Table 10. New York Hydroelectric Technical/Practical Potential in 2022

Application	Potential (MW)	Potential (GWh)
New production at new dams	1,079	5,501
New production at existing dams	754	2,477
Repowering, modernization, and upgrading	408	538
Expansion of production at existing hydropower stations	286	651
Total	**2,527**	**9,167**

Source: Optimal Energy Inc. (prepared for NYSERDA). *Energy Efficiency and Renewable Energy Resource Development Potential in New York State* . 2003. Study excludes pumped storage as a renewable resource. http://www.nyserda.org/sep/EE&ERpotentialVolume1.pdf

Hydrokinetic Energy

The hydrokinetic energy technical/practical potential in New York is estimated to be approximately 1,000 MW by 2025.[82] In order to complete a hydrokinetic project, a developer must first obtain a preliminary permit from the Federal Energy Regulatory Commission (FERC), which allows the developer to study the feasibility of a hydrokinetic project at an identified site. Once the feasibility of the project has been assessed, the developer then applies for a license to construct and operate a hydrokinetic facility.

As of April 2009, there were nine proposed hydrokinetic projects in New York waterways that had been issued preliminary permits by FERC,[83] including two in the East River.[84] The proposed installed capacity of these projects totaled more than 650 MW. There are currently no hydrokinetic projects in the State that have been granted a FERC license.

3.2 Wind Energy

3.2.1 Wind Use and Electric Generation

Central Electric Generation

The State ranks seventh in the nation in terms of existing wind capacity and fifteenth in potential wind capacity.[85] Large-scale wind capacity in New York is projected to reach nearly 1,300 MW by the end of 2009, up from just 48 MW in 2001. As of June 2009, New York had 791 installed wind turbines with a total capacity of 1260.8 MW and another 14 turbines under construction, which are expected to add another 21.0 MW of capacity.[86]

[82] E3, Inc. 2004.

[83] Projects are required to obtain preliminary FERC permits to do feasibility studies and demonstrations and FERC licenses prior to the construction of commercial facilities.

[84] Verdant Power's demonstration project was installed in the East River in 2006. Verdant Power. *The RITE Project.* 2009. http://www.verdantpower.com/what-initiative

[85] The American Wind Energy Association estimates that New York has a potential capacity of 7,080 MW.

[86] American Wind Energy Association. *U.S. Wind Energy Projects – New York.* 2009.

Customer-Sited Electric Generation

Compared with central electric generation, small-scale customer-sited wind generation has experienced modest growth in New York. As reported by DPS, 216 kW of net-metered customer-sited wind generation was installed in New York between 2001 and 2006, representing approximately 1 percent of the total installed net-metered customer-sited renewable electric systems in the State. As of June 2008, NYSERDA had supported the installation of 31 kW of small wind turbine systems at 34 project sites. The growth in customer-sited wind turbine installation is supported by 17 in-state wind turbine installers.[87]

3.2.2 Wind Energy Technical/Practical Potential

As shown in Table 11, the RPS Main Tier Cost Study assessed New York's onshore and offshore wind resources and determined that the State's wind potential stood at 8,527 MW by 2015.[88] Given the differential between wind energy costs and the corresponding wholesale revenue shown in Figure 2, it is expected that wind energy will continue to be significantly developed under the RPS. This development will represent substantial growth in wind energy production within the State, harnessing on the order of 30 percent of New York's technical/practical wind energy potential.

Table 11. Wind Technical/Practical Potential in New York by 2015

Onshore Wind Potential (MW)			Offshore Wind Potential (MW)	
Small Wind Projects (<20 MW)	**Medium Wind Projects (100 MW)**	**Large Wind Projects (>100 MW)**	**Great Lakes & Long Island**	**Total Potential (MW)**
512	597	6,884	534	8,527

Source: La Capra Associates and Sustainable Energy Advantage, LLC. *New York Renewable Portfolio Standard Cost Study Update: Main Tier Target and Resources.* 2008.

Reliability and Capacity Factors

Due to wind's variability, wind power creates challenges for reliable grid operations; however, wind plants can be assigned capacity values because they increase the overall statistical probability that a utility system will be able to meet demand requirements.[89] On the basis of a comprehensive assessment of the impacts of integrating wind energy into the bulk power system, it was determined that the capacity contribution of an onshore wind plant to the reliability of the New York system at time of peak demand was approximately 10 percent of its rated plant capacity; an offshore plant would be expected to

[87] Installers eligible to participate in NYSERDA's Wind Incentive Program. Power Naturally. *All Eligible Wind Installers*. 2009. http://www.powernaturally.org/Programs/Wind/Installers_all.asp?i=8

[88] KEMA Inc. (prepared for NYSERDA). *New York Main Tier RPS: Impact and Process Evaluation.* 2009. http://www.nyserda.org/Energy_Information/KEMA_RPSEvaluation%20MAR%2030_Final.pdf

[89] The capacity value of adding a wind plant to a utility system is approximately the same as the wind plant's capacity factor multiplied by its capacity. Thus, a 100-megawatt wind plant with a capacity factor of 35 percent would be similar in capacity value to a 35-MW conventional generator. American Wind Energy Association. *Wind Web Tutorial*. http://www.awea.org/faq/

contribute approximately 35 to 40 percent of its rated capacity because offshore wind production is better correlated with in-region peak demand.[90]

To integrate increasing levels of wind power into the transmission system without compromising reliability, the NYISO instituted one of the first state-of-the-art wind forecasting systems in the United States in 2008. Considered a best practice in the industry, the centralized system enables the NYISO to better utilize and accommodate wind energy by forecasting the availability and timing of wind-powered generation. Operators can instantly adjust generation supplies to meet the demand for electricity in real time as data are fed directly into NYISO's operational systems that balance load and generation.

Wind generating stations are sometimes concentrated in a relatively small area to benefit from the wind potential. However, the electric transmission capacity within this area may be insufficient to transfer all the energy that could potentially be generated from these units. This phenomenon is often referred to as "bottled energy." The NYISO is currently concluding a study to assess the impacts of higher penetration of wind plants within the State. A draft of this study should be available in July 2009 and will identify issues that may be related to bottled wind energy.

Siting

New York does not have a permitting process that is tailored for different size wind projects. Securing siting permits and community approvals can prove costly and time-consuming because most towns do not have knowledge of the economic and technical/practical implications of siting wind turbines. The 2008 Renewable Energy Task Force Report identified the need to address local siting and permitting barriers for small wind projects.[91] In the absence of specific local ordinances, the local approval process for small scale wind projects often defaults to the large scale wind reviews, which is a scale of review that far exceeds the requirements necessary for small wind turbines.[92]

The PSC regulates the siting of electric generating facilities with capacities if 80 MW and greater.[93] In the absence of specific regulations, new wind construction, like new fossil-fuel powered generation, is required to undergo a comprehensive SEQRA review that addresses environmental impacts. To address special environmental concerns associated with wind projects, guidelines for pre- and post-construction bird and bat surveys have been issued by DEC.[94] The guidelines provide direction in assessing ongoing and expected environmental impacts and also provide recommendations to the lead agency under SEQRA regarding the construction and operation of wind facilities. Depending on a project's specific location and size, other permits may also apply, such as Tidal Wetlands Permits, Freshwater Wetland Permits, Construction Storm Water Permits, and Coastal Erosion Control Permits.

Siting offshore wind projects in New York presents additional challenges. Underwater lands near shore are under the jurisdiction of the Office of General Services (OGS), and the State has the authority to grant leases for the use of underwater lands targeted for offshore wind development. In addition to the State

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[90] GE Energy Consulting (prepared for NYSERDA). *Effects of Integrating Wind Power on Transmission System Planning, Reliability and Operations*. 2005. http://www.nyserda.org/publications/wind_integration_report.pdf

[91] Renewable Energy Task Force. 2008.

[92] Network for New Energy Choices. *Taking the Red Tape out of Green Power*. 2008. http://www.newenergychoices.com/uploads/redTape-rep.pdf

[93] A Certificate of Public Convenience and Necessity from PSC is required for electric generating facilities larger than 80 MW.

[94] DEC, Division of Fish, Wildlife and Marine Resources. *Guidelines for Conducting Bird and Bat Studies at Commercial Wind Energy Projects*. 2009. http://www.dec.ny.gov/docs/wildlife_pdf/windguidelines.pdf

permits and SEQRA review that are required for land-based wind projects, offshore projects also require approvals from federal regulatory and permitting agencies.

3.3 Biomass Energy

Biomass and its derivative products, such as biogas[95] and liquid biofuels,[96] are organic, non-fossil plant materials initially produced through photosynthesis. The sources of biomass are diverse and can include wood and scrap forest materials, waste material from the forestry and pulp and paper industries, specialized energy crops, decomposed organic waste and the resulting methane stream, and liquid fuels derived from corn, sugar cane, or soybeans. The uses of biomass are similarly broad and include direct combustion to provide heat or generate electricity, the conversion of biomass into ethanol or biodiesel to create liquid transportation fuel, and the use of methane gas generated in landfills as a primary fuel or for electricity generation. Table 12 shows New York's primary energy use attributable to biomass, biogas, and biofuel energy resources for 2001 through 2007.

Since the publication of the 2002 State Energy Plan, interest in developing New York's biomass resources has moved from research and development efforts to mainstream government attention. For many years prior to the 2002 State Energy Plan, NYSERDA conducted research to explore and develop various biomass feedstocks and related technologies. Growing interest in biomass became apparent in 2004 with the introduction of the RPS, which supported wholesale Main Tier biomass generation and small-scale Customer-Sited Tier generation, chiefly with ADG. In 2008, the Renewable Energy Task Force Report called for the development of a Biofuels Roadmap, the development of which will be completed by late 2009.[97] The Biofuels Roadmap will be used to more accurately estimate New York's indigenous biomass technical/practical potential, to understand the economic and environmental impacts of biofuels, and to develop comprehensive biomass and biofuels policies.

Table 12. 2001-2007 New York Primary Energy Use from Biomass, Biogas, and Biofuel Energy Resources

New York State Biomass, Biogas, and Biofuel Energy Resources (TBtu)											
	Residential	Commercial		Industrial		Transportation	Electricity[1]			Total Biomass, Biogas & Biofuel	Total State Primary Energy
Year	*Biomass*[2] *(Wood)*	*Biomass*[2] *(Wood)*	*Biomass*[2] *(Biogenic Waste)*	*Biomass*[2] *(Wood)*	*Biomass*** *(Biogenic Waste)*	*Biofuel*[2] *(Ethanol)*	*Biomass (Wood)*	*Biomass (Biogenic Waste)*	*Biogas (Landfill Methane)*		
2001	55.1	9.7	2.5	17.2	0.6	0.4	5.0	10.7	2.0	**103**	4,069
2002	55.9	9.9	2.5	13.5	0.5	0.3	4.1	10.3	2.7	**100**	4,026
2003	58.9	10.3	2.4	13.4	0.5	1.9	4.1	10.2	2.6	**104**	4,187
2004	60.3	10.1	2.5	16.7	0.5	24.4	5.0	10.3	2.6	**133**	4,260
2005	66.2	10.1	2.6	16.4	0.5	27.1	5.2	10.9	2.6	**142**	4,212
2006	60.3	9.3	2.6	16.6	0.5	60.2	5.1	10.7	3.3	**169**	4,005
2007	67.7	9.7	2.4	16.9	0.5	80.3	4.8	10.4	3.6	**196**	4,129

Note: Assumes a rolling 3 year average NYS fossil fuel conversion factor for renewable electricity resources.
[1]Net-metered, customer-sited renewable electricity primary energy consumption increased from less than 0.1 TBTUs in 2001 to approximately 0.3 TBTUs in 2006. In 2006 solar-PV
[2]2007 data was estimated based on U.S. growth rate from 2006 to 2007.

Source: EIA. *State Energy Data System: New York, 2001 - 2007* . 2009. http://www.eia.doe.gov/emeu/states/state.html?q_state_a=ny&q_state=NEW%20YORK
Source: NYSERDA. *Patterns & Trends – New York State Energy Profiles: 1993 - 2007* . 2009. http://www.nyserda.org/energy_information/patterns%20&%20trends%201993-2007.pdf

[95] Biogas is the gasified product of biomass or the methane produced from the anaerobic decomposition of biomass from sources such as landfills, wastewater treatment plants, manure and other agricultural byproducts, sewage treatment facilities, and food and beverage processing, sales, and distribution facilities.

[96] Biofuels are liquids derived from biomass, through chemical, thermal, and biological processes. Ethanol and biodiesel are the dominant biofuels currently available and will be the focus of this Assessment. Biofuels are typically blended with petroleum products, e.g., ethanol with gasoline and biodiesel with diesel, and used as transportation fuels.

[97] Renewable Energy Task Force. 2008.