTIAL ENVIRONMENTAL IMPACTS					ANALYSIS
	Increased Adoption of DG and RE	Reduced energy demand	Increased EE and grid capability	GHG Emissions	Criteria Pollutant Emissions	Waste Generation	Water Pollution and Use	Social and Economic Impacts	
Drive greater penetration of clean energy attributes in new affordable housing projects by providing technical support and advocacy for the benefits of clean/efficient building technologies (e.g., coordinate with New York City Housing Authority (NYCHA) on new building designs in NYC).	✔	✔	✔						
Leverage resources like the "Center for Active Design" to drive innovation in housing development. Encourage owners or funders of affordable housing to implement high-efficiency standards, and provide technical assistance to developers to ensure they can achieve it at reasonable costs.		✔	✔						
COMMERCIAL									
Make it simple to view the projected energy costs of a commercial building by ensuring the availability of continuous supporting data and training on how to act on it. Build a network of peer-to-peer advising that diffuses best practices and case examples among market players. Integrate this information into key decision making processes (e.g., refinancing, capital planning, building purchase).		✔	✔						These activities are not expected to result in direct environmental impacts. Indirect impacts may arise to the extent that such activities contribute to or facilitate greater use and/or adoption of EE and DG in commercial buildings. For further analysis of the environmental, social and economic impacts of specific clean energy resources and technologies, see Chapters 5, 9 and 10.
Guide end user organizations to operate at a higher efficiency level regardless of additional investment through training building managers in best practices, providing (declining) incentives to demonstrate the value of effective building managers operating efficient building management systems, and connecting experienced and inexperienced market actors to increase diffusion of behavioral best practices.		✔	✔						
Move the state-of-the-art standard forward through partnerships with select leading-edge institutions to build and rehabilitate "prototype" facilities demonstrating Net-Zero/deep energy level savings, potentially through projects combining efficiency with distributed generation technologies.		✔	✔						
Reduce soft costs through initiatives like building platforms that offer service providers (e.g., Energy Service Companies (ESCOs)) improved data & analytics to target and convert decision-makers, reducing audit costs through leveraging data, and reducing installation costs (and improving quality) through training and the dispersion of best practices in the market.	✔	✔	✔						

ACTIVITY	CEF OUTCOMES			POTENTIAL ENVIRONMENTAL IMPACTS					ANALYSIS
	Increased Adoption of DG and RE	Reduced energy demand	Increased EE and grid capability	GHG Emissions	Criteria Pollutant Emissions	Waste Generation	Water Pollution and Use	Social and Economic Impacts	
Seek opportunities to drive change through joint partnerships with other economically important states (e.g., California) in order to create a "case for change" that convinces multi-state, highly centralized organizations (e.g., national retailers).		✔	✔						
INDUSTRIAL									
Accelerate growth in process efficiency by partnering with the Department of Energy, advanced industrial service providers and leading edge industrial firms to push state-of-the-art process efficiency forward, and thereby demonstrate the value to less efficiency-oriented firms.		✔							These activities are not expected to result in direct environmental impacts. Indirect impacts may arise to the extent that such activities contribute to or facilitate greater use and/or adoption of DER. For further analysis of the environmental, social and economic impacts of specific clean energy resources and technologies, see Chapters 5, 9 and 10.
Educate industrial and data center decision makers on the value of energy management as a permanent, continuous, and embedded core mission – as fundamental as any other aspect of cost and operations management. Providing prominence to forums for sharing best practices in managing energy at the centralized and plant-specific decision-maker level will place effective energy management at the forefront of the conversation on cost-competitiveness. Leverage partnerships using International Organization for Standardization (ISO) 50001 and United States Department of Energy (DOE)'s Better Plants and Industrial Technologies Programs.		✔							
Enable the emergence of a solution provider base with resources and support to assist industrial companies in executing a long term energy management strategy by providing targeted training courses for facility-level managers and engineers, teaching skills in assessing energy performance/opportunities, setting and achieving performance goals, creating and implementing action plans, and best practices in continuous commissioning to reduce maintenance and energy costs.		✔							
Serve as a match-maker between supply and demand for technical talent through direct assistance, sub-contracting engineering consulting firms, and through academic networks (e.g., Ph.D. grad students in the State University of New York (SUNY) schools). Provide low-cost technical support to aid industrial firms seeking energy efficiency.		✔	✔						By building the skills of energy efficiency professionals and increasing the affordability of engineering advisory services, this activity may generate regional economic benefits.
LOCAL GOVERNMENTS									
Education and outreach, including training of local officials in key roles and general awareness of clean energy opportunities.	✔								These activities are not expected to result in direct environmental impacts.

ACTIVITY	CEF OUTCOMES			POTENTIAL ENVIRONMENTAL IMPACTS					ANALYSIS
	Increased Adoption of DG and RE	Reduced energy demand	Increased EE and grid capability	GHG Emissions	Criteria Pollutant Emissions	Waste Generation	Water Pollution and Use	Social and Economic Impacts	
Tools, including model regulations and standards, benchmarks and best practices, portals to ease the selection process for clean energy options, and model competitive offering instruments, such as RFPs.	✔								Indirect impacts may arise to the extent that such activities contribute to or facilitate greater use and/or adoption of DER. For further analysis of the environmental, social and economic impacts of specific clean energy resources and technologies, see Chapters 5, 9 and 10.
Accessibility and ease of use of State support and resources.	✔	✔	✔						
Technical assistance, including assistance to enable effective engagement with their utility.	✔	✔	✔						
GRID-TIED RENEWABLES									
Establishment of the New York Generation Attribute Tracking System to foster a transparent trading market and reporting platform.	✔								These activities are not expected to result in direct environmental impacts.
Re-evaluating early prospecting work to determine the best remaining sites for onshore wind projects including co-location with existing generators.	✔								Indirect impacts may arise to the extent that such activities contribute to or facilitate greater use and/or adoption of DER. For further analysis of the environmental, social and economic impacts of specific clean energy resources and technologies, see Chapters 5, 9 and 10.
Developmental work to support the emergence of commercially-ready approaches to capturing the "value of renewables" attributes such as increased fuel diversity, energy price volatility reduction, long-term price and supply assurance.	✔								
Providing technical assistance to developers of smaller scale and community renewable projects in the areas of permitting, interconnection, siting, and pursuing opportunities to align the NYISO interconnection queue process with the Article 10 process.	✔								
OFF-SHORE WIND (OSW)									
Continue research and development efforts on critical areas such as OSW cost reduction, specifically focusing on initiatives and investments by New York and/or other states that have the potential to meaningfully reduce the cost of this resource such as: siting, pre-development, market visibility, financing structures, construction/O&M cost reduction, and transmission goal will be to support the development of a market that has the scale necessary to drive innovation and reduce delivered costs.	✔								Depending on the level of investment in research and development activities, short-term regional economic benefits may result. Indirect impacts may arise to the extent that such activities contribute to or facilitate greater use and/or adoption of

ACTIVITY	CEF OUTCOMES			POTENTIAL ENVIRONMENTAL IMPACTS					ANALYSIS
	Increased Adoption of DG and RE	Reduced energy demand	Increased EE and grid capability	GHG Emissions	Criteria Pollutant Emissions	Waste Generation	Water Pollution and Use	Social and Economic Impacts	
Engage in targeted research and outreach initiatives to address market barriers for all OSW stakeholders throughout the Atlantic Bight. NYSERDA will work with DOS to update the "New York Offshore Winds Atlantic Ocean Study" and support the stakeholder engagement process coordinated by DOS and the U.S. Bureau of Ocean Energy Management to establish Wind Energy Areas that account for the needs of ocean users and protect the ocean environment in general.	✔								OSW. For further analysis of the environmental impacts of OSW, see Chapter 5.
CUSTOMER-SITED RENEWABLES									
Providing direct financial incentives where needed to stimulate demand as a temporary bridge to a market solution.	✔								Activities may lead to greater adoption of customer-sited DER. Impacts, however, are uncertain because the exact mix of customer-sited clean energy resources and technologies realized through the CEF is uncertain. For further analysis of the environmental, social and economic impacts of specific clean energy resources and technologies, see Chapters 5, 9 and 10.
Renewable and DER integration	✔								
Working with private and public partners to reduce soft-costs, standardize product offerings, document and create awareness of system performance and system integration with other on-site clean energy measures, develop a quality service-provider base, and explore financing and new business model options.	✔								Activities may generate regional economic benefits. Such activities are unlikely to generate direct environmental impacts. Indirect impacts may arise to the extent that such activities contribute to or facilitate greater adoption of customer-sited DER. For further analysis of the environmental, social and economic impacts of specific clean energy resources and technologies, see Chapters 5, 9 and 10.
Working with municipal and local government partners to advance permitting and siting practices that can encourage customer-sited renewable technology.	✔								
Catalyze strategic business partnerships along the commercialization supply chain.	✔								
Continue to build the entrepreneurial capacity for cleantech innovation in New York.	✔								
Develop cleantech assets that can assist and attract multiple companies and other stakeholders, such as testing and commercialization resources.	✔								

ACTIVITY	CEF OUTCOMES			POTENTIAL ENVIRONMENTAL IMPACTS					ANALYSIS
	Increased Adoption of DG and RE	Reduced energy demand	Increased EE and grid capability	GHG Emissions	Criteria Pollutant Emissions	Waste Generation	Water Pollution and Use	Social and Economic Impacts	
Develop business readiness of a potential partner in addition to a project's technical merit to increase probability of successful commercial outcomes.	✔								
Explore working with private partners and academia in New York to advance technological innovation that could drive down the costs of these systems.	✔								
Support R&D at various stages, including early-stage transformative opportunities, technology demonstrations, and later stages of commercialization.	✔								
Improved building performance			✔						To the extent that improvements in building performance are based on upgrades of existing buildings, such activities could generate adverse impacts if such upgrades require the use or disposal of hazardous waste. For further analysis, refer to Section 5.1 and Exhibit 5.6.
Clean Transport			✔						Relative to conventional ICE vehicles, increase use of clean transport (including FCVs, BEVs, PEVs and HEVs) is likely to reduce GHG and criteria pollutants relative to ICE vehicles. However, the environmental impacts of clean transport will depend on scale and mix of clean transport as well as the generation mix of the electrical grid that such vehicles rely upon as a source of electricity.
Digital/tech-enabled energy solutions	✔	✔	✔						While digital/tech-enabled solutions do not create any direct environmental impacts, like any industrial product, the hazardous materials contained in such technologies may indirectly generate life-cycle environmental impacts during manufacturing, transportation and end-of-life product disposal.

ACTIVITY	CEF OUTCOMES			POTENTIAL ENVIRONMENTAL IMPACTS					ANALYSIS
	Increased Adoption of DG and RE	Reduced energy demand	Increased EE and grid capability	GHG Emissions	Criteria Pollutant Emissions	Waste Generation	Water Pollution and Use	Social and Economic Impacts	
Energy system resiliency	✔		✔						Greater system resiliency is likely to generate regional economic benefits from more reliable transmission, distribution, and generation; fewer power interruption events; streamlined facility repairs for such events; and improved resilience to the effects of climate change.
Where critical industrial assets exist, seek to develop a manufacturing/supply chain in New York, thereby providing economic development opportunities for New Yorkers.	✔		✔						Activities may generate regional economic benefits.
Critical energy-related environmental research that is needed to better understand and mitigate the environmental impacts of emerging and existing energy technologies.	✔		✔						These activities are not expected to result in direct environmental impacts. However, such research may help to mitigate the environmental footprint of emerging and existing energy technologies. The magnitude of such impacts, however, is uncertain.

APPENDIX B | RESPONSE TO COMMENTS ON THE DRAFT GEIS

B.1 INTRODUCTION

This appendix summarizes comments submitted on the draft GEIS (DGEIS), issued October 23, 2014. A Notice of Completion of the DGEIS was published in the Environmental Notice Bulletin on November 5, 2014, and comments were requested to be provided through December 5, 2014. Fifteen written comments were received. No comments were received from individual citizens or entities not a party to this proceeding.

Responses to each substantive comment raised are presented below. This appendix is organized into two parts. Responses to comments common across multiple filers are presented first followed by comments unique to individual filers, presented in alphabetical order by filer. Copies of individual comment letters are available through the REV Matter Master, Case 14-M-0101.

B.2 COMMENTS COMMON TO MULTIPLE FILERS

Comment: While the DGEIS considers a range of potential impacts, the uncertainties of REV's proposed market structures and the approximate formulation of the CEF make it difficult to generate reasonable estimates about the deployment of DER. As a result of this uncertainty, the DGEIS fails to contain a meaningful or in-depth analysis of potentially adverse environmental impacts. Because of the amount of uncertainty pertaining to the REV and CEF, it is unclear whether or not the Commission can make the required findings under SEQRA. One commenter suggested that a Programmatic EIS may be more appropriate as it would allow for subsequent tiered analyses.

Response: We disagree with the comment and believe that the DGEIS does contain a meaningful and in-depth analysis of the potentially adverse environmental impacts on a generic basis. The nature of a generic EIS is that it is more general than a site-specific EIS. In that regard, the DGEIS is properly based on conceptual information and general projections for future activity, and considers the scope of potential impacts by presenting and analyzing a number of hypothetical scenarios to illustrate on a conceptual level the likely impacts of the proposed actions. It is exactly because the final structure and deployment levels are unknowable at this time that it is appropriate to consider potential environmental impacts on a generic and conceptual basis.

The reference to "the required findings under SEQRA" is a reference to a future step in the SEQRA process. The preparation of SEQRA findings is an agency responsibility which is not part of the actual GEIS preparation. SEQRA findings are required in conjunction with all future decisions by the Commission to implement the proposed actions. If the Commission later finds that after considering the final GEIS it has insufficient information upon which to make a written statement of facts and conclusions to support a particular future decision, it would have several options, among others, including the preparation of a supplemental EIS before taking action, the implementation of an alternative, or the fashioning of conditions requiring supplemental environmental review as part of the implementation process.

The distinction of a "Programmatic EIS" is no longer in use in New York regarding SEQRA. The early SEQRA regulations (Part 617, effective November 1978) used the terms "generic EIS" and "programmatic EIS" interchangeably. A draft guidance document issued by the NYSDEC Division of Regulatory Affairs circa 1981-1983 defined a "generic EIS" as a conceptual EIS related to an entire group of physical (usually construction) projects. A "programmatic EIS" was defined as a conceptual EIS dealing with new or revised agency plans or programs including, among other things, regulatory rules or permit programs. The term "programmatic EIS" was dropped by NYSDEC in the 1987 version of Part 617 as subsumed in the concept of a generic EIS. In any event, we believe that the DGEIS is already the type of conceptual EIS that would have qualified as a programmatic EIS under the former regime.

The allowance for "subsequent tiered analyses" as desired by the comment already pertains to this type of generic EIS. For example, the DGEIS examines the environmental impact of financial support for wind energy generation facilities on a conceptual level, whereas the construction and other physical impacts of a particular facility to be constructed would be subject to a site-specific environmental review by the siting authority pursuant to either SEQRA (if the siting authority is a local government) or Article 10 of the Public Service Law (if the siting authority is the New York State Board on Electric Generation Siting and the Environment). In those examples, there would be a required subsequent tier of environmental review, but neither subsequent review would be conducted by the Commission as lead agency.

Comment: Multiple commenters suggested the DGEIS should rely on cost-benefit analysis to assess the potential economic and environmental impacts of the proposed action. One commenter states that the reference to future cost-benefit analyses to be conducted by utilities in the future does not satisfy the statutory obligation under SEQRA to assess social and economic impacts. Another commenter states that an alternative mitigation structure should be considered for inclusion in the DGEIS discussion of environmental impacts, whereby DER resources that produce less environmental damage are assigned higher values in the context of a cost benefit analysis.

Response: When the Commission makes its decisions to implement various aspects of the proposed actions, the Commission will necessarily weigh and balance all the relevant considerations in making those decisions. Given the complex nature of environmental, social and economic impacts, the task of doing the weighing and balancing does not lend itself to a formulaic cost-benefit equation where every factor can be assigned a price tag. SEQRA recognizes this complex nature of decision-making and does not require that a formal cost-benefit analysis be conducted as part of an EIS. Deciding to approve a broad-natured regulatory policy is not like deciding to build a site-specific infrastructure project where impacts can be more readily quantified. For broad regulatory policy decisions, SEQRA provides for the consideration of such matters on a generic and conceptual basis such as has been done here in the preparation of the DGEIS. The

DGEIS is not the vehicle by which the balancing decisions are made; the balancing decisions are made later in the process in the form of orders issued by the Commission in conjunction with its SEQRA findings that will articulate in writing how the Commission has considered the information compiled in the EIS and a statement of facts and conclusions to support each particular future decision. The DGEIS does not rely upon future cost-benefit analyses to be conducted by utilities for its assessment of environmental, social or economic impacts. Rather, the DGEIS describes such impacts on a conceptual basis to the degree that they can be appropriately characterized on a non-site-specific basis. The benefit/cost analysis framework DPS Staff has proposed for later use by utilities is not required by SEQRA, but is instead proposed by DPS Staff as an add-on tool to assist utilities in making good decisions. Many of the future utility decisions will be in the nature of deciding to build site-specific infrastructure projects for which some form of formal cost-benefit analysis may be appropriate. The incorporation of environmental factors into a benefit/cost analysis framework is something that could be considered by the Commission if it decides to adopt a specific benefit/cost analysis framework as proposed by DPS Staff.

Comment: In order to obtain a true representation of the environmental impacts of REV policies and programs, the DGEIS needs to develop and consider a greater number of scenarios covering a wider range of goals and technologies. By focusing exclusively on peak-load reduction, the DGEIS may not capture the full range of environmental impacts of the REV and CEF. One commenter expressed concern that a focus on peak loads implicitly narrows the geographic scope of the DGEIS since peak loads are mainly a problem in New York City and Long Island. Other objectives of the REV and CEF that could serve as metrics in addition to peak reduction include resiliency, avoided GHG emissions, avoided energy costs, avoided capacity costs, and marginal emissions rate impacts. Another commenter suggested adding scenarios that analyze the impacts of a market failure under the REV and CEF, for example an alternative lower-bound scenario where CEF funding does not fully replace EEPS and RPS funding, or scenarios that model widespread proliferation of fossil fuel-based distributed generation, such as existing CHP systems running more often and/or backup generators run for economic (and not backup) purposes.

Response: We agree that peak reduction is not the only outcome of the REV and CEF proceedings. The scenarios presented in the DGEIS, however, are not intended to be exhaustive – i.e., the DGEIS is not intended to describe all possible outcomes of the REV and CEF. Peak reduction is used as a proxy to guide the development of scenarios that could feasibly result from actions and policies triggered by the REV and CEF. Developing scenarios that simultaneously achieve one or more other desired outcomes, such as resiliency, reduced GHG emissions, increased fuel diversity, market animation, or scenarios including outcomes such as market failure would require large amounts of data and information not readily available. For example, a quantitative measure of each stated REV and CEF objective would need to be developed and further information and assumptions regarding how such objectives are balanced against one another would also be required.

Moreover, the scenarios presented in Chapter 4 do not limit or constrain the impacts considered in Chapter 5. As discussed in Chapter 5, because the portfolio of technologies to be developed, and the extent to which each technology will be used (or activated) in response to the REV and CEF is uncertain, the assessment of environmental impacts is necessarily wider in range than the scenarios presented in Chapter 4. As an example, while Chapter 4 does not discuss estimate the potential contribution of main-tier renewables such as offshore wind, this environmental impacts of the technology is nonetheless considered in Chapter 5 of the DGEIS. In other words, evaluating additional scenarios will not substantially increase the range of potential environmental impacts considered in Chapter 5 of the DGEIS.

Comment: Several commenters noted that in some cases, the resources included in the scenarios represent aggregations of technologies that can have varying characteristics, with respect to technology and/or fuel-type, operating characteristics and emission profiles. Therefore, the final GEIS should provide more detail regarding the specific technologies and resources that contribute to each scenario. Similarly, several commenters also suggest that the DGEIS should categorize DERs consistently in Exhibits ES-1 and ES-3.

Response: Data of a sufficiently granular level are not readily available to disaggregate the groups of technologies and/or fuel sources relied upon in Chapter 4 (and presented in Exhibit ES-1) of the DGEIS. Further disaggregating these categories to specify individual technologies would require assumptions further removed from available data and information, and portray a false sense of precision regarding the contribution of individual technologies to the total contribution of the larger categories of customer-sited renewables and/or distributed generation.

Comment: The DGEIS fails to incorporate cost-efficiency improvements for renewable energy. The DGEIS should be revised to take into account future advancements in the cost-efficiency of renewable energy. For example, while the cost of wind energy has declined, the average capacity factor has increased. While the DGEIS cites the increase in capacity factor, it does not mention the decrease in costs. Additionally, solar PV enhancements through NY-Sun will likely further drive down costs and increase efficiency for solar technology. The final GEIS should take into account future advancements in cost-efficiency for New York's utility-scale renewable resources.

Response: Incorporating projected reductions in the cost of renewable energy technologies in coming years could be handled in several ways. One approach could assume that the bounding scenarios include the same amounts the renewable capacity, but at a lower cost than is currently reflected in Exhibit 4-3. Alternatively, we could assume that spending on renewable technologies remains the same, but "buys" more renewable capacity as a result of falling costs.

The latest "Levelized Cost of Energy Analysis – Version 8.0" published by Lazard shows that wind generation costs fell by 58 percent from 2009 to 2014, at an average rate of over 13 percent per year, although the rate of decrease has slowed over that period.[629] Further cost reductions at a moderate 10 percent annual rate would reduce wind costs by one-third by 2020 and two-thirds by 2025. Applying this trajectory for all utility-scale

[629] Lazard. 2014. Lazard's Levelized Cost of Energy Analysis – Version 8.0. September. Accessed January 14, 2015 at: http://www.lazard.com/PDF/Levelized%20Cost%20of%20Energy%20-%20Version%208.0.pdf.

renewables and assuming constant spending would increase the reported peak reduction from this resource by 25 percent in the lower bound scenario and 68 percent in the upper bound.

Solar PV costs have fallen dramatically in recent years, 78 percent from 2009 to 2014,[630] but projections for further cost reductions are substantially lower ranging from two percent to six percent per year.[631] Assuming a moderate four percent annual cost reduction for customer-sited renewables would produce a 15 percent and 30 percent reduction in costs by 2020 and 2025, respectively. Such price reductions would in turn increase peak reduction capacity by nine percent in the lower bound scenario and 17 percent in the upper bound scenario.

Chapter 5 of the final GEIS has also been updated to recognize the declining cost of wind and solar technologies over time.

Comment: That DGEIS incorrectly omits utilities-scale renewables as contributors to peak demand reduction. For example, NYISO's 2014 Power Trends report concludes that wind energy helped address power demand during peaks in the summer of 2013 and winter of 2014.

Response: We disagree with the commenter's interpretation of the DGEIS' treatment of utility-scale renewables. The DGEIS states "[t]he scale of [utility-scale or main-tier] these resources **generally** precludes locating them near load centers; therefore, they contribute less to the distributed energy objectives of the REV" [emphasis added].

While Chapter 4 of the DGEIS does not develop a quantitative estimate of the potential contribution of utility-scale renewables to peak reduction, Chapter 5 of the DGEIS assesses the potential positive and negative impacts of increased penetration of utility-scale/main-tier renewables in New York's power sector. As such, revising the analysis in Chapter 4 to include contributions by utility-scale/main-tier renewables to peak reduction capacity is unlikely to change the assessment or discussion of impacts in Chapter 5 of the DGEIS.

Comment: Exhibits 5-6 and ES-3 should be clarified as summarizing only direct impacts and a separate summary should be developed that highlights the potential indirect impacts of the listed technologies. One commenter expressed concern that only one technology received positive or potentially positive ratings in this summary table.

Response: Exhibits ES-3 and 5-6 in the DGEIS reflects the direct impacts of each individual technology. To minimize the potential for misinterpretation, these exhibits have been removed from the final GEIS. Chapter 5 of the final GEIS has also been re-organized to clearly delineate discussion of direct and indirect effects. Greater clarification on the underpinning rationale for the approach selected to assess environmental impacts is provided in Section 5.1 of the final GEIS.

[630] *Ibid*.

[631] Solar Industry Update," D. Feldman, National Renewable Energy Laboratory, 17 December 2013; "Photovoltaic System Pricing Trends," D. Feldman et al, NREL, 22 September 2014.

As discussed in Chapter 5 of the final GEIS, direct effects represent the expected results of increasing the use of each technology on an individual basis. In considering the direct effects of each technology, we consider the environmental impacts associated with each technology's operations and fuel source. With respect to the direct effects of an increase in the use of biogas, the potentially positive and positive impacts assigned in the draft GEIS relate to using manure or landfill waste as a fuel source, which would result in positive or potentially positive environmental impacts as traditional disposal of these wastes is then avoided. In contrast, when considering the impacts of biomass technologies, the draft GEIS assigned a potentially negative impacts based on the potential for fuel-source related impacts from increased agriculture activities associated with growing biomass crops such as sawgrass. Examination of the indirect impacts of the REV and CEF – impacts which occur in later in time or further away, such as displacement of fossil fuel generation, are discussed qualitatively in Section 5.1 of the DGEIS and Section 5.3 of the final GEIS.

Comment: The DGEIS does not consider the important effects that different DER technologies may have when complementing each other. For example, energy storage and fossil-fired DG can increase the ability of the grid as a whole to integrate higher levels of variable renewable generation. Numerous studies highlight the importance of "hybrid" systems in providing grid stability, reliability and resiliency, such as PV-trigeneration, PV-cogeneration, CHP-energy storage, and PV-storage systems.

Response: We agree that implementation of the REV and CEF will inherently result in the interaction of multiple resources and technologies. Throughout the document, the DGEIS acknowledges the potential for complementarity between multiple technologies. For example, Chapter 5 acknowledges the critical relationship between energy storage and low-carbon energy generation, including PV and other renewable energy resources. Section 5.2 of the DGEIS broadly discusses the role of smart grid technologies, describing such technologies as critical for other resources, such as economic demand response programs, variable charging rates, GVI, and renewable generation, to achieve their full potential (DGEIS, p. 5-3). In response to the comments submitted, Chapter 5 of the final GEIS has been further revised to include additional references to "hybrid" systems cited by the commenter, including PV-trigeneration, PV-cogeneration and CHP combinations.

Comment: The DGEIS fails to appropriately acknowledge the benefits of energy storage in increasing grid efficiency and avoiding transmission & distribution losses.

Response: Chapter 5 of the final GEIS has been updated to more clearly acknowledge the benefits of energy storage to reduce loss of electricity during transmission and distribution. Clarifying text has also been added to the discussion of energy storage technologies to ensure consistency between Chapters 4 and 5 of the final GEIS.

Comment: It is inappropriate for the DGEIS to assign negative impacts to all types of fuel cells in Exhibits ES-3 and 5-6. The DGEIS should be revised to distinguish the different environmental impacts of various types of fuel cell and applications. For example, the DGEIS does not recognize positive emission impacts of fuel cells as compared to traditional central utility power plants, nor does it recognize the positive impacts from reduced water consumption that could result if fuel cells are installed to displace energy generated through the baseline utility system. Several commenters also noted that risks from hydrogen leaks and flammable liquids exist in some types of fuel cells, but not others. One commenter further notes that the concern for hydrogen leaks from fuel cells is grossly overstated because stationary fuel cell products are certified to an international safety standard. Another commenter asserts that the DGEIS incorrectly associates fuel cells with traditional combustion-based DG.

> **Response**: As noted in the section on Fuel Cell Energy in Section 5.3 of the DGEIS, fuel cell design is complex and varies depending on fuel cell type and application. As requested by several commenters, Chapter 5 of the final GEIS has been updated to reflect additional information regarding the differences in environmental impacts across different types of fuel cells and fuel cell applications. As previously discussed, to minimize the potential for misinterpretation of Exhibits ES-3 and 5-6 in the DGEIS, these exhibits have been removed from the final GEIS.

Comment: Chapter 4 omits some technologies, such as fuel cells, microturbines, and small gas turbines, which have favorable environmental profiles and options available for mitigating emissions. Chapter 4 should also include all-electric fuel cells in the analysis of energy generation potential and emissions impacts. California's Self Generation Incentive Program (SGIP) provides an example of the market potential of all-electric fuel cells within a state with GHG reduction programs for DG in place. According to the program's 2012 impact report, all-electric fuel cells contributed 288 GWh in comparison to the 639 GWh combined of all other technologies, including CHP. The commenter also presents data from SGIP on CO_2 emissions impacts from fuel cells.

> **Response**: While fuel cells are not explicitly included as an individual resource in the analysis, they are noted as potential drivers of both customer-sited renewable and distribution generation capacity. Insufficient data exist, however, to further disaggregate the estimates of customer-sited renewables and distributed generation presented in Chapter 4 of the DGEIS. Doing so would require assumptions further removed from available data and information, and portray a false sense of precision regarding the contribution of individual technologies such as fuel cells to the total contribution of the larger category of customer-sited renewables and/or distributed generation.

Comment: Several commenters raised concerns about the possible proliferation of fossil fuel distributed generation under the REV and CEF. Many of these commenters recommended specific mitigation strategies that the Commission should adopt, including the incorporation of environmental benefits in future cost-benefit analyses, the exclusion of "dirty" sources, emissions standards such as those adopted by the California Air Resources Board (CARB), and a system for periodic review of the project portfolio.

> **Response**: As discussed in Chapters 5 and 6 of the DGEIS, we agree that the proliferation of fossil-fuel based DG in response to the REV and CEF may result in adverse environmental impacts. Chapters 5 and 6 of the final GEIS have been further updated to include the additional mitigation strategies raised by commenters.

Comment: The DGEIS does not give adequate treatment to global warming and community resilience. While the DGEIS does an excellent job of recognizing the potential for climate change to harm our society, the DGEIS should include a qualitative analysis of climate change adaptation. For example, the GEIS should evaluate how resilient a post-REV energy system will be to effects of future climate change, such as sea level rise, storm surge, inland flooding, extremely precipitation, and extreme heat.

> **Response**: The DGEIS provide a limited discussion of climate change risks and potential benefits of the REV and the CEF in terms of increased reliability and greater resilience to the effects of climate change (See Chapter 9, page 9-6). In response to the concerns raised, Chapters 3 and 9 of the final GEIS have been expanded to further discuss both climate change risks and the potential benefits the REV on the State's climate change resiliency.

Comment: The Commission should consider additional policies designed to continue the program commitments of existing energy programs, including the EEPS and RPS.

> **Response**: Development of policy is not the role of the GEIS. However, the outcomes of the REV and CEF proceedings are intended to build on the progress of the Commission's clean energy programs, including EEPS and RPS.

Comment: Environmental justice concerns and impacts to low-income communities merit significantly more detail and examination. Concern exists that low-to-moderate income residential customers may realize only the costs, and not the benefits of the REV. The Commission needs to consider inclusion of more specific institutional protections for low-to-moderate income residential ratepayers in the REV and CEF framework.

> **Response**: While the intent of the GEIS is not to set Commission policy on energy affordability, the Commission is engaged on a number of fronts in the REV and CEF proceedings to address low to moderate income customers that include sustaining commitments to affordable universal service, system wide benefits and consumer protections. Additional emphasis on LMI customers is also being articulated in NYSERDA's CEF proposal that includes identification of barriers and strategies to improve energy affordability and to better engage the LMI community to deploy more clean resources to obtain energy and economic benefits. In addition, the Commission has recently launched a proceeding in Case 14-M-0565 – In the Matter of Examining Programs to Address Energy Affordability for Residential Utility Customers, to review and assess the adequacy of the commission's low-income programs.

Comment: Two commenters suggested methodologies to be used in future planning and project-specific review under the REV and CEF, including ecosystem services, triple bottom line, optimization models, the SWITCH tool, NREL development pathways, and landscape scale spatial planning.

> **Response**: While the GEIS is based on conceptual information and general projections for future activity, the REV and CEF proceedings allow ample opportunity for stakeholder input for suggestions on specific technologies and methodologies, as described above.

B.3 ADVANCED ENERGY ECONOMY INSTITUTE (AEEI), ON BEHALF OF ADVANCED ENERGY ECONOMY (AEE), THE ALLIANCE FOR CLEAN ENERGY NEW YORK (ACE NY) AND THE NEW ENGLAND CLEAN ENERGY COUNCIL (NECEC)

(AEEI2) Comment: The timeframes for the projected lower and upper bound scenarios are only loosely defined, making it difficult to assess the reasonableness of the DGEIS projections. The commenter also expresses confusion with the use of different timeframes for the "upper" and "lower" bounds. A more effective approach may be to construct the two bounds using the same timeframes with different parameters, such as technology cost and performance, policies, and economic growth.

> **Response:** The two scenarios use different timeframes to construct a pair of alternatives encompassing the widest range of possible outcomes. Capturing the resulting, maximum-possible range, allows for the analysis of a wide range of potential impacts of the REV and CEF. With respect to using different parameters as the basis for constructing the two bounding scenarios, the purpose of an EIS is to assess the potential impacts of various alternative approaches for accomplishing a given objective. In doing so, assumptions regarding those aspects of the scenario that are exogenous to the alternatives, such as economic growth or changes in technology cost and performance, must be kept constant. To assess differences in environmental impact from differences in these assumptions would be to conduct an EIS on those exogenous factors, rather than the original actions themselves.

(AEEI3) Comment: It is unclear which programs and policies are considered part of each scenario in Exhibits ES-1 and 4-1. For example, it is unclear whether the NY Sun Initiative, which is targeting more than three GW of solar by 2023, is considered part of the baseline or in the alternative scenarios. According to Exhibit 4-1, the upper bound of the alternative scenario shows just 241 MW of customer-sited renewable energy, but the baseline capacity in this category is just 54 MW. This inconsistency suggests that the market size for customer-sited renewables may be overly conservative in the DGEIS. The final GEIS should include greater clarification regarding the data relied upon under each scenario.

> **Response:** The NY-Sun target of three GW represents total installed capacity across both residential and non-residential systems, across all size classes. The customer-sited renewables resource included in the DGEIS bounding scenarios is more comparable to the NY-Sun blocks designated for smaller-scale systems less than 200 kW. The NY-Sun website notes 1.68 GW of capacity targeted for these smaller-scale systems. This value, however, further represents installed nameplate capacity, not on-peak demand reduction. In the case of PV, the DGEIS assumes a 25 percent contribution by these systems to peak demand reduction. Therefore, the NY-Sun initiative target represents 420 MW of peak demand capacity by 2023, as compared a total peak demand capacity of 295 MW under the upper-bound scenario modeled to occur by approximately 2025. While this is less than the NY-Sun target, this amount is within the range of potential outcomes given the uncertainty of the REV and CEF at this time. As noted on pages 4-7 to 4-8 of the DGEIS, EE and "retail" (i.e., customer-sited) PV will contribute 491 MW to New York peak load in 2015, based on NYISO's load forecast. Of this amount, the DGEIS assumes that customer-sited PV contributes 54 MW of this total, based on the relative proportion of

actual 2013 reductions from those two resources as reported by the IOUs and NYSERDA.

(AEEI4) Comment: Exhibits 4-1 and 4-2 and the corresponding exhibits in the Executive Summary should present data on an annual and cumulative basis over the study period for all scenarios, with the timeframe clearly identified.

Response: The upper and lower bound scenarios presented in Chapter 4 were constructed based on a cumulative time period of five and 10 years, respectively. Data are not currently available to model the likely trajectory of each resource category on a year-by-year basis.

(AEEI8) Comment: Exhibit 4-3 should be modified to include quantified cost savings estimates. Further, the DGEIS should indicate whether the costs presented are capital expenditures, operation costs, or are based on lifecycle costs, and indicate the timeframe.

Response: The costs presented in Exhibit 4-3 represent a present value of the incremental capital expenditures necessary to achieve the stated quantity of each resource over the relevant timeframe for the lower and upper bounds (i.e., five and 10 years, respectively). Developing cost savings estimates for each resource category would require a detailed model of the entire power-sector, potentially extending beyond the boundaries of New York State. The inputs and assumptions necessary for such a modeling exercise are not currently available, nor would the resulting analysis significantly change the analysis of environmental impacts in Chapter 5 and the discussion of mitigation in Chapter 6.

(AEEI12) Comment: The assumptions for the CHP and DG market potential seem arbitrary and likely grossly underestimate the potential for these two categories.

Response: As discussed in Chapter 4 of the DGEIS, current estimates of the technical and economic potential for CHP in New York State far exceed both past and current installation rates. The difference between the economic potential and realized investment in CHP is the result of many barriers, including challenges with interconnection, risk from changes in fuel and electricity prices, and technical complexity. As such, estimates of CHP penetration are based on the potential contribution from CHP to the alternatives as a function of recent and planned installation rates, increased to reflect the possibility of additional focus and prioritization of this resource under the REV and revised CEF frameworks.

(AEEI16) Comment: The DGEIS incorrectly includes geothermal heat pumps (GHPs) within the discussion of Low-Carbon and Carbon-Free Energy Resources. This section is mainly about energy supply, whereas GHPs are best thought of as high-efficiency space conditioning equipment, not an as an energy resource. Therefore, this section should be deleted or integrated within the discussion of energy efficiency.

Response: As explained in the Chapter Organization section in Chapter 5 of the DGEIS, Section 5.3 examines clean energy resources and technologies designed to increase the penetration of renewable energy-based energy generation, while Section 5.2 introduces clean energy resources and technologies designed to optimize power consumption and reduce the need for electric power. Based on this organizing framework, GHPs can reasonably be included in Section 5.3. However, Chapter 5 of the final GEIS has been updated to recognize that GHP could also have been considered as part of the discussion in Section 5.2 of the DGEIS on technologies that optimize energy consumption.

B.4 BLOOM ENERGY (BE)

(BE3) Comment: The DGEIS should further distinguish between different types of fossil fuel-based DERs. For example, reciprocating engines operate at efficiencies in the range of 30-40 percent and generate electricity using a combustion process resulting in significant criteria air pollutants, noise and odor pollution, and in some cases high water use. All-electric fuel cells, which are currently included in the same category, have a fundamentally different profile; they generate electricity at efficiencies closer to 60 percent via a non-combustion electrochemical process, thereby virtually eliminating criteria air pollutants, noise and odor pollution, and water use. None of the technology categories should include different technologies with significantly different environmental attributes.

Response: We agree that different types of fossil-fuel based DERs have differing environmental impacts. The discussion of environmental impacts in Chapter 5 of the final GEIS has been expanded to include additional information provided by the commenter.

(BE4) Comment: The DGEIS should be revised to include a quantitative assessment of the benefits of various technologies.

Response: As noted in the DGEIS, the exact mechanisms that will occur under REV and CEF are uncertain at this time, thus a quantitative analysis of the benefits of various technologies (or combinations of technologies) is not possible at this time. Chapters 5 and 9 of the DGEIS provide a generic and qualitative description of the potential environmental benefits of various technologies and resources that could be implemented under the REV/CEF. A more detailed analysis of impacts (both positive and negative) will be required under appropriate federal, state, and local permitting and environmental review processes when potential site-specific projects are proposed.

B.5 CLEAN ENERGY ORGANIZATIONS COLLABORATIVE (CEOC)[632]

(CEOC6) Comment: Chapter 6 does not include any reference to development of a New York State distributed generation emissions rule.

Response: Section 6.1, *Potentially Applicable Federal and State Regulations*, of the DGEIS discuss both State and federal regulations that may apply to distributed generation. This section also discusses several State regulations that may apply to specific distributed generation technologies, including biomass, municipal waste combustion, and landfill gas combustion. This section also briefly describes 6 NYCRR Part 222, a proposed rule which may establish state-wide emission standards and capacity

[632] Alliance for a Green Economy, American Lung Association of the Northeast, Association for Energy Affordability, Citizens' Environmental Coalition, Columbia University's Sabin Center for Climate Change Law, Environmental Advocates of New York, Pace Energy and Climate Center, The Nature Conservancy, Sierra Club, and the Vermont Energy Investment Corporation.

limits for distributed generation sources; however, the DGEIS also acknowledges that the course of this regulatory initiative is uncertain at this time.

(CEOC8) Comment: The regulatory and institutional changes required to facilitate REV and CEF (namely the creation of a DSPP) may take many years to become effective. As such, it may be that the timeframe established for the alternative projections are too short. The lower bound assumption of approximately five years assumes that the changes needed to make REV and CEF work will be designed, implemented, and operational relatively quickly.

Response: We agree that the exact timing of the changes related to REV and CEF is unknown. As previously discussed, however, the scenarios constructed and presented in Chapter 4 are designed to represent an upper and lower bound on the range of possible outcomes of the REV and CEF proceedings, where the lower bound is designed to represent a reasonable peak demand reduction that could be achieved within five years. The lower bound does not necessarily suggest that all actions or goals of the REV and CEF will be achieved within five years, but rather that a peak load reduction of three percent could reasonably be achieved as a result of the REV and CEF proceedings within five years.

(CEOC9) Comment: Exhibit 4-1 fails to take into account any change in overall energy consumption during non-peak times, focusing instead on each energy resource's contribution to reductions in peak demand and grid-based generation. Exhibit 4-2 shows emissions reductions based only on the corresponding peak demand reduction. These exhibits should be amended, or additional exhibits added to the final DGEIS, to show calculated overall emissions reductions.

Response: The commenter's statement is incorrect. As stated in the DGEIS (page 4-5), "[i]n some cases (e.g., energy efficiency, renewable energy systems), the resources deployed to reduce peak demand may also result in lower total energy consumption, which translates to lower emissions." The emissions reductions presented in Exhibit 4-2 are actually based on reduction in grid-based consumption of fossil fuels over all time periods, not just peak periods. Chapter 4 of the final GEIS has been revised to clarify the methodology used to calculate emission reductions presented in Exhibit 4-2.

(CEOC10) Comment: The assumptions in the DGEIS regarding energy efficiency achievements are inconsistent with the fact that the CEF calls for a decrease in financial support for NYERDA's energy efficiency programs. The assumption that distribution utilities will continue to invest resources in energy efficiency programs for their customers is not guaranteed. The PSC should consider an order and enforcement to ensure that distribution utilities continue to invest in energy efficiency.

Response: Chapter 1 acknowledges that the CEF funding is anticipated to be lower than the current programs the CEF is replacing. However, energy efficiency outcomes are not be driven solely by the level of financial support from the CEF. While NYSERDA anticipates decreasing its funding over time, NYSERDA is also shifting its overall strategy for supporting the State's clean energy industry. A key objective of the CEF is to design its activities to foster new investment opportunities and attract private investment in clean energy technologies in the State of New York. As such, there is uncertainty about the total amount of funding available for energy efficiency initiatives following implementation of the CEF. The assumptions underlying the future potential of energy efficiency is described in more detail in Section 4.4 of the DGEIS.

(CEOC11) Comment: The Commission should set either MWH targets for energy efficiency or determine a fixed energy efficiency budget, and then revise the DGEIS based on assumptions corresponding to these two approaches.

Response: It is not the intent or the place of the GEIS to set future policy for the Commission. Although MWH targets for energy efficiency and overall budgets may be set for the REV and CEF programs, part of the intent of these programs is to move away from use of strictly traditional metrics such as MWH to measure success and include other benefits such a market penetration and deployment of new technologies, resiliency and other system and consumer benefits.

(CEOC14, CEOC15) Comment: The use of a 2009 FERC study to inform bounding scenarios for DR capacities may be inappropriate, as FERC may not have jurisdiction over demand response programs following the D.C. Circuit's opinion in *Energy Power Supply Association v. FERC*, 753 F.3d 216 (D.C. Cir. 2014), invalidating FERC Order 745. Further, data from the 2009 FERC study may not be applicable or accurate within the 2016 REV implementation period or the upper-bound projection of 2025.

In the event that the D.C. Circuit's opinion invalidating FERC Order 745 remains valid, the Commission should develop its own demand response programs through utility purchase or within the wholesale market. Doing so will ensure that the DGEIS's assumptions regarding DR remain accurate.

Response: The cited court opinion invalidating FERC Order 745 is not relevant to the estimate of demand response potential because the FERC did not base its estimates of demand response potential on FERC's own jurisdiction or authority over demand response programs. To the extent that a study based on data and assumptions from 2009 and earlier is not applicable to the bounding scenarios presented in the DGEIS, the relevant comparison is between the relevance of data available in 2009 and the data available at the time of the analysis. While some uncertainty is created by potential changes in conditions and technology over the preceding five years, the magnitude of this uncertainty is likely no greater than the uncertainties in the other aspects of the DR analysis or the DGEIS overall. In addition, in developing the DR contribution to the bounding scenarios, the DGEIS assumes a level of DR considered "achievable" by the FERC study's authors, or approximately 70 to 80 percent of the estimated "full participation" potential. Therefore, to the extent that DR potential has diminished over the recent past, evidence remains that the assumed DR contribution to the scenarios is reasonable. Lastly, a more recent nation-wide analysis of DR potential is not available.

(CEOC16) Comment: The upper and lower bounds for CHP deployment are not justified. While the DGEIS notes that actual deployment has deviated from past installation projects due to technical challenges, the DGEIS provides little information as to how it reaches the adjusted figures. The DGEIS should use current projections or more thoroughly justify its projections.

Response: The comment incorrectly characterizes the discussion and analysis of CHP in the DGEIS. As stated on page 4-10 of the DGEIS, "Current estimates of the technical and economic potential for CHP in New York State far exceed both past and current installation rates." [emphasis added]. An estimate of the economic potential for a particular technology such as CHP is not a projection of what will actually happen in the future, but a theoretical upper limit based on a single factor (i.e., cost-effectiveness). A projection would need to incorporate consideration of policy factors and initiatives that may or may not come to pass. In lieu of any certainty or specific policy actions resulting from the REV and CEF, the bounding scenarios include amounts of CHP based on increases over recent and actual installation rates, likely a far better basis for prediction of future rates than a theoretical economic potential estimate. The stated increases in installation rate (i.e., 50 percent and 300 percent greater than current rates) are intended to represent a reasonable range designed to inform the assessment of environmental impacts.

(CEOC17) Comment: The DGEIS fails to accurately show how variations in CHP systems result in significantly different emissions profiles. CHP systems vary greatly – engine design, fuel type, and other load specifications – and thus, have different emission profiles. The final GEIS should provide a clearer understanding of the treatment of CHP based on varying operational characteristics.

Response: We agree that the emission profiles of different types of CHP systems vary. The discussion of environmental impacts of CHP systems included in Section 5.2 of the final GEIS has been expanded to include additional information regarding the environmental impacts of different types of CHP systems provided by the commenter.

(CEOC18) Comment: The DGEIS should recognize that thermal demand, not electric demand, determines electricity production from CHP systems which are generally operated to follow thermal demand. If absent this concept should be incorporated into the final GEIS because it may impact the amount of CHP-based electricity generated during summer peak periods.

Response: We agree that CHP systems typically are thermal-load following because thermal load is typically the limiting factor in usable system output, and therefore maximum efficiency is reached when neither electric nor thermal output is wasted. However, depending on the nature and severity of peak load conditions, it may be economically reasonable for CHP systems to operate at less than maximum efficiency in order to provide distributed electric energy in support of the power system. Therefore, the DGEIS makes the simplifying assumption that CHP capacity is available for peak demand reduction. Chapter 4 of the final GEIS has been updated to further clarify this assumption.

(CEOC20) Comment: The DGEIS incorrectly qualifies the success of the RPS program as uncertain. While NYSERDA is not on track to achieve its 2015 RPS target, the program has still proven to be extremely cost-effective at increasing fuel diversity and reducing carbon emissions, and has produced direct economic investment at a benefit-cost ratio of $3 to $1.

Response: Chapter 1 of the DGEIS describes the RPS and its current progress (DGEIS, pp. 1-12 to 1-14). As the commenter notes, achievement of the 2015 RPS target is uncertain; however, we agree that the overall success of the program can be measured in other terms. Chapter 1 of the final GEIS has been updated to incorporate the additional information raised by the commenter on the economic and environmental outcomes of the RPS.

(CEOC25) Comment: The DGEIS downplays many of the important environmental values of resources that optimize energy consumption and fails to present an accurate depiction of the true long-term environmental impacts of these resources. Rather than presenting both energy generating resources and resources that optimize energy consumption into one summary table, the benefits of such resources should be properly considered in a separate summarizing exhibit.

Response: The longer-term, indirect effects of the clean energy resources and technologies are discussed qualitatively in Section 5.1 of the DGEIS and Section 5.3 of the final GEIS. Additional discussion of the benefits associated with resources that optimize energy consumption are included throughout Chapters 5 and 9.

(CEOC26) Comment: The DGEIS should more comprehensively highlight early phase environmental impacts, including the manufacturing phase of solar PV cells and land disturbance from siting wind turbines.

Response: Pages 5-22 to 5-23 of the DGEIS discuss common impacts that may occur during construction of low-carbon and carbon-free energy resources.

(CEOC28) Comment: In the context of mitigation methods for small-scale fossil-fuel facilities, the commenters commend DPS for advancing the notion of eligibility standards for REV. DPS should also, however, provide assurance that these alternative policies will be included in the Track Two REV Proceeding.

Response: It is not the proper role of the GEIS to commit the Commission or Department to any future course of action, but rather review the potential impacts of the actions that have been proposed. The GEIS has identified that increased deployment of small-scale fossil-fuel facilities may result from the REV/CEF programs, and has identified measures to eliminate, minimize or mitigate the impacts of such facilities, including eligibility standards for the REV program. The Commission may consider potential environmental outcomes in performance-based rulemaking in addition to market rules and pricing.

(CEOC29) Comment: The DGEIS must account for all the various scenarios of fossil fuel generation that may be created by REV, including existing CHP systems running more often, and backup generators being run for economic (and not backup) purposes. Only by adequately accounting for the contributions of such types of small-scale fossil fuel-based distributed generation can the Commission take steps to mitigate them in Track 2.

Response: We disagree that additional scenarios are required before the Commission can consider strategies to mitigate the possible proliferation of small-scale fossil fuel-based distributed generation. Chapters 5 and 6 of the DGEIS already recognize and discuss this potential area of risk. These two chapters have been further revised in the final GEIS to reference additional concerns and possible mitigation strategies raised during the public comment period.

(CEOC30) Comment: The DGEIS should expand on the codes and regulations mentioned as applicable to small-scale combustion sources in the pull-out box in Chapter 5, *Mitigating Potential Impacts Associated with Small-Scale Fossil Fuel-Based Generation*, such as how permits govern conventional backup generators, and whether changes in the permit attainment process could help to alleviate concerns about the proliferation of these sources.

> **Response**: Chapter 6 of the DGEIS discusses both State and federal air emissions regulations that may be applicable to distributed generation. As suggested by the commenter, the text box in Chapter 5 of the final GEIS has been revised to include additional information applicable to backup generators.

B.6 CITIZENS' ENVIRONMENTAL COALITION (CEC)

(CEC2) Comment: The DGEIS fails to acknowledge that the REV pertains solely to retail energy markets.

> **Response:** The REV does not pertain solely to retail energy markets. As discussed in the REV Straw Proposal filed on April 24, 2014, achieving the vision of the DSPP, a fundamental component of the REV, will require examining how enhanced integration of DER by the DSPP will impact, and be impacted by, already existing wholesale-level competitive markets, programs, and processes.

(CEC3) Comment: The DGEIS fails to analyze the environmental impacts of existing nuclear energy facilities. One commenter states that the PSC is involved in contracts that subsidize wholesale centralized generators, which is inconsistent with stated REV goals. The commenter states the "above market rate subsidies" to nuclear reactor facilities in particular is not in the public interest, due to the potential environmental impacts of these facilities in relation to safety concerns and radioactive waste accumulation.

> **Response**: Although it is not clear from the comment, it appears the concern involves Reliability Support Services Agreements that are under discussion with the owners of some nuclear generation facilities in the state. Those discussions are separate from and beyond the scope of the REV/CEF proceedings and therefore were not considered in the GEIS.

(CEC4) Comment: The DGEIS' description of the proposed action does not constitute clean energy, as it includes fossil fuels, nuclear energy, and biomass combustion.

> **Response**: The definition of "clean energy" is a matter of policy. A key principle of REV is to enhance deployment of distributed energy resources and some of these may utilize wind or solar but also bio-mass and potentially fossil fuels under prescribed conditions.

(CEC5) Comment: The proposed goals in the DGEIS are inadequate, as it only considered very limited greenhouse gas emission reductions and no plans to achieve 80 percent reductions by 2050. Furthermore, the proposed actions described in the DGEIS do not include metrics for measuring and monitoring progress on energy efficiency, clean renewables, job creation, and lower energy costs. The DGEIS also do not include a plan to inform and educate the public about changes in the energy system in order to encourage meaningful engagement.

Response: This comment seems directed at elements associated with the design and implementation of the REV/CEF. The more appropriate forum for such comments is review and comments of REV/CEF proposals rather than the analysis of potential impacts performed in the GEIS. To the extent that the comment is directed at the REV/CEF objectives which guided development of the scenarios in Chapter 4, we direct the commenters to Chapter 4 of the final GEIS and Section B.2, p. B-3 for further discussion of the approach used to develop the GEIS alternatives.

(CEC10) Comment: The DGEIS does not analyze consumer costs and consumer protections.

Response: The DGEIS discusses anticipated costs of the REV and CEF in Chapters 4 and 9, including an indication of which types of costs might be incurred by society in Exhibit 9-3. These "societal" costs can also be viewed as costs to consumers. In addition, the Environmental Justice section of Chapter 9 outlines objectives of the CEF proposal which include consumer protections. As mentioned in Chapter 1 of the DGEIS "[t]he recently initiated phase of Case 12-M-0476 will explore best practices related to data ownership, data interchange, and rules for third-party data access, incorporating appropriate consumer privacy protections, as well as whether and how statewide policies should be developed."

(CEC11) Comment: The DGEIS does not adequately analyze nuclear energy and waste. In particular, the DGEIS fails to analyze the significant environmental impacts posed by our existing fleet of aging nuclear reactors that have major safety concerns and accumulating inventories of high level radioactive waste.

Response: As discussed in Chapter 2 of the DGEIS, (pages 2-11 to 2-18), nuclear power has historically contributed to base-load generation in New York State, with nuclear generation accounting for just under a third of total generation in 2013. While the mechanisms by which the REV and CEF will achieve their goals are still under development, and the exact mix of clean energy resources and technologies that will be implemented under the REV and CEF programs is uncertain, increased use of nuclear energy is not one of the outcomes contemplated under the clean energy goals of the REV and CEF. As such, the impacts of nuclear waste are not discussed in detail in the DGEIS. In addition, the extent to which implementation of clean energy technologies contemplated under the REV and CEF might lead to a reduction in the use of nuclear energy is unknown at this time; thus, the potential impacts of such a reduction are discussed only qualitatively in the DGEIS. Chapter 5 (pages 5-5 to 5-6) of the DGEIS discusses potential impacts of displaced nuclear generation.

B.7 CITY OF NEW YORK OFFICE OF SUSTAINABILITY (CNYOS)

(CNYOS2) Comment: While distributed generation allows utilities to locate distributed energy resources closer to consumers, incremental investment needed to connect new DER resources to the grid may offset the benefits described in the DGEIS.

Response: Chapter 9 of the final GEIS has been revised to acknowledge the incremental infrastructure investment that will be required to connect new DER resources to the grid and the uncertainty in how such investments compare against the potential infrastructure that may be avoided by decentralizing New York State's electricity system.

B.8 DOOSAN FUEL CELL AMERICA (DFCA)

(DFCA1) Comment: Chapter 4 of the DGEIS is too conservative in its treatment of the benefits that could result from displacing thermal load and grid generation with more efficient CHP systems. Based on information from the U.S EPA eGRID database (9^{th} ed. V 1.0), installing one MW of fuel cells would reduce nearly five metric tons of NOx and over 11 metric tons of SOx annually.

> **Response:** As noted, Chapter 4 takes the conservative view that fossil-fuel fired CHP systems do not result in net reductions in emissions. While it is true that some types of CHP systems may reduce emissions, particularly the emissions noted by the commenter, it is also true that some CHP systems increase emissions if they are only moderately efficient and may displace low- or no-emission grid generation such as nuclear and hydroelectric. Without a highly disaggregated and detailed assessment of both the wide variety of operating characteristics and a power sector model to determine changes in grid-based generation on a daily or hourly basis, the GEIS makes the conservative assumption that on average, across all potential scenarios, CHP systems result in no net reduction in emissions.

(DFCA5) Comment: The conclusion that fuel cells have a negative impact on waste management is unsupported and inconsistent. Not all fuel cells contain hazardous waste and while some municipal solid waste (MSW) is produced during maintenance and end-of-life decommissioning, other generation technologies (such as solar, wind, geothermal, and ocean energy) also produce MSW but the DGEIS concludes no waste management impacts for such technologies.

> **Response**: Discussion of fuel cell energy in the DGEIS notes that some fuel cells contain flammable liquids, including methanol, formic acid, certain borohydride materials, and butane. We agree, however, that not all fuel cells contain hazardous waste. The final GEIS has been revised to make this distinction and provide additional support for the assessment of the environmental impacts of fuel cells.

(DFCA6) Comment: The conclusion that fuel cells may have a negative impact on public health is unsupported. Fuel cells can result in significant savings of both criteria air pollutants, greenhouse gas emissions, and regional water use, all of which have the potential to benefit public health.

> **Response**: Chapter 5 of the DGEIS acknowledges the potential for fuel cells to have "lowest level of air emissions of any fossil fuel-based electricity generating technology" and that fuel cell technology could advance to the point where heat and water are the only byproducts of fuel cell energy. However, the DGEIS also acknowledges the risks of fuel cell energy associated with the fuel cell technology itself. The final GEIS has been updated to provide additional support for the assessment of the environmental impacts of fuel cells and the circumstances under which varying environmental impacts may arise.

(DFCA7) Comment: Fuel cells are extremely quiet and will not adversely impact noise pollution.

> **Response**: We agree that fuels cells do not create any noise pollution. Exhibits ES-3 and 5-6 of the DGEIS are consistent with this statement (i.e., "noise and odor pollution" were rated "no impact" for fuel cells).

B.9 NEW YORK DEPARTMENT OF STATE, UTILITY INTERVENTION UNIT (UIU)

(UIU1) Comment: The DGEIS lacks sufficient explanation of the assumptions and data relied upon. In particular, the examples used to illustrate the benefits of greater system efficiency provided in the DGEIS may be unrepresentative. For example, the estimated long-term avoided capacity and energy savings of between $1 billion and $2 billion per year is based on unrepresentative data due to the fact that the 2013 summer was unusually hot. The final GEIS should be based on fully identified assumptions and appropriate data, and avoid generalizing outcomes based on insufficient data.

> **Response**: The sources for assumptions and data relied upon in the analysis are identified in the footnotes included throughout the DGEIS, as well as supported by the Reference list included at the end of the report. As stated in Section 9.2, *Potential Benefits Categories*, the estimated benefits of increasing system efficiency are "illustrative examples" and not intended to be representative of exact benefits. Chapter 9 of the final GEIS has been revised to recognize that this example of potential benefits is based on data from an unusually warm summer in 2013.

B.10 ENVIRONMENTAL DEFENSE FUND (EDF)

(EDF1) Comment: The single greatest risk associated with the REV is the risk of increased greenhouse gas emissions from greater use of distributed fossil fuel power generation. Anecdotal evidence suggests that fossil fuel-based distributed generation in the form of emergency generators has become more widespread in recent years as a result of reliability issues during extreme weather events. The DGEIS should attempt to develop a reliable estimate of the amount and nature of back-up generation already in place in New York State, and a profile of the amount and type of back-up generation likely to come online in the foreseeable future. This additional information could be set forth in a Supplemental Environmental Impact Statement or in the Final Generic Environmental Impact Statement, as appropriate. To the extent that such information cannot be readily obtained due to the lack of any centralized directory of such resources, the commenter notes that in the future, developing such a directory would be a valuable first step toward evaluating and, ultimately, mitigating, the environmental impact of these resources.

> **Response**: We agree that the potential for the REV and CEF to increase fossil fuel-based distributed generation represents a significant risk of the REV and CEF proceedings. While backup generators used for non-emergency purposes are required to register or obtain a permit under Title V, backup generators used solely for emergency purposes are not currently regulated. Additionally, the universe of emergency backup generators varies widely, from small household units to larger units used by hospitals or other similar institutions. As such, data on the total universe of backup generators used in the State for both emergency and non-emergency purposes is not currently available. Chapter 6 of the

final GEIS has been expanded to provide greater detail on existing regulations for backup generators.

(EDF2) Comment: DPS should consider using a dynamic baseline year, consistent with the DGEIS' assessment of two alternatives based on dynamic conditions (i.e., five and ten years). The commenter further suggests that the State's draft Energy Plan may represent a potential source to devise a dynamic baseline scenario; specifically, the State's draft Energy Plan includes a "reference case" projecting New York State's electric mix in 2020 and 2030 (page 59).

Response: Although the exact results and outcomes of the REV and CEF are not known, it is reasonably certain that changes will occur in the current suite of policies and initiatives addressing energy generation and consumption, particularly demand side and distributed energy resources. Therefore, defining a "no action" outcome at some year in the future is functionally equivalent to constructing an additional scenario(s). Instead, the DGEIS relies on a near-term static baseline (i.e., 2015) to represent the "no action" alternative because such a baseline can be projected with relative certainty and it is unlikely that the REV and CEF will change New York State's electricity industry before the selected baseline year of 2015. With respect to the State's draft Energy Plan, the reference case is presented in terms of energy, rather than peak demand, and further does not specify any contribution by demand response or other distributed generation considered in the DGEIS.

(EDF3) Comment: While the DGEIS intimates than an obstacle to introduction of any kind of time-sensitive pricing for residential or smaller commercial customers is the cost of advanced metering, the DGEIS includes no incremental cost for "Rate Structures" in Exhibit 4-3. If implementation cost is an impediment, the DGEIS should draw from experience elsewhere to provide supporting evidence, incorporate applicable data, and formulate statements about the cost of advanced metering. The commenter cites several pilot studies as potential sources for information on this topic.

Response: To assess the potential additional costs of advanced metering, we reviewed the existing literature for data on costs from recent installations in New York and nearby states. While the commenter offers references to several pilot-studies on time-variant pricing, the majority of these studies occur in California and Oregon. More recent data on actual advanced metering installations in Vermont suggests an estimated cost of $221 per meter.[633,634] Based on this cost, approximately $318 million would be necessary to implement advanced metering on the number of residential households assumed in the analysis.

[633] Green Mountain Power. 2011. 2011 Integrated Resource Plan. Accessed January 14, 2015 at: http://www.greenmountainpower.com/upload/photos/250GMP_IRP_2011_Revised-_clean.pdf; Vermont Public Service Board. 2011. Petition of Green Mountain Power Corporation for approval of its Advanced Metering Infrastructure Plan. Docket 7704. July 22. Accessed January 14, 2014 at: http://psb.vermont.gov/sites/psb/files/orders/2011/7704 FNL.pdf.

[634] This value is also consistent with recent results from the Smart Grid Investment Grant (SGIG), which estimated a per meter cost of $269. (SmartGrid.gov. Advanced Metering Infrastructure and Customer Systems. Project Website. Accessed January 15, 2015 at: https://www.smartgrid.gov/recovery_act/deployment_status/ami_and_customer_systems.)

(EDF4) Comment: The DGEIS should discuss demand response and innovative pricing together. The DGEIS' discussion of demand response is incomplete because it fails to articulate the potential that rate structures, such as critical pricing, can have on load shifting. Conversely, where rate design is valued for its ability to moderate peak loads, it should not be addressed as an isolated mechanism. This discussion should be further expanded to include the role of time-variant pricing.

> **Response**: We agree that time-variant pricing and demand response could be considered in a more integrated fashion in Chapter 4. However, doing so would require additional assumptions and projections regarding both of these resources that are not well-supported by existing information (e.g., the magnitude of pricing signals, what portion of customers would be subject to time-varying pricing, and which portion of these customers could feasibly provide demand response).
>
> Additionally, while Chapter 5 of the DGEIS presents demand response and rate design in two separate sections, there are multiple places in the DGEIS where the two mechanisms are discussed in a more integrated manner. For example, Chapter 5 discusses dynamic pricing as a type of DR mechanism (DGEIS, page 5-9). In addition, Chapter 10 discusses the combination of price signals and automated technology to reduce load. Chapters 5 and 10 of the final GEIS have also been further updated to reflect additional information provided in the studies cited by the commenter.

(EDF5) Comment: While Exhibit 5-4 of the DGEIS states that pricing tied to peak and off-peak times should consider the impact on "customers that are least able to change behavior and respond to price signals," it provides no evidence of utility initiatives that have addressed these concerns. The commenter urges full consideration in a supplemental discussion of what these well-designed pilot studies have found on this subject. The commenter further provides a range of pilot studies that the DGEIS could rely upon.

> **Response**: The commenter is correct that the DGEIS included only limited evidence of initiatives that addressed how customers respond to price signals. Chapters 5 and 9 of the DGEIS have been revised to include discussion of utility pilot studies cited by the commenter.

(EDF6) Comment: The DGEIS assessment of rate structures is unnecessarily limited in its utility by its segregation of rate design and demand response. There are a wide range of case studies that the DGEIS could rely upon to illustrate the effectiveness of demand response and innovative pricing exist.

> **Response**: Section 4.4 of the DGEIS discusses the basis for the projections for demand response and innovative rate structures in the alternatives analysis, referencing several studies. For example, innovative rates are limited to only a fraction of the state's residential customer load in order to be conservative (p. 4-16).
>
> Chapters 5 and 9 of the final GEIS have also been revised to include additional discussion of the case studies cited by the commenter.

(EDF10) Comment: While EPA's recent proposal to strengthen the NAAQS for ground-level ozone may mitigate some of the adverse impacts from Ozone as a result of increased distributed fossil fuel generation, it would be helpful if the DGEIS included a more complete understanding of what local impacts are addressed by this rule, as well as what types of generation are covered by the rule and how they are regulated under the rule.

> **Response**: Because EPA's proposed rule revising the NAAQS for ozone was issued after the release of the DGEIS (i.e., on November 25, 2014), EPA's proposed rule was not included in the DGEIS. Section 6.1 of the final GEIS has been updated to include information about EPA's recent proposal. However, because the portfolio of technologies developed under REV and CEF, and the extent to which each technology will be used or activated, is uncertain, how the activities of the REV and CEF may interact with EPA's proposed ozone standards is uncertain at this time.

(EDF11) Comment: The DGEIS discusses multiple options for mitigating the environmental impacts associated with small-scale fossil-fuel based generation. However, these approaches rely upon a flawed assumption that small-scale generators will directly participate in REV markets. If small-scale generators are able to participate in the REV markets without expressly entering into transactions to sell its services, then the mitigation measures considered in the DGEIS may in fact be ineffective.

> **Response:** Chapters 5 and 6 of the final GEIS has been updated to reflect the concerns raised by the commenter.

B.11 ENERGY STORAGE ASSOCIATION (ESA) and NEW YORK BATTERY AND ENERGY STORAGE TECHNOLOGY CONSORTIUM, INC. (NYBEST)

(ESA2, NYBEST2) Comment: Because the DGEIS groups all types of energy storage together, the DGEIS incorrectly concludes that energy storage has negative environmental impacts. Multiple commenters disagree that energy storage system will add to greenhouse gas emissions because it is a net consumer of electricity. The commenters note that environmental impacts related to energy storage are both site-specific and technology-specific. The commenters cite various studies as further support of energy storage's potential to reduce emissions.

> **Response**: Chapter 5 of the final GEIS has been revised to reflect the concerns raised by the commenters.

(ESA3, NYBEST3) Comment: The DGEIS should present potential impacts of pumped hydro separately from other energy storage technologies. Grouping these technologies leads the DGEIS to erroneously portray energy storage as having negative environmental impacts in several categories. The negative impacts for "Land Use and Biological Resources" and "Water Quality" associated with pumped hydropower are not relevant or applicable to compressed air energy storage, batteries, or flywheels.

> **Response**: We agree that the negative impacts for "Land Use and Biological Resources" and "Water Quality" are associated with pumped hydropower and are not applicable to CAES, batteries or flywheels. This difference in impacts is represented by a footnote in Exhibits ES-3 and 5-6 of the DGEIS.
>
> While the final GEIS cannot assess cumulative impacts until specific project sites and characteristics have been identified, qualitative discussion of the potential environmental

impacts of energy storage technologies in Exhibit 5-4 of the final GEIS have been revised to reflect the concerns raised by the commenter.

(ESA4, NYBEST4) Comment: Although the DGEIS briefly mentions the benefits of combining energy storage and renewables, one commenter notes that it does not fully acknowledge the myriad benefits arising from this pairing. The commenter encourages the Commission to incorporate additional information regarding energy storage's role facilitating the integration of renewable energy into the final GEIS.

Response: Chapter 5 of the GEIS has been revised to reflect the concerns raised by the commenters.

B.12 FUEL CELL AND HYDROGEN ENERGY ASSOCIATION (FCHEA)

Because comments submitted by FCHEA were consistent with comments submitted by other organizations, responses to comments by FCHEA are presented along with responses to comments submitted by other organizations in Section B2.

B.13 NATURE CONSERVANCY (TNC)

Because comments submitted by the Nature Conservancy were consistent with comments submitted by other organizations, responses to comments by Nature Conservancy are presented along with responses to comments submitted by other organizations in Section B2.

B.14 NORTHEAST CLEAN HEAT AND POWER INITIATIVE (NECHPI)

(NECHPI7) Comment: The DGEIS fails to adequately recognize the role of microgrids to achieve the goals of the REV. Microgrids play a potentially major role in peak-load reduction, as well as many of the other goals of the REV.

Response: Section 5.2 of the DGEIS broadly discusses the role of smart grid technologies, describing such technologies (including microgrids) as critical for other resources, such as economic demand response programs, variable charging rates, GVI, and renewable generation, to achieve their full potential (DGEIS, p. 5-3). Section 5.2 of the final GEIS has been expanded to discuss microgrids in more detail, consistent with the REV subcommittee formed under Working Group 2 on microgrids and community grids.

(NECHPI8) Comment: The DGEIS fails to acknowledge the NY-PRIZE program as one of the ongoing initiatives supporting the development of community microgrids in New York State.

Response: Chapter 1 of the final GEIS has been revised to include reference to and description of NYSERDA's NY Prize program.

(NECHPI9) Comment: While the DGEIS recognizes climate change as a risk to existing energy infrastructure, it does not consider the potential effect and risks that climate change poses to renewable sources of energy.

Response: Chapter 3 of the final GEIS has been updated to include a discussion of the risks that climate change poses to both existing energy infrastructure as well as renewable energy resources.

(NECHPI11) Comment: The DGEIS presents an unbalanced treatment of CHP, lacking sufficient discussion of CHP as a technology that optimizes energy consumption by increasing the efficiency of energy. CHP is one of the few DERs that can help to maintain a balance between demand and supply at any time. CHP can also reduce greenhouse gas emissions, as they are more efficient than the thermal load and grid generation they displace. Although CHP systems are currently mostly fueled by natural gas, CHP is unique in its ability to use many different kinds of fuel sources, including renewables such as biogas, synfuels, and biomass. Solar cogeneration serves as an example of an emerging hybrid system where CHP can serve to increase the efficiency of traditional solar installations. By focusing exclusively on peak reduction, the DGEIS fails to accurately account for the ability of CHP to serve as a mechanism that can reduce emission as well as line losses.

Response: We agree that CHP can serve as a mechanism to reduce emissions and line losses in addition to peak load reduction. Chapters 5 and 9 of the final GEIS have been revised to clearly reflect the range of benefits of CHP. However, we disagree that the analysis in Chapter 4 of the DGEIS does not take into account these other categories of benefit. Peak load reduction serves as a metric from which to construct the two scenarios, but this metric does not constrain the quantity of any particular technology. As discussed in greater detail in Chapter 4, a variety of factors are used to estimate the quantity that each technology may contribute under each scenario. In other words, focusing on a different objective, such as lower emissions or fewer line losses, would not change the amount of CHP estimated under each scenario presented in Chapter 4 of the DGEIS.

(NECHPI12) Comment: The DGEIS does not concretely reflect the fuel-neutral approach espoused in the REV. It will take a balanced mix of resources to achieve the state's energy and carbon goals, and overreliance on one source of distributed generation can result in operational challenges such as overgeneration. Overgeneration will require renewables curtailment, unless mitigation strategies, such as the use of CHP, are implemented.

Response: The DGEIS does not assume reliance on any given technology or fuel source. As noted consistently throughout the DGEIS, the exact portfolio of technologies that will be developed under the REV and CEF, and the extent to which each technology will be used or implemented, is uncertain at this time. As a result of this uncertainty, the alternatives analysis developed in Chapter 4 includes renewables, DR, EE and DG driven by a wide range of fuels. Chapter 5 further expands the scope of the DGEIS by including additional technologies and resources not explicitly identified in Chapter 4, which may contribute to achieving the goals of the REV and CEF.

Chapter 5 of the final GEIS has been revised to note that demand response and energy storage can serve to mitigate the risk of overgeneration associated with renewable energy sources.

(NECHPI14) Comment: Policy coordination between separate government agencies in New York State is lacking. Significantly better coordination, information sharing, and common evaluation criteria are needed to ensure that each agency/organization responsible for regulating electric utility operations does so in a manner that supports the REV and CEF. The Commission should establish a regular and systematic means for communication, criteria development, and implementation across all state agencies involved in these proceedings.

> **Response**: The comment does not appear applicable to the scope of the REV/CEF proceedings or the GEIS. The Commission and the Department are actively working to improve communications, interaction with and involvement of sister agencies and the state's energy authorities, many of which are full members of the Article 10 Siting Board and automatic parties to various energy proceedings. Both NYSERDA and DEC staff were directly involved in the preparation and review of the DGEIS and GEIS.

(NECHPI15) Comment: The list of environmental compliance requirements for distributed energy resources, especially for CHP, is significant. The Commission should immediately establish a working group of stakeholders from all of the regulatory agencies affected by the REV and CEF to standardize and streamline environmental requirements and the associated processes, procedures and documentation needed for compliance purposes.

> **Response**: A stated purpose of the REV proceeding is enhanced deployment of DER. An understanding of the potential impact of current and future regulatory requirements is an integral element of that effort.

B.15 NEW YORK BATTERY AND ENERGY STORAGE TECHNOLOGY CONSORTIUM, INC. (NYBEST

Because comments submitted by NY-BEST were consistent with comments submitted by ESA, responses to comments by NY-BEST are presented along with responses to comments submitted by ESA in Section A.11.

B.16 NEW YORK GEOTHERMAL ENERGY ORGANIZATION (NY-GEO)

(NY-GEO1) Comment: As there is no specific mention of geothermal electrical energy production (or "hot rocks geothermal"), it is assumed that the "Geothermal" category in Exhibits ES-3 and 5-6 refer to geothermal heat pumps (GHPs). The basis used to construct this table is unclear. The final GEIS should provide greater clarification on the guidelines and source information used to determine the placement of a particular technology into the various impact categories. In particular, the final GEIS needs to better explain the basis for determining the potential Air Quality impacts for GHPs. In addition, the commenter asks what industry-specific professionals or experts were consulted in the assemblage of the information utilized for the summary chart.

> **Response:** "Geothermal" in the summary table refers to geothermal heat pumps (GHPs), as indicated in the Geothermal Energy section of the DGEIS on page 5-43. The information relied upon and the analysis of impacts that could result from geothermal heat pumps is presented on pages 5-44 to 5-45 of the DGEIS; this analysis forms the basis of the conclusions presented in Exhibits 5-6 and ES-3. However, as discussed previously, Exhibits ES-3 and 5-6 have been removed from the final GEIS to minimize the potential for misinterpretation.

The GEIS relies on information from State agencies, publicly available sources, and public comments submitted in response to the Commission proceedings. A complete list of sources relied upon in the DGEIS can be found in the References section. Efforts to personally contact every industry professional or expert individually are outside the scope of this effort.

B.17 SIERRA CLUB (SC)

(SC1) Comment: As an ongoing need for the RPS program exists, more proactive planning for utility-scale renewable energy should occur in advance of the expiration of the RPS in 2015. The Commission should consider developing new enforceable targets and funding for the RPS as part of the REV's GHG reduction goals.

Response: Development of policy is not a role of the GEIS. The Commission is considering potential directions for future RPS programs along with several other potential strategies, some considered and reviewed in the GEIS.

(SC2) Comment: The DGEIS understates the efficacy of the RPS program in achieving the State's energy goals. The final GEIS should be revised to reflect the benefits of the RPS. For example, NYSERDA's September 2013 Review reports that every $1 spent on the RPS generated $3 of direct investment in New York.

Response: Chapter 1 of the final GEIS has been updated to reflect the additional information provided by the commenter regarding the efficacy of the RPS program.

(SC 4) Comment: Utility-scale renewables can contribute to the reduction in peak demand. For example, NYISO's 2014 Power Trends report indicates that wind energy helped address power demand during peak periods in the summer of 2013 and winter of 2014. In particular, offshore wind projects have the potential to moderate peak loads and in so doing, reduce ratepayer costs. The DGEIS should recognize the peak demand reduction benefits of utility-scale renewables.

Response: We agree that utility-scale renewables can contribute to peak demand capacity. Exhibit 4-1 of the DGEIS includes a contribution of more than 1,000 MW of summer peak capacity from utility-scale renewables in the upper bound scenario. Utility-scale renewables are, however, listed separately from the other resources because, for the most part, utility-scale renewables are not generally located in close proximity to areas of high customer load, and therefore do not provide the same types of benefits of more widely distributed energy resources which are a key focus of the REV and CEF proceedings. One relevant exception is the possibility of substantial off-shore wind capacity located in close proximity to down-state load centers. For example, the Long Island – New York City Offshore Wind Project, currently in the early stages of consideration, could generate 700 MW of installed capacity (equivalent to approximately 300 MW of summer peak capacity on average).[635] The Long Island – New York City Offshore Wind Project currently anticipates a commercial operation date of no earlier than 2017. Estimates of the potential off-shore wind resource are much greater, ranging

[635] Long Island-New York City Offshore Wind Project. Project website. Accessed January 14, 2015 at: http://www.linycoffshorewind.com/.

from a few thousand MW to over 100 GW depending on location and assumptions regarding both technical and environmental feasibility. Several hundred MW of off-shore wind would provide a meaningful contribution to the bounding scenarios presented in Exhibit 4-1. Chapter 5 also discusses the potential environmental impacts of off-shore wind and other utility-scale renewables.

APPENDIX C | REVISIONS TO THE DRAFT GENERIC ENVIRONMENTAL IMPACT STATEMENT

Appendix C lists edits that have been made to Draft GEIS to incorporate new and revised information

EXECUTIVE SUMMARY

- Revised to reflect changes made between the draft and final GEIS.

CHAPTER 1: SEQRA AND DESCRIPTION OF THE PROPOSED ACTION

- Revised Section 1.3 to elaborate on the efficacy of New York's EEPS and RPS programs.
- Revised Section 1.6 introduce the NY Prize program.
- Editorial Changes

CHAPTER 2: THE ELECTRIC INDUSTRY IN NEW YORK STATE

- Revised Section 2.4 to reflect more recent data on New York's electricity market.

CHAPTER 3: ENVIRONMENTAL SETTING

- Revised Section 3.4 to include greater discussion of the threats posed by climate change to existing energy infrastructure and potential future renewable energy investments.

CHAPTER 4: ALTERNATIVES CONSIDERED

- Added greater discussion on the basis and rationale for the scenarios developed.
- Refined and clarified discussion of CHP and energy storage technologies in response to public comments.
- Editorial changes.
- Revised Exhibit 4-2 to clarify the methodology used to calculate emission reductions.

CHAPTER 5: ENVIRONMENTAL IMPACTS OF PROPOSED ACTION

- Revised organization to clearly delineate direct and indirect impacts.
- Removed DGEIS Section 5.4, which presented a table summarizing environmental impacts for all resources and technologies by resource area.

5.1: Framework for Evaluating The Environmental Impacts of the REV and CEF

- Minor editorial changes.

5.2: Direct Effects

- Additional discussion to clarify the approach used to analyze direct impacts of the REV/CEF.

- Expanded discussion on energy storage technologies, including information on current energy storage capacity in the US.
- Expanded the list of energy storage technologies and clarified their connection to renewable generation technologies.
- Added case studies on the success of and connection between demand response programs and rate structure change programs.
- Expanded discussion of microgrids.
- Refined discussion of CHP systems, including language clarifying the range of applications and fuels for CHP systems.
- Elaborated on the range of applications, technologies, and fuels for fuel cells.
- Added information on the historical declines in the cost of solar PV modules and wind turbines.
- Added discussion on the co-application possibilities between technologies, including CHP, energy storages and renewable energy resources such as solar modules.
- Expanded discussion of the range of technologies and associated environmental impacts of geothermal energy generation.
- Editorial Changes.

5.3: Indirect Effects

- Editorial changes

5.4: Other Anticipated Technologies

- No changes.

5.5: Cumulative Impacts

- No changes.

CHAPTER 6: REGULATORY FRAMEWORK AND MITIGATION OF POTENTIAL ADVERSE IMPACTS

- Revised Section 6.1 to add discussion of EPA's proposed revisions from November, 2014 for NAAQS for Ozone.
- Revised Section 6.1 to elaborate discussion on state-level planning measures and permitting processes available to mitigate the impacts of distributed fossil fuel generators.
- Editorial changes.

CHAPTER 7: UNAVOIDABLE ADVERSE IMPACT

- No changes.

CHAPTER 8: IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

- No changes.

CHAPTER 9: GROWTH-INDUCING ASPECTS AND SOCIOECONOMIC IMPACTS

- Revised Section 9.2 to clarify that the estimated long-term avoided capacity and energy savings are based on data from an unusually warm summer in 2013.

- Revised Section 9.2 to note uncertainty regarding future costs of new T&D infrastructure.
- Revised Section 9.2 to note that CHP and energy storage can help to reduce transmission losses.
- Revised Section 9.2 to elaborate on benefits of the REV and CEF to increase the State's resilience to changes in climate.
- Revised Section 9.2 to include discussion of case studies on variable and TOU rates and customer acceptance of utility initiatives.
- Editorial changes.

CHAPTER 10: EFFECTS ON ENERGY CONSUMPTION

- Expanded discussion of customer acceptance of utility initiatives for time-variant pricing.

CHAPTER 11: REFERENCES

- Revised to include new changes added in the Final GEIS.

APPENDIX A: SUPPLEMENTAL ANALYSIS OF POTENTIAL ENVIRONMENTAL IMPACTS ASSOCIATED WITH CEF ACTIVITIES

- No changes.