Synapse
Energy Economics, Inc.

Indian Point Replacement Analysis: A Clean Energy Roadmap

A Proposal for Replacing the Nuclear Plant with Clean, Sustainable Energy Resources

Prepared for the Natural Resources Defense Council and Riverkeeper

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Overview

Indian Point Energy Center (IPEC) in Westchester County, New York currently operates two nuclear reactors with a combined capacity of 2,060 MW. The original 40-year operating licenses for these two units are set to expire in 2013 and 2015. In hearings that will commence on October 15, 2012, the Nuclear Regulatory Commission will consider whether to approve the plant owner's application to renew the units' licenses for an additional twenty years.

The case for replacing IPEC with clean energy resources is stronger than ever due to on-going transmission and generation initiatives, and the potential for expanding energy from renewables and efficiency. The cost impacts of our clean energy scenario are likely to be very small – on the order of one percent.

In 2011 Synapse Energy Economics prepared a study of the implications of not relicensing the IPEC units, finding that (a) there would be sufficient capacity to support electric system reliability in the absence of IPEC; (b) there is a significant potential for a variety of electricity resources to replace IPEC; and (c) the cost of replacing IPEC with new resources is likely to be modest, on the order of a one to three percent increase in electricity costs.

This report updates our 2011 analysis and focuses on whether and how IPEC could be replaced entirely with a portfolio of clean energy resources, i.e., energy efficiency and renewable resources. We consider recent developments such as Governor Cuomo's Energy Highway Initiative – an effort to identify new sources of power for New York including renewable energy, traditional generation, and transmission – as well as assess recent data provided by the New York Independent System Operator (NYISO) regarding future capacity needs. We then identify a set of policies that the State should pursue to promote the development of a clean energy replacement scenario.

Our updated analysis reaffirms our previous study's conclusion that numerous options exist for safely and cost-effectively replacing IPEC, and also describes an energy replacement strategy for Indian Point based entirely on energy efficiency and renewable generation. The key findings of our study demonstrate that:

- IPEC's two reactors can be retired without undermining the reliability of New York's electric system. Even if IPEC's two units were retired immediately, New York is projected to retain a capacity surplus through 2020, based on the generation capability in the New York Independent System Operator's 2012 *Gold Book*. Thus, there is at least seven years for the market and the State to develop the resources necessary to replace IPEC and maintain a reliable electric system.

- New York could replace the entirety of Indian Point's 2,060 MW of capacity by implementing a clean energy portfolio comprised of 1,030 MW of energy efficiency and

1,030 MW of renewable capacity. This portfolio of resources could easily be installed by 2022 to replace IPEC, even though the full 2,060 MW will not be needed until sometime after that. Because of their relatively modular nature, these resources could be installed gradually over the next decade in order to best meet the growing need for capacity.

- The cost impacts of our clean energy replacement scenario are likely to be very small, with the net effect being an increase of roughly one percent in costs to customers in 2022, equivalent to roughly one dollar per month for the average residential customer.
- Over the past year, progress has been made in developing new generation and transmission facilities, such as the 1,136 MW Cricket Valley Energy Center, the 660 MW Hudson Transmission Project, and the 1,000 MW Champlain Hudson cable. In addition, the Governor's Energy Highway Initiative has spurred a significant number of proposals for developing new generation and transmission facilities.
- New York State has a large amount of untapped energy efficiency that could be used to help replace IPEC. We estimate that expanding the current energy efficiency initiatives in the state to more aggressive but very feasible levels could result in 1,600 MW of new efficiency resources by 2022.
- New York State also has enormous potential to develop new renewable resources. Our analysis of the renewable resources currently proposed in the Interconnection Queue, under consideration in the Energy Highway RFI, and called for by the NY-Sun Initiative could result in the addition of more than 4,000 MW of wind and solar resources by 2022.

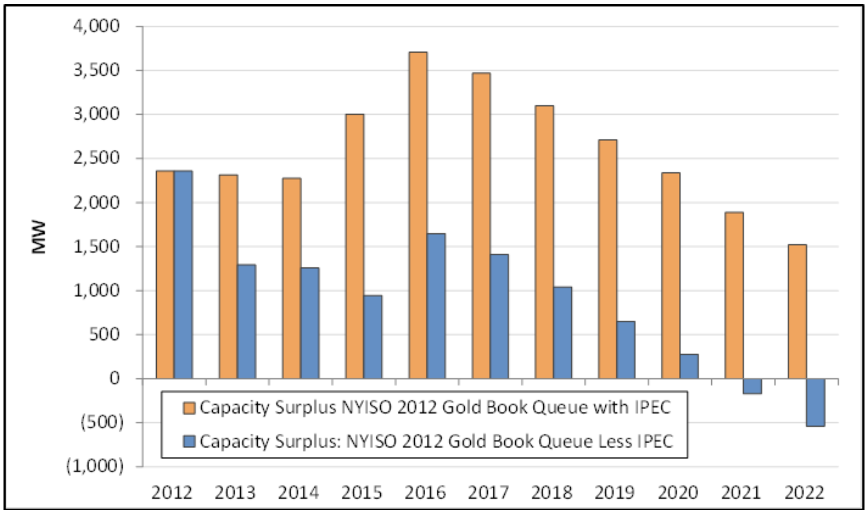
Maintaining Reliability in the Event Indian Point is Retired

It is clear that IPEC could be retired without posing reliability problems for the New York electric system, for several reasons. First, the system currently has a surplus of capacity that is expected to last many years into the future. Figure ES-1 presents a summary of the electricity capacity surplus in the state as of 2012, as well as a forecast of how that surplus of capacity is likely to change over the next decade both with and without IPEC, based upon the New York Independent System Operator's expectation of generation changes over the next few years. As indicated by the blue bars, if IPEC is retired, the net capacity when accounting for proposed additions and retirements exceeds the reserve requirements through 2020. Thus, there is a period of at least seven years for the market and the State to develop the resources necessary to replace IPEC and maintain a reliable electric system.

Based on the 2012 NYISO Gold Book data, without IPEC, New York is projected to maintain surplus capacity through 2020.

Second, the generation capacity in New York is expected to increase over the next few years. As indicated by the orange bars in Figure ES-1, NYISO currently projects net capacity additions to the electric system through 2016. The Bayonne Energy Center (500 MW) and the Marble River Wind Farms (215 MW) are new generators that NYISO assumes are very likely to reach commercial operation and thus should be assumed operational for planning purposes. Similarly, upratings at Nine Mile Point 2 (168 MW) and the Munnsville Wind Power site (6 MW) are also assumed operational for planning purposes. Additionally, the NYISO *Gold Book* lists a number of projects in the Interconnection Queue that have achieved substantial milestones in the approval process. This list includes, for example, the Cricket Valley Energy Center, which has recently received several permits and is expected to commence construction in 2013. Finally, the NYISO Interconnection Queue includes many additional generators that may become operational in later years, but are not accounted for yet by the NYISO for planning purposes.

Figure ES-1: Capacity Surplus, Including 2012 Gold Book Proposed Additions and Retirements



Source: Figure 4

Third, several new transmission facilities are in the process of being planned, constructed or completed, which will significantly assist the transmission of power into different regions of the state, including the regions near IPEC. These include, for example, (a) a 345 kV transmission line from Bergen, New Jersey to West 49th St in New York City, with a thermal rating of 660 MW; (b) a 15 MW transformer uprate for an existing 345 kV transmission line from New Jersey to New York City; and (c) a 320 kV direct current (DC) transmission line from Hydro Quebec to Astoria, New York, with a thermal rating 1,000 MW.

Fourth, the Governor's Energy Highway Initiative is expected to spur the development of new generation and transmission facilities over the next several years. The recent responses from the Governor's Request for Information included the following:

- New renewable generation projects, totaling 1,600 to 4,200 MW.
- Repowering projects, in the event that existing marginally economic facilities retire, totaling as much as 2,400 MW.
- New natural gas-fired generation projects, totaling as much as 4,000 MW.

- Nine new DC transmission projects, ranging in capacity from 500 MW to 2,000 MW each, designed to bring electricity from Canada, the PJM Electricity Market, and upstate New York to locations in the region around IPEC. Two of these proposals would deliver electricity directly into New York City.
- Twenty new alternating current (AC) transmission lines, five of which are new lines while the remainder are upgrades to existing lines. Two of the new projects are specifically designed to mitigate contingencies and increase line capacity in the event that IPEC is retired soon.

Fifth, in the event that IPEC's retirement is announced, the wholesale electricity markets are likely to respond with new generation projects beyond what is proposed today.

Finally, there are many steps that the State can take to promote the development of new resources and maintain the reliability of the electric system in the event that IPEC is retired. Over the next seven to ten years while there is excess capacity on the system, the State can (a) modify public policies to promote the development of additional energy efficiency and renewable resources, as outlined in this report; (b) take steps to develop some of the proposals submitted in the context of the Energy Highway Initiative; (c) ensure that the wholesale electricty markets are functioning as effectively as possible, for example by creating a new capacity zone in the highly-constrained regions near New York City; and (d) in the unlikely event that reliability becomes threatened in future years, the State can take steps to temporarily continue operation of existing generators that would otherwise be retired.

Most stakeholders now agree that IPEC could be retired and its power replaced through a combination of new generation, transmission, and efficiency resources, without jeopardizing the reliability of the New York electric system. In January 2012 numerous stakeholders testified before the New York State Assembly Standing Committee on Energy and Assembly Standing Committee on Corporations, Authorities and Commissions regarding IPEC replacement options. Several of the witnesses, including representatives from NYISO and Consolidated Edison, testified that IPEC could be retired without causing reliability concerns. At the conclusion of the hearings, the Committee Chairs determined that IPEC could close without threatening reliability or significantly impacting electric rates, provided proper planning and investments in transmission, energy efficiency, and completion of currently planned resources is carried out (NY State Assembly, 2012).

NYISO testified that proposed generation projects in Southeast New York could add up to 2,000 MW of new power by 2015 and several transmission projects could bring up to 3,000 MW online by 2016. Further, relieving transmission constraints could free up over 1,500 MW from existing power plants.

Despite the evidence presented at these hearings, some concern regarding reliability has persisted. One source of this concern stems from NYISO's Reliability Needs Assessment (RNA) sensitivity analyses prepared in 2010 and 2012. These assessments included a sensitivity analysis in which the IPEC units are not relicensed. The 2012 RNA sensitivity results found that there would be a deficiency in 2016 if the units were retired in 2013 and 2015 (NYISO, 2012b, pp. 42-43).

However, it is important to recognize that the RNA IPEC retirement scenario represents a very conservative scenario, in which NYISO assumes that *no* new generation will come online after 2013, and all generators that are considering retirement will go offline. In particular:

- The RNA IPEC retirement scenario assumes that no new electricity generators are installed after 2013, due to the uncertainty of predicting when and where new generators will be installed. However, there is no question that new generators will be added to the New York electric system after 2013, especially if IPEC is not relicensed. For example, the RNA analysis did not include the capacity of the 1,136 MW Cricket Valley Energy Center in its RNA IPEC scenario.
- The RNA IPEC retirement scenario assumes that all plants that are currently designated for mothballing or retirement are in fact retired. This results in roughly 1,527 MW of retirements in addition to what is assumed in the NYISO *Gold Book*. Some of this capacity may not be mothballed or retired in the next few years, especially if IPEC is not relicensed.
- The RNA IPEC retirement scenario does not account for the fact that the State could take steps to address potential reliability issues following the decision to not relicense IPEC. However, there are many actions that the State could take to address potential reliability issues, if needed.

In August 2012, the New York State Energy Planning Board released its *New York State Transmission and Distribution Systems Reliability Study and Report,* which specifically addressed the reliability concerns associated with IPEC retirement.[1] Regarding the draft NYISO RNA sensitivity analyses that show a potential deficit in capacity following IPEC's closure, the Energy Planning Board writes:

> "…there are mechanisms in place that would adequately replace any deficiency related to the closure of the IP [Indian Point] units. New York has robust planning and regulatory processes that would automatically implement either market-based options or regulatory backstop solutions in the event a deficiency is identified.
>
> In addition, there are a variety of generation and transmission projects that are in different stages of development that could provide adequate replacement power." (State Energy Planning Board, 2012, p. 84)

New York State's energy market is dynamic and flexible, and is subject to thorough reliability planning processes and regulatory oversight. The retirement of IPEC therefore represents a

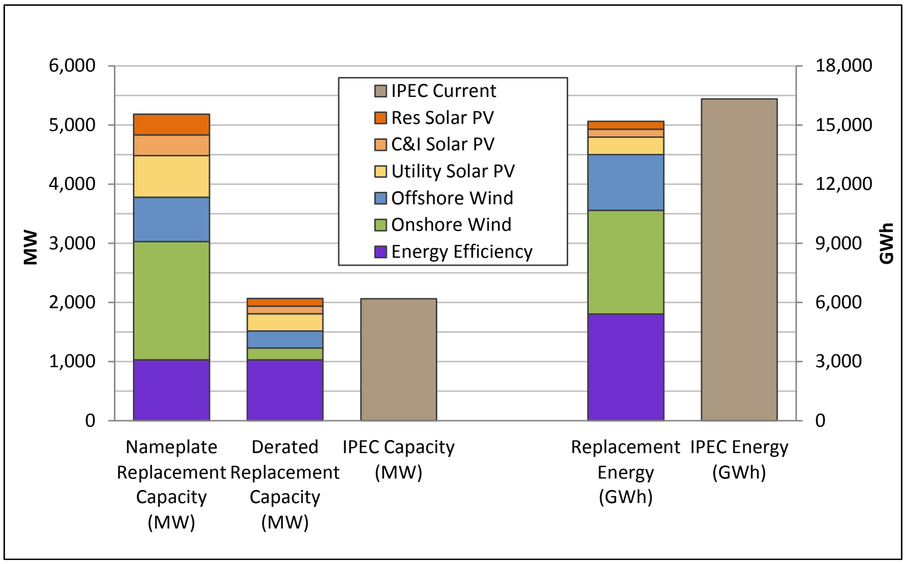
[1] The New York State Energy Planning Board is directed by the New York State Legislature to undertake a study of the overall reliability of the State's electric transmission and distribution systems.

change to the New York electric system that must be properly planned for, but not one that is likely to threaten the reliability of the electric system.

A Clean Energy Replacement Portfolio

We have created a portfolio consisting of both energy efficiency and renewable resources to illustrate how a combination of such clean energy resources can be used to replace IPEC. Our portfolio includes equal amounts of energy efficiency and renewable capacity, with each resource type contributing 1,030 MW to replace the 2,060 MW from IPEC. We assume that this portfolio of resources could be installed by 2022 to replace IPEC, even though the full 2,060 MW will not be needed until sometime after that.

Figure ES-2: Efficiency and Renewable Resources in the Clean Energy Replacement Portfolio



Source: Figure 14

For energy efficiency, we assume that a portion of the incremental savings described below will contribute to the clean energy portfolio. These resources will be distributed throughout the state roughly according to where the electricity demand is located.

For renewable resources, we include renewable capacity at the UCAP value, because this is the value that is comparable to the capacity from IPEC for reliability purposes. [2] We choose a mix of renewable resources that reflects the mix of those resources currently proposed in the Interconnection Queue, the Energy Highway RFI, and the NY-Sun Initiative. Figure ES-2 presents the mix of efficiency and renewable resources included in our illustrative clean energy portfolio.

[2] Capacity values are reported in Summer Unforced Capacity MW, or UCAP, which is the net anticipated useable capacity when outages and other generator operating characteristics are considered.

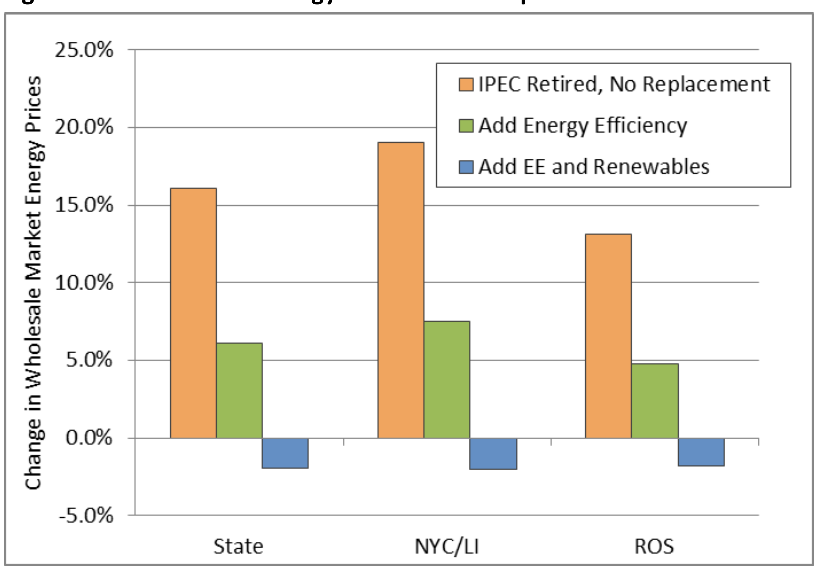
Potential Costs of the Clean Energy Replacement Scenario

Retiring IPEC and replacing it with a portfolio of clean energy resources will have two primary impacts on costs to New York electricity customers. First, wholesale electricity market costs will be impacted by a combination of generation supply mix changes and demand reduction. Second, additional costs will be incurred to support the development of expanded energy efficiency programs and renewable generation. We refer to these latter costs as "public policy" costs, because they will be incurred as a result of public policy mechanisms, such as the energy efficiency system benefits charge and the renewable energy certificates.

We estimate the impacts on wholesale electricity markets by constructing a supply curve of the generation resources in the New York electricity market. We start with actual data for 2011, creating supply curves for annual, summer, winter, and spring/fall seasons in order to capture the different market impacts across the different seasons. We also create supply curves for two separate regions of the state: (1) New York City and Long Island, and (2) the rest of the state. These two regions currently experience significantly different wholesale electricity prices.

Then we construct the same set of supply curves for 2022 by modifying the 2011 curves to account for expected changes in generation capacity and fuel costs. For each of the 2022 supply curves we create one that includes IPEC capacity and energy, and one that includes the capacity and energy from our clean energy portfolio. We then take the difference in average costs to estimate the likely impact of replacing IPEC on the electricity market costs.

Figure ES-3: Wholesale Energy Market Price Impacts of IPEC Retirement and Clean Energy Portfolio

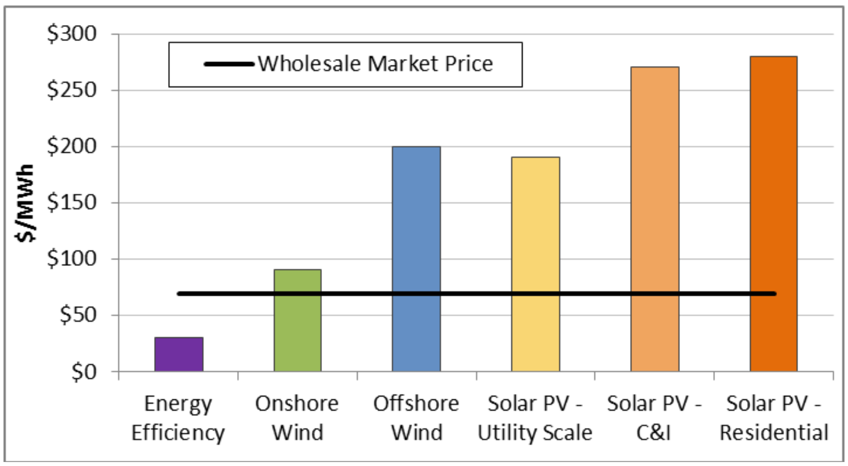


Source: Figure 17

Figure ES-3 illustrates some of our findings. The leftmost bar indicates that if IPEC is removed from the system with no replacement, the wholesale energy cost is likely to increase by roughly 16 percent for the whole state. When energy efficiency is included in the market, along with the IPEC retirement, the increase in wholesale energy costs is on the order of six percent. When renewable resources are added to the system, along with the efficiency and the IPEC retirement, wholesale electricity costs are likely to be reduced by approximately two percent.

We then estimate the public policy costs that are likely to be required to implement the clean energy portfolio. Figure ES-4 presents an estimate of these costs on a $/MWh basis. We forecast that the overall electricity market price in 2022 is likely to be roughly $70/MWh, including both energy and capacity. The energy efficiency resources included in our portfolio are likely to cost approximately $30/MWh, resulting in a savings of $40/MWh as compared with the market price of energy. The renewable resources are all expected to cost more than the market price, as indicated in the graph. The public policy costs of the renewable resources will equal the difference between the renewable resource costs and the electricity market price of $70/MWh.

Figure ES-4: Public Policy Costs of the Clean Energy Portfolio



Source: Figure 18

We estimate that the public policy costs are likely to include more than $200 million in savings from energy efficiency and approximately $750 million in costs for renewable resources, for a net cost of roughly $550 million per year. This represents an increase in New York system electricity costs on the order of two percent.

In terms of customers' electricity bills, the impacts of the wholesale energy market will affect only that portion of the bill that includes the energy generation costs, rather than the portion that includes charges for distribution and other services. For residential customers, the energy portion is typically about half of the bill. The public policy costs, on the other hand, are generally collected across the entire bill. When these two effects are combined, we estimate that the total impact on customers' bills will be very small, on the order of a one percent increase.

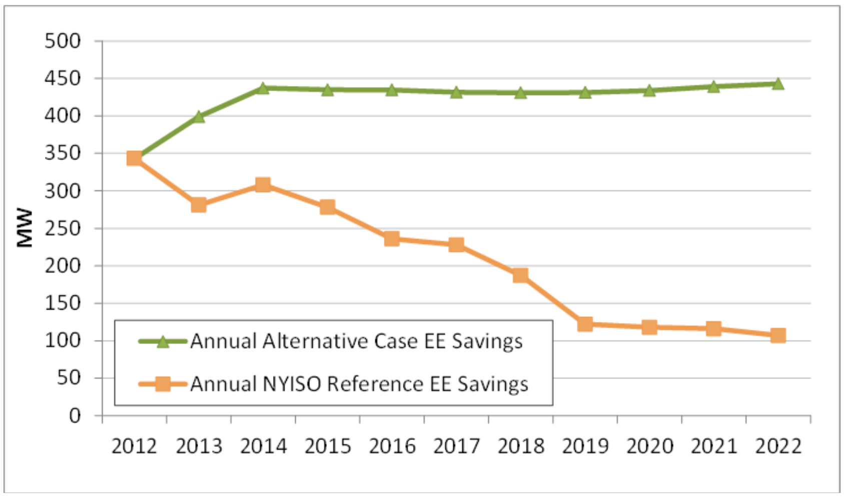
For a typical residential customer this would translate into roughly one dollar per month in increased costs. Those customers that participate in the expanded energy efficiency programs in our portfolio will see reductions in electricity bills that far outweigh this increase in cost.

Energy Efficiency Opportunities

The state of New York has supported various successful energy efficiency programs and policies for many years. Nonetheless, there is no question that a large amount of cost-effective efficiency resources remains undeveloped.

The NYISO Gold Book includes forecasts of future electricity load, both with and without energy efficiency. As indicated in Figure ES-5, the current forecast assumes that under current planning assumptions, efficiency savings will decline over the next decade, and by 2019 will be less than half of what they are today.

Figure ES-5: Annual Energy Efficiency Savings Assumed by NYISO versus Our Analysis



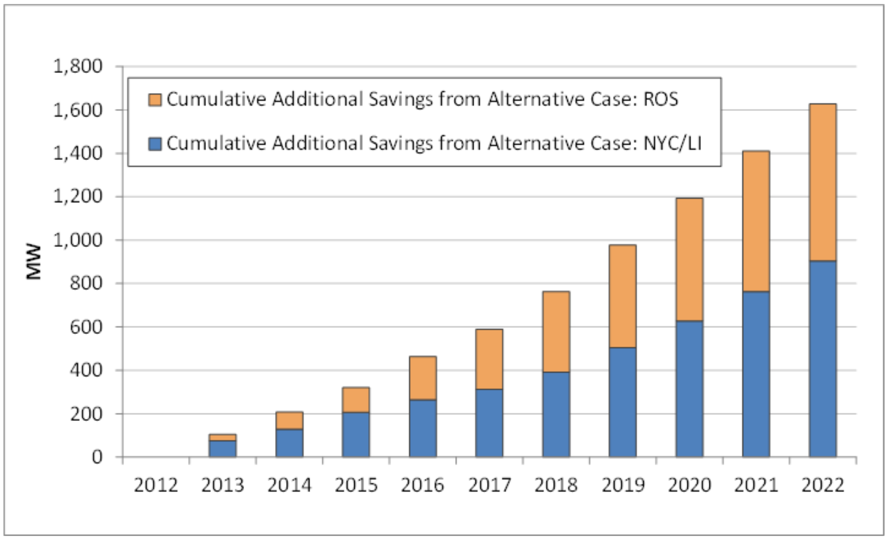
Source: Figure 9

We recommend that the State take an alternative, lower-cost approach and pursue higher levels of energy efficiency savings. Energy efficiency program administrators should pursue a slightly more aggressive level of savings over the next few years, on the order of what several leading states are achieving today, and then maintain this level of savings for at least the next decade.

This increase in energy efficiency savings will be sufficient to provide more than 1,600 MW of new energy efficiency capacity by the end of the decade. As indicated in Figure ES-6, much of this energy efficiency capacity (more than 900 MW) could be installed in the New York City and Long Island area where the need for electricity capacity is greatest.

This energy efficiency can be installed at very low cost. The energy efficiency program budgets for 2012-2015 approved by the Public Service Commission for New York program administrators exhibit an average cost of less than $30/MWh, much lower than any other electricity resource available.

Figure ES-6: Cumulative Energy Efficiency Available from Our Analysis



Source: Figure 10

Renewable Resource Opportunities

Over the past decade, New York has begun to tap into its significant renewable energy resource base with policies to support the development of wind, solar, and other renewable resources. For example, since 2005, NYSERDA has procured 1,862 MW of new renewable capacity (NYSERDA, 2012c). Nonetheless, there remains a significant amount of renewable resources that can be developed, both to help replace IPEC and to meet other important state energy goals.

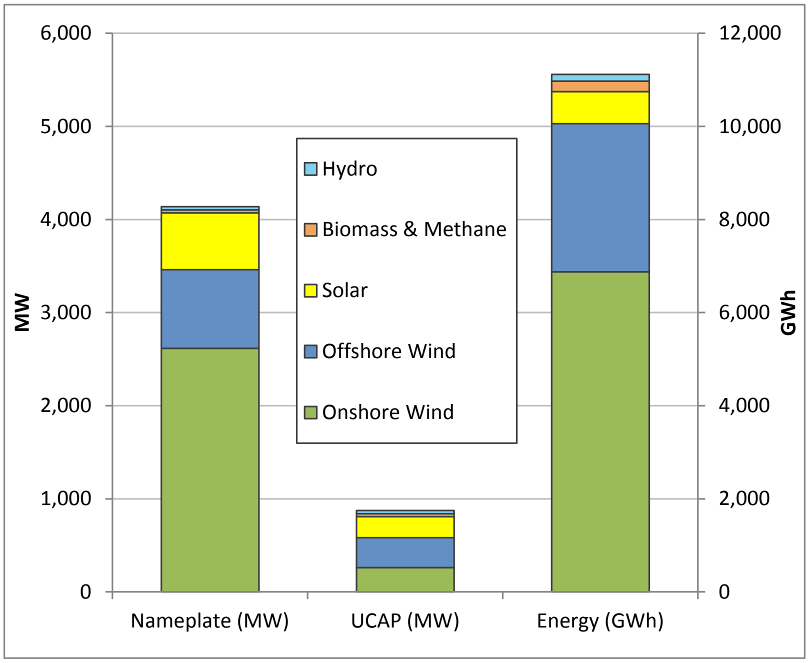
There are numerous proposals for adding new renewable resources to the system soon. For example:

- The 2012 NYISO *Gold Book* assumes for planning purposes that 1,288 MW (143 MW derated) of renewable capacity will be installed over the next several years.
- The NYISO Interconnection Queue includes an *additional* 1,312 MW (215 MW derated) of renewable projects that are in varying stages of development.
- The Energy Highway Request for Information resulted in several new proposals for renewable generators of various types, totaling at least 1,047 MW (335 MW derated) beyond what is included in the NYISO *Gold Book* or Interconnection Queue.
- Furthermore, the NY-Sun Initiative – a solar photovoltaic (PV) expansion program – is expected to spur the development of PV facilities throughout the state.

Figure ES-7 presents a summary of the renewable resources that have been proposed to date from the Interconnection Queue, the Energy Highway RFI, and the NY-Sun Initiative. As indicated, more than 4,000 MW of renewable capacity could be developed from these proposals alone.

We also present the amount of UCAP capacity available from these different renewable resources in order to indicate the extent to which NYISO will account for the reliability value of the intermittent renewable resources. Even after accounting for the UCAP value, there is nearly 1,000 MW of derated capacity available from these proposals. Given that currently proposed renewable projects could replace nearly half of IPEC's capacity, it is reasonable to expect that new renewables could provide 1,030 MW of capacity by 2022, as significantly more renewables could be developed over the next decade to help replace IPEC. In particular, there remains a large untapped potential in New York for onshore wind, offshore wind, rooftop PV, and utility-scale PV.

Figure ES-7: Proposed Capacity and Energy from Renewable Resources (Queue, RFI, & NY-Sun)



Source: Figure 13

Recommended Policy Options for Implementing the Clean Energy Replacement Portfolio

There are a number of policy options that the State could adopt to promote the development of the clean energy replacement portfolio. We recommend the following policies be adopted to promote energy efficiency resources:

- Update the Energy Efficiency Portfolio Standard Goal. This goal should be updated in the spring of 2013 to allow program administrators and other stakeholders time to respond by 2015. The new goal should encourage program administrators to pursue all cost-effective energy efficiency, and should require a minimum level of annual electricity savings of 1.5 percent per year.

- Improve the energy efficiency screening process. The Public Service Commission should require that energy efficiency resources be screened at the program level, not at the measure level, in order to minimize lost opportunities, recognize the interdependence of energy efficiency measures, and promote equity across customer types.
- Enable the spending of the full energy efficiency budget. The State should work with the efficiency program administrators to assess the barriers to spending the existing energy efficiency funds and identify ways to overcome them.
- Enable energy efficiency to participate in wholesale electricity markets. The State should allow energy efficiency to participate in wholesale electricity markets in order to improve the efficiency of those markets and provide revenues to support additional efficiency.
- Provide resources and support to enforce building codes. NYSERDA should continue and expand its support for architects, engineers, builders, code officials, and energy modelers.
- Facilitate greater private sector support for clean energy resources. The State should take steps to create the right market conditions for the private sector to support energy efficiency and renewable resources. For example, this should include more public-private partnerships such as a Green Bank, and other financing strategies such as Property Assessed Clean Energy (PACE).

These policy options can be considered "no regrets" options: they all make sense on their own regardless of whether IPEC is retired soon.

We recommend the following policies be adopted to promote renewable resources:

- Update and expand the RPS. The State should update the RPS structure and goals in the spring of 2013 to allow NYSERDA and project developers time to prepare for compliance after 2015. The new goal should require renewables to provide 30 percent of annual energy by 2016, with that goal increasing by one percent each year thereafter.
- Improve the NYSERDA renewable energy certificates (RECs) solicitation process. NYSERDA should issue solicitations on a more predictable basis, should offer higher prices for RECs as needed, and should coordinate their solicitations with NYPA and LIPA.
- Modify the RPS to support specific technologies. The RPS should include additional tiers to support the development of offshore wind and PV because of the unique benefits that these resources offer the state.
- Extend the NY-Sun Initiative. This initiative should be extended legislatively to run for ten years, with a goal of providing 2,200 MW of solar power by 2022, and could provide $1.5 billion in support for solar projects.
- Support and Expand the Offshore Wind Collaborative. This effort should be supported in order to increase the development of this key resource located in the regions near

New York City and Long Island. The Collaborative should establish a goal of developing 5,000 MW of offshore wind by 2020, and support this goal with siting and long-term financing support for offshore wind.

- Implement Public-Private Financing Strategies for Renewables and Efficiency. New York State should also do a lot more to leverage its support for efficiency and renewables by creating the right market conditions for the private sector to step in. This should include implementation of more public-private partnerships such as a Green Bank and other financing strategies such as commercial Property Assessed Clean Energy (PACE) financing programs.

Note that these policy options can all be considered "no regrets" options. That is, they all make sense on their own regardless of whether IPEC is retired soon. However, in the event that IPEC is retired, it will be especially important to implement these policies to ensure that the state is able to maintain an electric system that is both clean and reliable.

1. Introduction

Indian Point Energy Center (IPEC) in Westchester County, New York currently operates two nuclear reactors with a combined capacity of 2,060 MW. The original 40-year operating licenses for these two units are set to expire in 2013 and 2015, and it is uncertain whether the Nuclear Regulatory Commission (NRC) will approve the units' license renewals, particularly given recent operating and waste disposal legal challenges.[3] Therefore it is an opportune time for New York to consider alternatives to the Indian Point Energy Center.

The NRC's Atomic Safety and Licensing Board is currently scheduled to hold hearings regarding IPEC's relicensing on October 15-24, 2012. However, on June 8, 2012, the U.S. Court of Appeals for the District of Columbia invalidated the Nuclear Regulatory Commission's Waste Confidence Decision Update and directed the NRC to perform a more thorough analysis of the risks regarding temporary storage and permanent disposal of nuclear waste.[4] This evaluation of waste storage risks must now be completed prior to a decision being made concerning IPEC's relicensing.

This report focuses on whether and how IPEC could be safely retired and its capacity replaced by clean energy resources, i.e., energy efficiency and renewable generation, and the policies that would be needed to support this transition. Synapse Energy Economics prepared this analysis at the request of the Natural Resources Defense Council, Inc. and Riverkeeper, Inc.[5] This analysis is an update to the 2011 report titled *Indian Point Energy Center Nuclear Plant Retirement Analysis*, which found that a surplus of capacity exists near IPEC resulting in no need for additional capacity for reliability purposes until 2020. Additionally, the 2011 analysis concluded that IPEC's capacity could be replaced through a combination of energy efficiency and demand response, local renewable resources, repowering of existing older power plants, and new efficient generation plants. The economic impact of such a replacement strategy on customer

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[3] The Indian Point units' two federal operating licenses expire in September 2013 and December 2015, although they may be administratively extended by the Nuclear Regulatory Commission (NRC) if currently pending relicensing proceedings are not resolved by those dates. Additionally, in August 2012, the NRC voted to postpone its decision regarding Indian Point's relicensing until it addresses issues of spent fuel storage.

[4] In its decision on State of New York v. NRC No. 11-1045 regarding the NRC's rulemaking on temporary storage and permanent disposal of nuclear waste, the court held that "the rulemaking at issue here constitutes a major federal action necessitating either an environmental impact statement or a finding of no significant environmental impact. We further hold that the Commission's evaluation of the risks of spent nuclear fuel is deficient…." The court directed the NRC to provide a more thorough analysis than it provided in the Waste Confidence Decision Update.

[5] Synapse Energy Economics, Inc. is a research and consulting firm specializing in energy, economic and environmental topics. Additional information about Synapse Energy Economics and the report authors is available at www.synapse-energy.com.

bills was estimated to be modest, and customers who participate in energy efficiency programs would experience an overall reduction in their bills due to energy savings.

Our updated analysis reaffirms our previous study's conclusion that numerous options exist for safely and cost-effectively replacing IPEC and takes new developments into account. The New York energy landscape has changed since the 2011 Synapse study. A key development is Governor Cuomo's Energy Highway Initiative, the purpose of which is to modernize New York State's energy system through upgraded transmission capabilities and energy projects. Additionally, the New York Independent System Operator (NYISO) has released updated load and energy forecasts pertaining to New York's electricity needs for the next decade.

Our analysis is based upon existing literature regarding electricity resource development in New York, particularly the New York Independent System Operator *Gold Book*, which contains forecasts of peak demand and a comprehensive queue of electricity resources that are currently being proposed (NYISO, 2012a). Transmission and energy project proposals from the Energy Highway Initiative are also considered.

We note at the outset that this report provides an overall assessment of the potential opportunities and costs associated with replacing IPEC's energy and capacity, based upon readily available current data. The actual impacts of retiring IPEC will depend upon a variety of factors in the New York electricity market that are very difficult to forecast with precision at this time. Nonetheless, our analysis provides useful information illustrating some likely impacts.[6]

[6] This report does not address the policy arguments for or against relicensing of the IPEC units or the environmental, public health and safety issues associated with IPEC.

2. The New York State Electric System

Below we discuss the current state of New York's electric system and possible developments over the coming decade, followed by an analysis of the effect of IPEC's retirement on system reliability.

At the outset we note that any electric system has both capacity and energy requirements. Capacity (measured in megawatts) represents the system's ability to generate enough electricity in order to meet peak demand. Energy (measured in megawatt-hours) represents the total amount of electricity generated to meet demand over a given period of time (e.g., over the course of a year). To ensure reliability, the system must have sufficient capacity to meet the highest anticipated amount of electricity demand in any one hour.

Over the past year, progress has been made in developing new generation and transmission facilities, such as the 1,136 MW Cricket Valley Energy Center, the 660 MW Hudson Transmission Project, and the 1,000 MW Champlain Hudson cable. In addition, the Governor's Energy Highway Initiative (discussed in the following section) has spurred a significant number of proposals for developing new generation and transmission facilities.

2.1 Recent Developments: New York Energy Highway Initiative

In his 2012 State of the State address, Governor Cuomo called for the construction of an "energy highway," a public-private partnership to upgrade and modernize New York's energy system. The goals of the New York Energy Highway Initiative include reducing constraints on transmission throughout the state, as well as encouraging the development of renewable generation (Anderson, 2012). The Energy Highway is envisioned to bring generation from the northern and western portions of the state, Canada, and New England to more congested areas in the Hudson Valley and the New York City area, while also supporting the development of new wind, solar, and other renewable energy projects. The introduction of the initiative by Governor Cuomo sends a strong message that New York is committed to addressing its energy infrastructure needs and developing its renewable energy resources.

"Just as we built the New York State Thruway to unite distant parts of the state, we will develop an "Energy Highway" system that will bring excess fossil-fuel energy from Western New York downstate, and also tap into Upstate's potential for renewable energy, like wind power. Just like we built the Northway, we will develop an energy expressway down from Quebec. This will preserve Western New York's current allocation of low cost hydropower and at the same time help address the energy needs of Downstate."

Governor Andrew M. Cuomo, 2012 State of the State Address, January 4, 2012

On April 11, 2012, the New York Energy Highway Task Force ("Task Force") issued a Request for Information (RFI) for project proposals and received 130 submissions from various developers, utilities, and other entities. The responses from the Governor's Request for Information included the following:

- New renewable generation projects, totaling 1,600 to 4,200 MW.
- Repowering projects, in the event that existing uneconomic facilities retire, totaling as much as 2,400 MW.
- New natural gas-fired generation projects, totaling as much as 4,000 MW.
- Nine new DC transmission projects, ranging in capacity from 500 MW to 2,000 MW each, designed to bring electricity from Canada, the PJM Electricity Market, and upstate New York to locations in the region around IPEC. Two of these proposals would deliver electricity directly into New York City.
- Twenty new alternating current (AC) transmission lines, five of which are new lines while the remainder are upgrades to existing lines. Two of the new projects are specifically designed to mitigate contingencies and increase line capacity in the event that IPEC is retired soon.

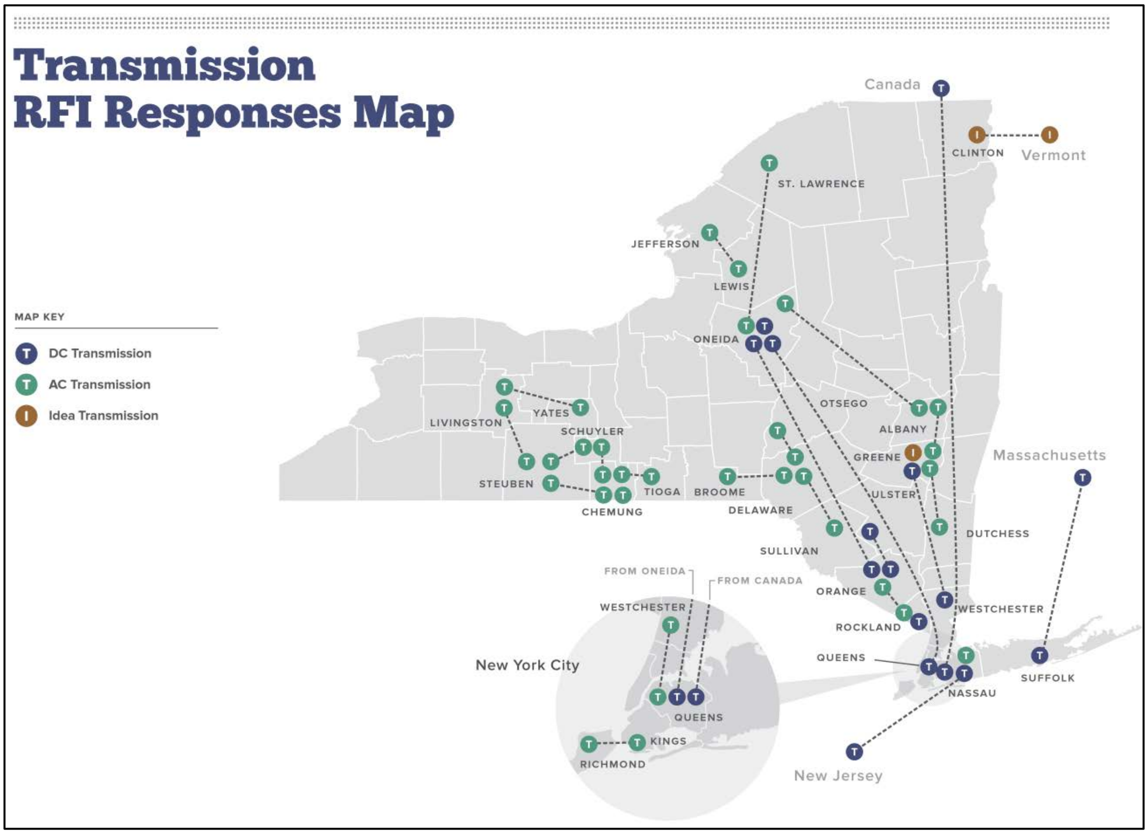
Implications for the Development of Transmission

Following the release of a transmission needs study in April 2012, a coalition of New York State transmission owners proposed forming a public-private partnership called NY Transco to undertake construction of 18 transmission projects that would relieve many current constraints on the flow of electricity to major load centers. Of the proposed work, three projects are currently underway or "immediately actionable," while four others are ranked as "actionable." In addition to addressing general congestion issues, a pair of projects is designed specifically to address reliability in the event of IPEC's retirement. Other projects in the plan are expected to integrate greater amounts of wind generation in Jefferson County and in western New York, with the timing of these projects corresponding to the completion of wind projects in the NYISO queue (Finlay, 2012). Proposed transmission projects are presented in Figure 1.

The development of new transmission capabilities across the state will have a considerable effect on the ability to transmit energy from areas of surplus to areas of need. It is also expected to expand the fuel diversity of generation resources serving the southeastern regions of the state and improve reliability.

With these transmission investments, the location of energy resources across the state becomes less important in ensuring that sufficient resources are available to serve major load centers. In particular, the infrastructure upgrades will reduce New York City and Long Island's dependence on local generation and allow the region to benefit from the substantial clean energy generation resources that exist or are under development in other parts of the state.

Figure 1: Transmission Responses from Energy Highway RFI



Source: http://www.nyenergyhighway.com/rfidocument/transmission/

Implications for the Development of Renewable Resources

Among the projects proposed in response to the Energy Highway RFI are renewable energy projects totaling between 335 and 1,047 megawatts (MW) beyond what is currently listed in the Interconnection Queue, and after adjusting for each resource's UCAP value (the reliability value of the intermittent renewable resources to the electric system as defined by NYISO). [7]

Following a review of the RFI responses and stakeholder input in the fall of 2012, the Task Force will issue an action plan regarding these proposals. The purpose of the action plan is to provide an environment that will spur private sector action. The issuance of the RFI illustrates both the State's support for renewable energy and the potential resources available to serve New York's

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[7] Capacity values are reported in Summer Unforced Capacity MW, or UCAP, which is the net anticipated useable capacity when outages and other generator operating characteristics are considered. For new resources with no historical data, NYISO's default UCAP values are 0.10 for onshore wind, 0.42 for offshore wind, 0.42 for utility-scale solar PV, and 0.37 for residential and commercial PV. Once resources are in operation, these values are modified based on historical data, typically resulting in higher UCAP values. For the purposes of this analysis, however, only NYISO's default values are used. Our results are therefore conservative.

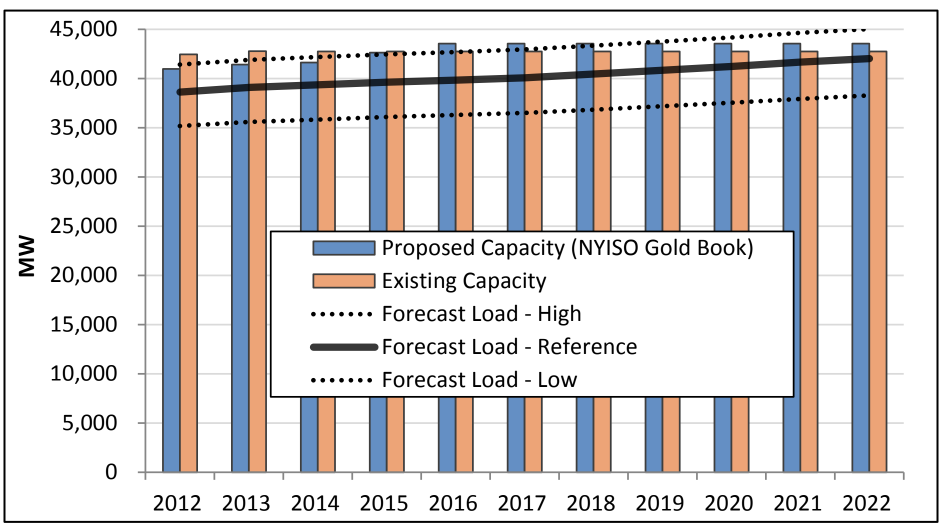
electricity demand. In Section 4 we present more information regarding the renewable projects that were proposed in response to this RFI.

2.2 Current Electricity Resource Needs and Future Uncertainties

The New York Independent System Operator annually prepares ten-year forecasts of future electricity demand and changes in generation capacity, compiling this data in an annual publication titled *Load and Capacity Data "Gold Book."* In the *Gold Book,* NYISO reports that, including IPEC, the total existing resource capability for 2012 is 43,686 MW, while the projected peak load (including a 16% reserve margin) amounts to 38,456 MW. The difference indicates a current capacity surplus in New York of more than 5,000 MW.

As shown in Figure 2, the generation capacity in New York is expected to increase over the next few years. As indicated by the orange bars in Figure ES-1, NYISO currently projects net capacity additions to the electric system through 2016. The Bayonne Energy Center (500 MW) and the Marble River Wind Farms (215 MW) are new generators that NYISO assumes are very likely to reach commercial operation and thus should be assumed operational for planning purposes. Similarly, upratings at Nine Mile Point 2 (168 MW) and the Munnsville Wind Power site (6 MW) are also assumed operational for planning purposes. Additionally, the NYISO *Gold Book* lists a number of projects in the Interconnection Queue that have achieved substantial milestones in the approval process. This list includes, for example, the Cricket Valley Energy Center, a 1,136 MW power plant that has recently received several permits and is expected to commence construction in 2013.

Figure 2: Capacity (including IPEC) with Forecasted Peak Load for 2012 - 2022



Source: NYISO 2012 Gold Book

As shown in Figure 2, NYISO expects the surplus of existing capacity to continue through 2022. The figure presents the amount of capacity available from existing generators, as well as the amount of capacity that is expected to be available after accounting for proposed capacity changes. The proposed capacity changes in the *Gold Book* include 1,533 MW of capacity retirements, 2,856 MW of capacity additions (derated), and additional uprates, demand resources, and distributed generation for a total net addition of 1,776 MW by 2022. The capacity additions are summarized in Table 1.

Table 1: NYISO *Gold Book* Proposed Capacity Additions 2012-2022

Generation Type	Nameplate Capacity (MW)	Derated Capacity by Summer UCAP (MW)
Wind Turbines	1,272	127
Hydro	11	11
Methane	2	2
Solid Waste	19	19
Combined Cycle	2,198	2,198
Dual Fuel	500	500
Total Proposed Additions	4,002	2,856

Note: Numbers may not add due to rounding

The amount of proposed capacity can be compared to the Reference Case load forecast, including a 16 percent reserve margin, to get an indication of the extent of capacity excess or shortfall. As indicated in Figure 2, New York State is expected to have an excess amount of capacity through 2022, despite load growth.

The NYISO *Gold Book* provides a useful resource for documenting expected future developments in New York's electricity demand and capacity requirements. However, other factors such as new policy initiatives, transmission availability, future environmental regulations, and other uncertainties must also be considered. Below we discuss several developments in these areas and their ability to affect the New York energy landscape over the coming decade.

In addition to proposed capacity changes listed in the *Gold Book*, NYISO maintains the Interconnection Queue, an extensive list of electricity resources that have been proposed by developers but that are in various stages of development and study and are not accounted for yet by NYISO for planning purposes. The Interconnection Queue currently lists 7,900 MW of proposed new and uprated summer unforced capacity, of which 2,600 MW are renewable resources.

The Queue also contains several new transmission facilities that are in the process of being planned, constructed or completed. These transmission projects will significantly assist the transmission of power into different regions of the state, including the regions near IPEC. The projects include (a) a 345 kV transmission line from Bergen, New Jersey to West 49th St in New York City, with a thermal rating of 660 MW; (b) a 15 MW transformer uprate for an existing 345 kV transmission line from New Jersey to New York City; and (c) a 320 kV direct current (DC) transmission line from Hydro Quebec to Astoria, New York, with a thermal rating 1,000 MW.

Another indicator of the potential for new generation in New York is the Governor's Energy Highway Initiative. Proposals from the Energy Highway contain an additional 335 to 878 MW of renewable capacity (derated) beyond what is listed in the NYISO *Gold Book* and larger Interconnection Queue.[8]

Responses to the Energy Highway RFI also include $2.9 billion of proposed new and upgraded transmission. Of these projects, three projects are listed as being “immediately actionable” and are designed to mitigate transmission needs that may occur following the retirement of Indian Point and generators in the New York City metropolitan area. The total estimated cost of this subset of projects is $385 million, and progress is expected to occur rapidly due to having already completed detailed engineering evaluations and, in certain cases, having already received or initiated NYISO and/or New York Public Service Commission approval (New York Transmission Owners, 2012).

Significant uncertainty also surrounds the possibility of future power plant retirements. As a result of lower natural gas prices and recent and potentially forthcoming EPA regulations, some of New York’s coal plants may become uneconomic. Higher coal prices and reduced demand have already been blamed for AES Eastern Energy LP’s December 2011 bankruptcy filing. At the time of its bankruptcy filing, AES owned or leased six New York coal-fired power plants (Pettersson, 2011). Additionally, Dynegy Inc., the operator of the Roseton and Danskammer power plants in the Town of Newburgh filed for Chapter 11 bankruptcy in 2011, in part due to low electricity prices and nearly $400 million in projected environmental upgrades that would be required by 2014 (Levensohn, 2011).

Some EPA regulations have been challenged by industry in court and efforts have also been made in the House of Representatives to overturn regulations legislatively. While many EPA regulations have been upheld by the courts, the Cross-State Air Pollution Rule (CSAPR), was vacated by the United States Court of Appeals for the District of Columbia in August 2012. EPA and environmental groups (including NRDC) have sought a rehearing of this decision.

Repowering projects are among those proposed in the Interconnection Queue and Energy Highway RFI, many of which are candidates for replacing current coal-, gas-, and oil-fired power plants in the event of their retirement. The likelihood of these repowering projects depends to a large extent on future fuel prices, the timing of proposed EPA regulations, and state legislative actions.

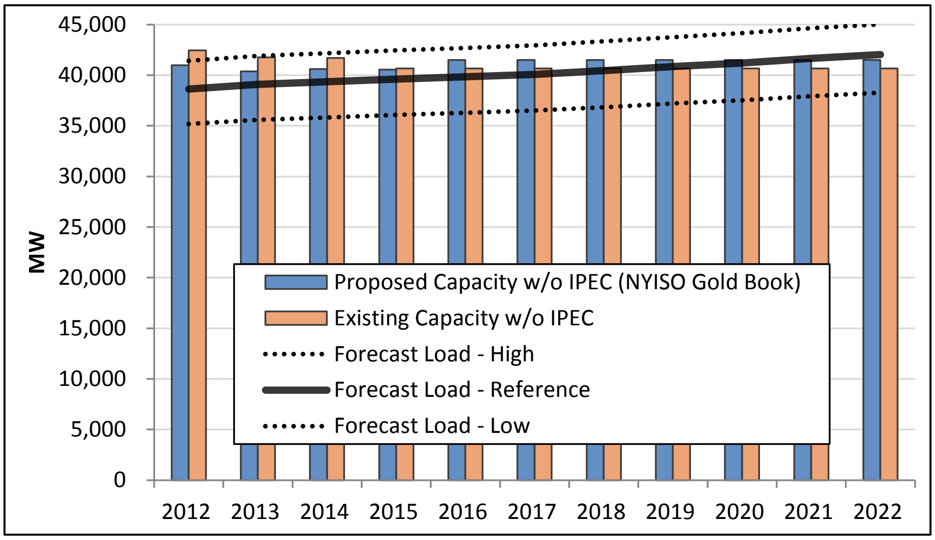
In sum, a high degree of uncertainty surrounds future capacity and transmission developments in New York State, in addition to the possibility of IPEC’s retirement. Yet the large surplus of existing capacity and abundance of new transmission and generation proposals point to the flexibility of New York’s electric system to meet future electric needs under a variety of scenarios. In the following section, the ability to meet capacity requirements without IPEC is explored.

[8] The RFI requested a low and high range of proposed capacity additions, with the low estimates totaling 355 MW and the high estimates totaling 1,047 MW.

2.3 Future Electricity Resource Needs without Indian Point

Although many uncertainties regarding future generation in New York State exist, NYISO's *Gold Book* forecasts for electricity load growth and generation additions and retirements provide a solid starting point for our analysis. Figure 3 demonstrates the impact of IPEC's retirement on the ability of capacity resources to meet reserve requirements. The proposed capacity and existing capacity data from Figure 2 were modified to reflect the retirement of Indian Point Unit 2 in 2013 and Unit 3 2015.

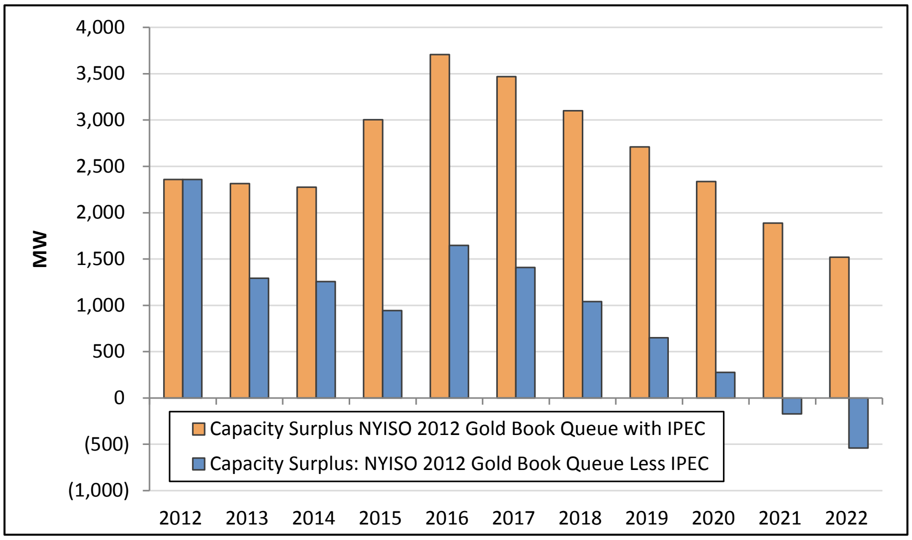
Figure 3: Capacity (excluding IPEC) with Forecasted Peak Load for 2012 - 2022



Source: Derived from NYISO 2012 Gold Book

Figure 4 builds off of Figure 3, and shows the level of capacity surplus or deficit in each year following IPEC's retirement. As Figure 3 indicates, were New York State to retire IPEC and rely solely upon remaining capacity that is currently in existence, the state would maintain a capacity surplus through 2018. When projected additions and retirements are included, as shown in the blue bars in Figure 4, New York maintains a capacity surplus through 2020, despite the absence of IPEC. By 2022 New York will need an additional 580 MW of capacity to meet reserve margins. Note that the full 2,060 MW of IPEC capacity will not need to be replaced until sometime after 2022.

Figure 4: Projected Capacity Surplus with and without Indian Point



Source: Derived from NYISO 2012 Gold Book

We recognize that evaluating statewide energy demands and capacity levels this way presents a simplistic view of the complexities associated with ensuring electricity reliability in New York State and in the different regions within New York State, especially New York City and Long Island. Our comparison of forecasted loads to forecasted capacity provides a general overview of the balance of capacity and demand. Demonstrating electric system reliability also requires a "resource adequacy" assessment, which includes detailed modeling of the operation of the electric system to determine an acceptable loss of load expectation. Demonstrating electric system reliability also requires a "transmission security" analysis, which includes detailed modeling of the operation of power plants and the transmission flows within each of the NYISO electricity zones to ensure that sufficient transmission capacity is available to move power from the generation sources to the electricity loads, even under stressed conditions.[9]

Nonetheless, our general overview of the balance of capacity and demand does provide useful information regarding the opportunities for replacing IPEC. The fact that the state currently has excess capacity, and that this excess capacity is expected to continue well into the future even with IPEC retired, indicates that retiring IPEC is very unlikely to result in reliability problems in 2013 or 2015, and that the state has several years' time before it will be necessary to replace IPEC's capacity. Our analysis indicates that the state is likely to have more than a decade before it needs to replace the full 2,060 MW of IPEC.

[9] For market and reliability purposes, NYISO has divided New York State into eleven zones: Zone A through Zone K. Throughout this report we use the term "NYC/LI" to refer to New York City and Long Island (i.e., NYISO zones J and K). We use the term "ROS" to refer to the rest of New York State (i.e., NYISO zones A through I).

2.4 Recent Assessments of Maintaining Reliability without Indian Point

According to NYISO testimony, proposed generation projects in Southeast New York could add up to 2,000 MW of new power by 2015 and several transmission projects could bring up to 3,000 MW online by 2016. Relieving transmission constraints could free up over 1,500 MW from existing power plants.

The ability of New York's electric system to ensure reliability in the event of IPEC's retirement was assessed in hearings in January 2012. Numerous stakeholders testified before the New York State Assembly Standing Committee on Energy and Assembly Standing Committee on Corporations, Authorities and Commissions regarding IPEC replacement options, reliability, and economic impacts.

Technical testimony presented by the New York Independent System Operator demonstrated that the State has more than sufficient generation capacity to enable IPEC's retirement. Additionally, Rick Gonzales, Senior Vice President and Chief Operating Officer for NYISO stated that transmission upgrades would allow the system to make better use of statewide generating resources, including renewables, and that these transmission upgrades would be a worthwhile investment regardless of the status of IPEC (NY State Assembly, 2012). According to NYISO testimony, proposed generation projects in southeast New York could add up to 2,000 MW of new power by 2015 and several transmission projects could bring up to 3,000 MW online by 2016. Relieving transmission constraints could free up over 1,500 MW from existing power plants (NY State Assembly, 2012).

Consolidated Edison, the utility that provides energy to New York City and Westchester County, testified that numerous options exist for replacing IPEC's energy and capacity. The company's vice president for energy management noted, "There are a number of options that can be considered for replacing Indian Point's electric capacity, energy and voltage support, including demand side management and energy conservation programs, new electric generating facilities or new electric transmission lines to import power from regions where there is a surplus" (Oates, 2012, p. 3).

At the conclusion of the hearings, the Committee Chairs determined that IPEC could close without threatening reliability or significantly impacting electric rates, provided proper planning and investments in transmission, energy efficiency, and completion of currently planned resources is carried out (NY State Assembly, 2012). Kevin Cahill, Chair of the Assembly Committee on Energy, remarked "The information we gathered clearly demonstrates that Indian Point can be shut down without unduly burdening New York's ratepayers or the electric system. We have the framework and the resources for a future without Indian Point. It all comes down to the State developing a plan and putting it in motion."

Despite the evidence presented at these hearings and the conclusions of the committee members, some concern regarding reliability has persisted. One source of this concern stems from NYISO's Reliability Needs Assessment (RNA) sensitivity analyses prepared in 2010 and 2012. In these assessments, NYISO conducted sensitivity analyses, including one where the IPEC units are not relicensed. The 2012 RNA sensitivity results found that there would be a deficiency in 2016 if the units were retired in 2013 and 2015 (NYISO, 2012b, pp. 42-43).

However, it is important to recognize that the RNA IPEC retirement scenario represents a very conservative scenario, in which NYISO assumes that no new generation will come online after 2013, and all generators that are considering retirement will go offline. In particular:

- The RNA IPEC retirement scenario assumes that no new electricity generators are installed after 2013, due to the uncertainty of predicting when and where new generators will be installed (NYISO, 2012b, p. 21). However, there is no question that new generators will be added to the New York electric system after 2013, especially if IPEC is not relicensed. For example, the RNA analysis did not include the capacity of the 1,136 MW Cricket Valley Energy Center in its RNA IPEC scenario.

- The RNA IPEC retirement scenario assumes that all plants that are currently designated for mothballing or retirement are in fact retired. This results in roughly 1,527 MW of more retirements than what is assumed in the NYISO *Gold Book* (NYISO, 2012a, p. 61). Some of this capacity may not be mothballed or retired in the next few years, especially if IPEC is not relicensed.

- The RNA IPEC retirement scenario does not account for the fact that the State could take steps to address potential reliability issues following the decision to not relicense IPEC. However, there are many actions that the State could take to address potential reliability issues, if needed.

In August 2012, the New York State Energy Planning Board released its *New York State Transmission and Distribution Systems Reliability Study and Report,* which specifically addressed the reliability concerns associated with IPEC retirement.[10] Regarding the draft NYISO RNA sensitivity analyses that show a potential deficit in capacity following IPEC's closure, the Energy Planning Board writes:

- "…there are mechanisms in place that would adequately replace any deficiency related to the closure of the IP [Indian Point] units. New York has robust planning and regulatory processes that would automatically implement either market-based options or regulatory backstop solutions in the event a deficiency is identified.

  In addition, there are a variety of generation and transmission projects that are in different stages of development that could provide adequate replacement power." (State Energy Planning Board, 2012, p. 84)

[10] The New York State Energy Planning Board is directed by the New York State Legislature to undertake a study of the overall reliability of the State's electric transmission and distribution systems.

Further, the market signals that stimulate generation investments have proven to work well in the past and are poised to become even more refined as capacity zones are revised. Currently, a new capacity zone is being considered for adoption in the Lower Hudson Valley that will amplify capacity price signals in the event of regional generation scarcity (Order on Compliance Filing, 2011).

New York State's energy market is dynamic and flexible, and is subject to thorough reliability planning processes and regulatory oversight. The retirement of IPEC therefore represents a change to the New York electric system that must be properly planned for, but not one that is likely to threaten the reliability of the electric system.

3. Opportunities for Energy Efficiency Resources

3.1 Current Policies Supporting Energy Efficiency

The state of New York has engaged in various energy efficiency programs and policies for many years. Currently these initiatives include an Energy Efficiency Portfolio Standard (EEPS), New York State Energy Research Development Authority (NYSERDA) statewide programs, regulated and non-regulated utility energy efficiency programs, initiatives targeting state government agencies, and building codes and appliance standards. These are examined in more detail below.

*Original SBC Program: New York Energy $mart^SM^*

To ensure adequate implementation of energy efficiency and other public policy initiatives in New York's competitive electricity markets, in 1996 the New York State Public Service Commission called for the establishment of a System Benefits Charge (SBC). The *New York Energy $mart^SM^* energy efficiency program was initiated in 1998 with the Commission's allocation of $162 million and New York State Energy Research Development Authority (NYSERDA) selected as the statewide third-party administrator. Over the past thirteen and a half years, New York has invested $1.93 billion in the New York Energy $mart^SM^ program. The program's portfolio is primarily allocated among four major program areas: Commercial/Industrial initiatives (33%), Research and Development (R&D) (21%), Low-Income initiatives (17%), and Residential (non-low-income) initiatives (17%) (NYSERDA, 2012).

Since 2008, additional funds collected through the SBC support additional programs under the state Energy Efficiency Portfolio Standard (described below). Starting in 2012, NYSERDA's core programs have been incorporated into the Energy Efficiency Portfolio Standard (Maniaci, 2012a). In 2012, NYSERDA also launched the Technology and Market Development Program. This program focuses on research and development activities, with the expectation that the program will result in nearly 450 GWh of energy savings by 2015.

Energy Efficiency Portfolio Standard: "15 by 15"

<u>EEPS Jurisdictional Programs</u>

In 2008, the New York State Public Service Commission established an electric and natural gas Energy Efficiency Portfolio Standard (EEPS) with the goal of reducing electricity consumption by 15% below 2015 forecasted levels. Meeting this "*15 by 15*" goal would result in annual energy savings in 2015 of approximately 24,900 GWh (NYPSC, 2008) from a combination of new energy efficiency programs, existing energy efficiency programs, state agency mandates, codes and standards, and activities by other entities outside of the Commission's jurisdiction (i.e., the Long Island Power Authority (LIPA) and the New York Power Authority (NYPA)) (NY DPS Staff, 2011; NYSERDA, 2012; NYPSC, 2011).

Currently more than 100 individual energy efficiency programs are provided under the EEPS by the New York State Energy Research and Development Authority (NYSERDA) and the major investor-owned utilities in New York. These programs are funded through the System Benefits Charge (SBC) (NY DPS Staff, 2011). Of the total *15 by 15* reduction goal, EEPS jurisdictional programs have a target electricity savings of approximately 7,700 GWh annually in 2015 (excluding contributions from previously existing programs). When combined with the New York Energy $mart^{SM} program, the total jurisdictional savings target reaches approximately 11,200 GWh annually in 2015 (NYSERDA, 2012). As of 2011, programs administered by NYSERDA resulted in savings of between 2,800 GWh to 2,900 GWh (36% of NYSERDA's original goal) and the regulated utilities saved approximately 870 GWh (21% of their goal) (Maniaci, 2012b).

RGGI and ARRA

In addition to the programs described above, NYSERDA manages a number of programs that were not considered in the *15 by 15* analysis, including programs funded by the American Recovery and Reinvestment Act (ARRA) and the Regional Greenhouse Gas Initiative (RGGI). NYSERDA estimates that as of the end of 2010, the RGGI programs had saved 8 cumulative annual GWh, and that the ARRA will contribute an additional 76 GWh in annual energy savings to the *15 by 15* goal by the end of 2012 (NYSERDA, 2011).

NYPA, LIPA, and State Agency Programs

The Long Island Power Authority (LIPA) and the New York Power Authority (NYPA) are energy providers that are not under the PSC's jurisdiction, but whose energy efficiency programs are expected to contribute to the *15 by 15* goal. From 2008 through 2011, these power providers have contributed an annual average of approximately 1,000 GWh in electricity reductions to the overall state total (Maniaci, 2012b).

LIPA is a public power company that has engaged in ten-year energy efficiency programs on Long Island since 1999. LIPA's current program, "Efficiency Long Island," was in initiated 2009, and is designed to leverage $924 million in funds to provide residential and commercial customers with rebates and other incentives. In 2011, LIPA's Efficiency Long Island (ELI) program resulted in nearly 171 GWh of savings (Opinion Dynamics Corporation; Energy & Resource Solutions Inc., 2012).

NYPA is a large state-owned electric power organization serving community and rural electric cooperatives, government entities, businesses, and nonprofit organizations, and has financed and directed energy efficiency projects at more than 3,000 public facilities across New York State (State Energy Planning Board, 2009). In 2011, NYPA's energy efficiency programs were projected to reduce electricity by 1,100 GWh annually, with 2011 efficiency initiative investments totaling $180 million (NYPA, 2011). In 2012, Governor Cuomo announced the development of a master plan for accelerating energy-saving improvements in state facilities, with NYPA slated to finance energy efficiency projects for the next four years at an average level of $200 million annually. These projects are designed to reduce energy consumption in state buildings by 20 percent, as well as provide energy efficiency financing and technical services to county and local governments and schools (Press Office of Gov. Cuomo, 2012). Many of these state buildings are located near primary load centers in the New York City and Westchester County areas, which will amplify their benefits to the New York State electric system and further reduce capacity needs if IPEC retires.

Other state agencies across the state carry out additional energy efficiency programs. These include programs at the Division of Housing and Community Renewal, which administers federal funds to provide weatherization assistance and also encourages affordable housing developers to exceed energy building code standards (DHCR, 2008)

Codes and Standards

Energy code and appliance standards are expected to contribute roughly 8,000 GWh, or approximately one third of the *15 by 15* energy savings goal, according to the Commission's 2008 order (NYPSC, 2008). This is somewhat less than the 11,000 GWh of potential from this sector reported in the 2009 *State Energy Plan* (State Energy Planning Board, 2009).

Since 2008, the state has updated and strengthened its New York Energy Conservation Construction Code (ECCC). The 2010 ECCC is based on ASHRAE Standard 90.1 (2007 version) and the 2009 International Energy Conservation Code (Online Code Environment and Advocacy Network, 2012). New York's updated ECCC is more restrictive than the previous code, and removes some exemptions for commercial renovations and additions (NY DPS Staff, 2011)

Other Policies and Programs Supporting Energy Efficiency

Power NY Act of 2011

An additional policy supporting New York's implementation of energy efficiency is the *Power NY Act of 2011*, which allows energy efficiency upgrades to be financed through loans that are repaid through a utility bill surcharge and directs the Department of Environmental Conservation to promulgate carbon dioxide emissions standards (Press Office of Gov. Cuomo, 2011).

3.2 Energy Efficiency Savings from Current Initiatives

Energy savings from the energy efficiency programs summarized above amount to approximately 5,370 GWh annually. Annual energy savings are presented in Table 2.

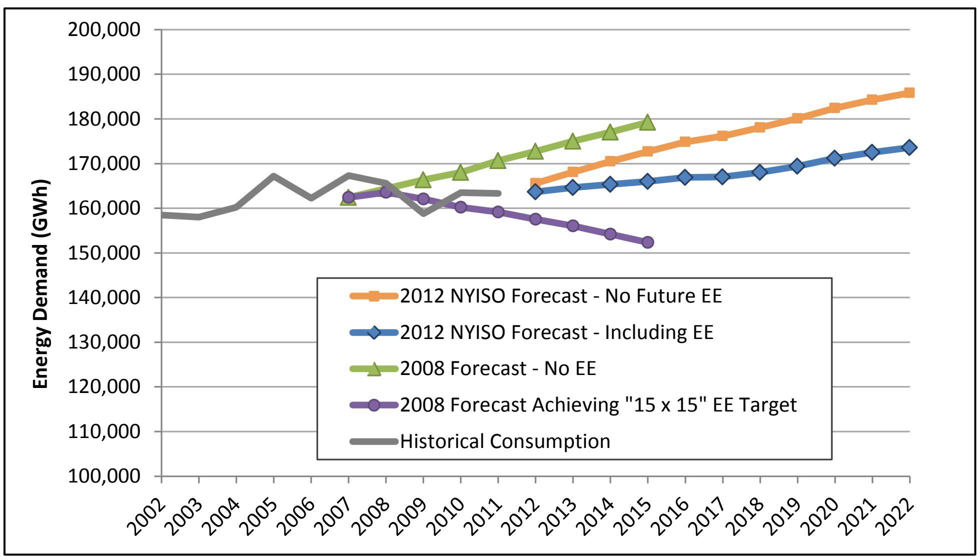
Figure 5 shows historical electricity demand in New York State through 2011, as well as pairs of forecasts (with and without energy efficiency) made in 2008 and 2012. The 2008 forecast without energy efficiency is included to illustrate the magnitude of the *15 by 15* Energy Efficiency Portfolio Standard (EEPS) goal, which was determined using the 2008 baseline forecast for 2015. The EEPS goal is designed to reduce statewide electricity consumption by 15 percent relative to the then-current forecast for 2015 electricity demand.

Table 2: Current Estimated Energy Efficiency Savings

	Annual GWh Savings
NYSERDA	2,800
Regulated Utilities	870
NYPA, LIPA	1,000
Codes & Standards	700
Total	**5,370**

The two 2012 forecasts in Figure 5 are from the NYISO 2012 *Gold Book*, with the lower forecast including NYISO's expected energy efficiency savings from EEPS jurisdictional programs, other utility programs, state agency initiatives, and building codes and appliance standards. When energy efficiency is included in the forecast, average annual growth for 2012 to 2022 is expected to be 0.59 percent (NYISO, 2012c).

Figure 5: Historical & Forecast Energy Demand under Various Energy Efficiency Assumptions



Source: NYISO 2012 Gold Book

NYISO's forecasted annual savings from energy efficiency (including from codes and standards) amounts to approximately 1.0 percent of statewide electricity sales from 2012 to 2015 but steadily declines to approximately 0.3 percent for the period 2019 to 2022. As is clearly visible from the graph, actual electricity consumption has deviated from the *15 by 15* goal's annual targets and NYISO's forecasts indicate that the *15 by 15* energy savings goal will not be achieved.

To reach the *15 by 15* target, the savings achieved by New York's energy efficiency programs, initiatives, and codes and standards will have to increase significantly. Whether this is possible depends on a number of factors, discussed below.

Rate of Implementation: As of February 28, 2011, approximately $500 million in funding for jurisdictional energy efficiency programs had been collected, but less than half had been expended or committed (NY DPS Staff, 2011). According to the New York Department of Public Service staff, the current funding surplus exists due to the time necessary to secure approval and initiate the program roll-out. As the programs shift from planning to implementation, it is expected that the magnitude of savings will increase substantially. Furthermore, as administrator experience grows, ineffective programs may be replaced with new programs, and successful existing programs may be expanded.

Economic Factors: The economic downturn has impacted program administrators' abilities to meet energy efficiency savings targets due to suppressed market demand for appliance upgrades, renovations, and new construction. More robust economic growth may have the opposite effect, leading to increased annual savings (NY DPS Staff, 2011).

Codes and Standards: In 2010, New York's Energy Conservation Construction Code was updated to reflect the 2007 version of ASHRAE standard 90.1 and the 2009 International Energy Conservation Code. Since then, however, updates have been made to both the standards that the ECCC is based on: ASHRAE Standard 90.1 was updated in 2010 and the International Energy Conservation Code was updated in 2012. These updated codes and standards have yet to be incorporated in New York's Energy Conservation Construction Code, despite the fact that the US Department of Energy has established them as the reference standards for state building energy codes (Online Code Environment and Advocacy Network, 2012; NMHC/NAA, 2012; US Department of Energy, 2012; Scott, 2011).

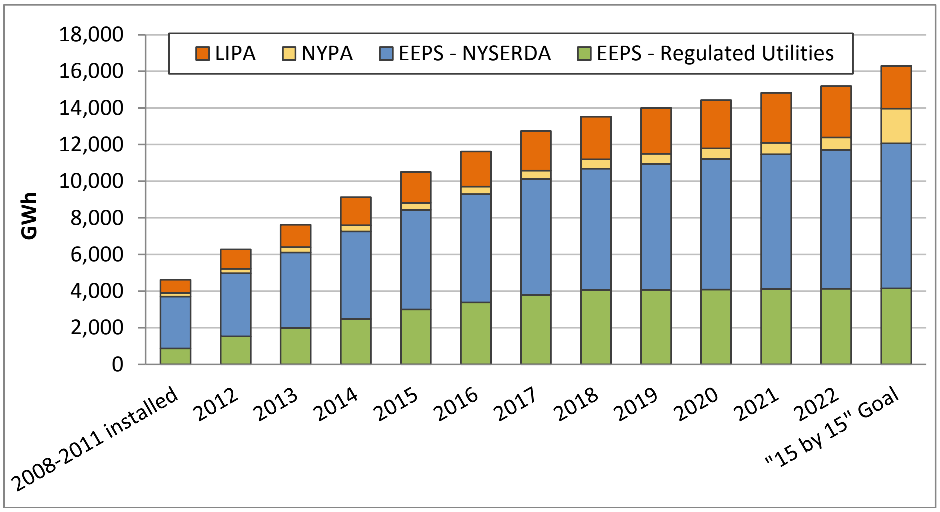
The failure of New York to make more frequent updates to its construction code may be delaying significant energy savings. In 2011, the US Department of Energy found that ASHRAE 2010 energy efficiency standard contains 18.5 percent site energy savings over the 2007 standard for commercial buildings, and the 2012 International Energy Conservation Code would achieve greater residential energy efficiency than the 2009 version (Scott, 2011; US Department of Energy, 2012).

The New York Department of Public Service staff note that the realization of savings from these standards is likely to take many years. This is in part because savings from building codes are strongly linked to economic activity (Saxonis, 2011). Implementation also requires that building professionals receive training and technical assistance on updated codes, which can be a lengthy process (Saxonis, 2011).

Appliance standards have also yielded lower than anticipated savings to date, largely because the economic recession has impacted the rate at which new appliances are purchased (Maniaci, 2012a). On the other hand, two recent national studies by ACEEE and IEE on the impact of new appliance standards found energy savings impacts ranging from 5 percent to 9 percent of the forecasted load by 2025 (Lowenberger, et al., 2012, p. 12; Rohmund, et al., 2011, p. 2). It is not clear to what extent these national level values are applicable to New York as NYISO staff note that New York has a significantly higher share of multifamily housing units which are typically slow to adopt energy efficient equipment.

Currently NYISO estimates energy savings from codes and standards to total only 700 GWh annually between 2012 and 2015, much less than anticipated when the EEPS was established in 2008 (Maniaci, 2012b). NYISO's estimates for current and future savings from utility and NYSERDA programs are shown below. According to NYISO's forecast, New York will likely not meet its *15 by 15* goal (indicated in the rightmost column) until some years after 2022.

Figure 6. Historical performance of EEPS and NYISO's forecast savings



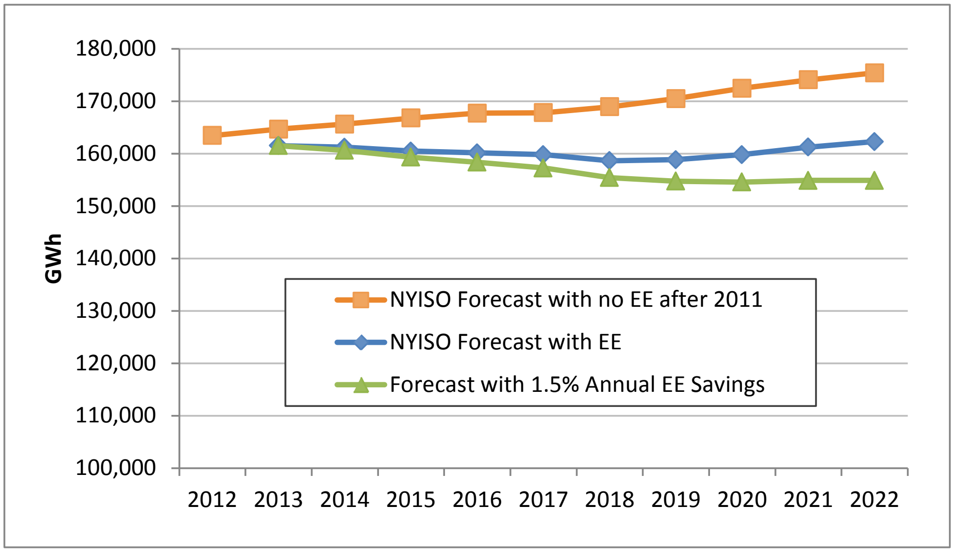
Source: NYISO 2012 Long Term Forecast Update (Maniaci, 2012)

3.3 Energy Savings Opportunities from Additional Initiatives

There is no question that significant energy efficiency savings beyond those in the NYISO forecast are possible. We have prepared an independent estimate of the "reasonably achievable" potential for energy efficiency savings in New York, including savings beyond those incorporated in the NYISO load forecast. Our estimate is based on a review of recent energy efficiency potential studies for New York and other states, as well as a review of the amount of energy savings that are being planned for and achieved by other leading states.

Based on this analysis, we find that a 1.5 percent annual demand reduction (relative to the prior year's sales) can reasonably be attained by New York over the next decade, leading to approximately nearly 21,000 GWh of cumulative savings by 2022, or an additional 8,440 GWh beyond what is currently assumed in NYISO's load forecast. This amount of energy efficiency could be achieved through a combination of refined and expanded ratepayer-funded energy efficiency programs and new building codes and appliance standards, and this amount of annual savings would essentially flatten New York's load growth over the next decade, as shown in Figure 7.

Figure 7: Statewide Load Forecast: NYISO vs. Alternative Case with Aggressive Energy Efficiency (GWh)



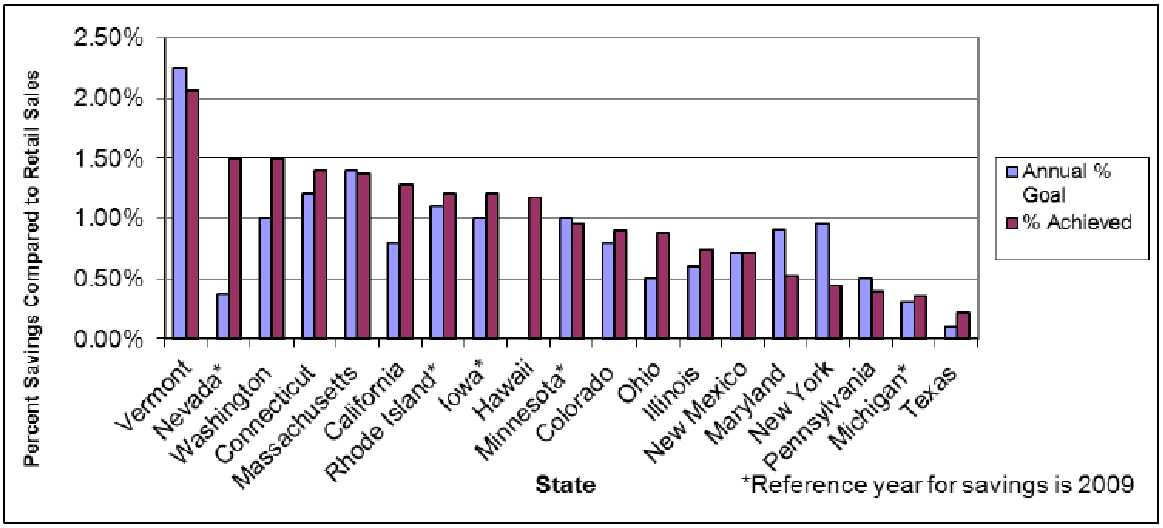
Source: NYISO 2012 Gold Book and Synapse calculations.

The 1.5 percent annual savings target represents a reasonable goal for New York. Relative to the goals set by other leading states and the amount of energy efficiency potential identified in previous studies, the demand reduction proposed by this target level is clearly feasible.

Savings greater than one percent of sales from ratepayer-funded energy efficiency programs alone have been demonstrated in recent years, with leading states achieving annual savings of 1.5 percent or even two percent of sales (Sciortino, Nowak, Witte, York, & Kushler, 2011; Takahashi & Nichols, 2008; Wontor, 2010; Garvey, 2007). Some of the highest savings have been realized in Vermont, which increased annual savings from 0.5% in 2000 to approximately 2.0% in 2011. Since 2007, Vermont has consistently achieved more than 1.5% in annual electricity reductions, with savings reaching nearly 2.5% in 2008 (Efficiency Vermont, 2012). Recently the American Council for an Energy-Efficient Economy (ACEEE) reviewed the annual energy savings from efficiency programs and found that six states achieved more than 1.25 percent of energy savings, with the top states reaching 1.5 or two percent. Annual savings for 2010 (as a percent of 2009 load) are shown in Figure 8.

In comparison to other states, New York has realized much lower levels of energy savings and is not on track to meet its *15 by 15* energy efficiency goals. With appropriate adjustments to its implementation strategy, it is reasonable to expect that New York can achieve savings on par with other states that have aggressively pursued energy efficiency.

Figure 8: 2010 State Energy Efficiency Resource Standard Targets vs. Achieved Savings



Source: Sciortino, Nowak, Witte, York, & Kushler, 2011

As experience with energy efficiency programs has grown, many states have been steadily increasing their efficiency targets and annual savings achievements. As of 2011, ACEEE reports that a number of states, including Massachusetts, Vermont, Minnesota, and Rhode Island, have annual energy savings goals of 1.5% or higher in place. Other states (including Arizona, Indiana, Illinois, and Ohio) are proposing to ratchet their savings targets up to 2.0% by the end of the decade. Table 3 presents annual savings goals of these states. These targets, together with recently achieved annual savings, suggest that New York can benefit from much greater energy efficiency savings than it has previously achieved.

Table 3: Selected States' Annual Savings Targets

State	Savings Target
Massachusetts	2.4% in 2012
Vermont	2.2% (approximate)
Arizona	2.0% beginning in 2014
Minnesota	1.5%
Rhode Island	1.5% in 2011, 2.5% of 2009 demand by 2014
Indiana	1.1% in 2014, 2.0% in 2019
Illinois	1.0% in 2012, 2.0% in 2015
Ohio	1.0% in 2014, 2.0% in 2019

Source: Sciortino, Nowak, Witte, York, & Kushler, 2011; and ACEEE State Energy Efficiency Policy Database; Vermont (http://www.aceee.org/sector/state-policy/vermont)

Given New York's experience and existing infrastructure for implementing energy efficiency, it is realistic to assume that the State can attain or surpass the levels of cost-effective efficiency savings realized in other states, particularly when contributions from building codes and standards are factored in. However, in order to present efficiency estimates that are clearly feasible and well within the reach of state policymakers and energy efficiency program administrators, we have chosen to use a lower estimate of 1.5 percent for this analysis.

In addition to being a realistic target compared with other states' goals, our estimate of approximately 21,000 GWh of cumulative electricity savings by 2022 is much lower than the state's identified energy efficiency potential. The 2009 *State Energy Plan* notes that a 2008 energy efficiency potential study found that approximately 26,000 GWh in energy savings could be obtained from ratepayer-funded efficiency programs and 11,000 GWh from improved building codes and appliance standards, for a combined total of 37,000 GWh of potential efficiency savings by 2015 (State Energy Planning Board, 2009). More recently, NYSERDA presented results of the *New York State Energy Efficiency and Renewable Energy Potential Study* with preliminary results indicating that electricity demand could be reduced with cost-effective energy efficiency by more than 60,000 GWh by 2030 (Michael, 2012, p. 5). Our reasonably achievable scenario of 1.5 percent annual efficiency savings therefore leaves much of New York's energy efficiency potential untapped.

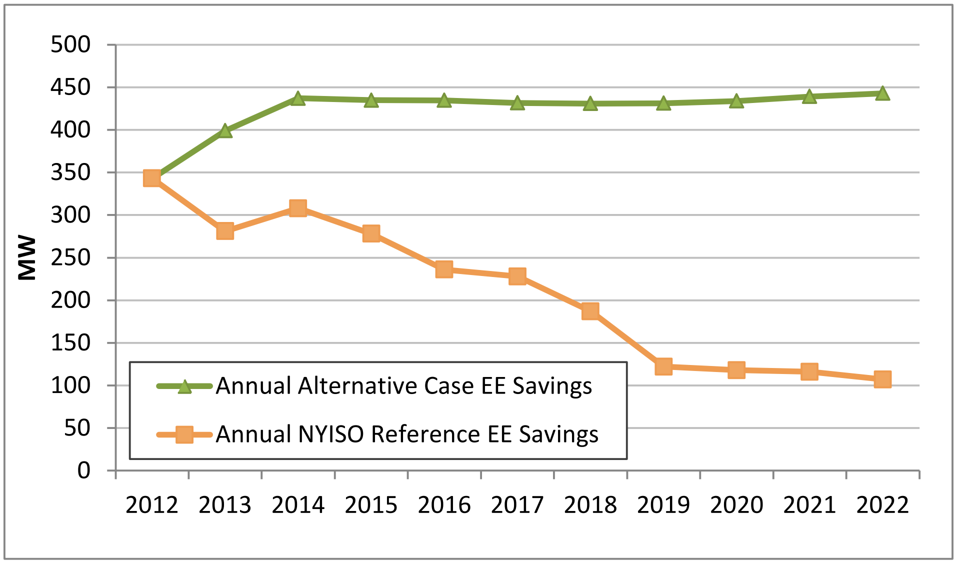
Finally, this estimate of approximately 21,000 GWh of savings over a ten-year period is conservative relative to current policy targets and estimates of New York's energy efficiency potential. In particular, the state's "*15 by 15*" goal for electric efficiency savings would require approximately 25,000 GWh of electricity savings by 2015, much higher than what would be achieved through 1.5% annual savings (NYPSC, 2008).

Projection of Energy Efficiency Opportunities for New York

Our analysis begins with NYISO's projection of energy savings and load estimates in the 2012 *Gold Book*. In the *Gold Book*, NYISO estimates that New York will achieve approximately 1,900 GWh of annual savings in 2012 (equal to 1.2% of the projected load in the same year without energy efficiency). As discussed earlier in this report, NYISO assumes that annual net energy savings will decline significantly over time from the current 1.2% level to 0.3% in 2022. In contrast, our scenario assumes that New York increases savings gradually to 1.5% per year and maintains it at this level through 2022. Figure 9 exhibits a comparison of annual net capacity savings for our alternative case and the reference case using the NYISO's energy savings projection.

To derive annual cumulative savings for our alternative case, we first estimated annual incremental savings and then summed and adjusted these savings to derive annual cumulative savings. More specifically, we added annual incremental savings from new programs each year, and assumed that energy savings decay over time at a certain rate. For the purposes of this analysis, we assumed a flat decay rate of 8.3% per year based on a 12-year measure lifetime, and that 50% of pre-existing savings level reoccur without additional program spending. In other words, we assumed a net decay rate of 4.2% per year.

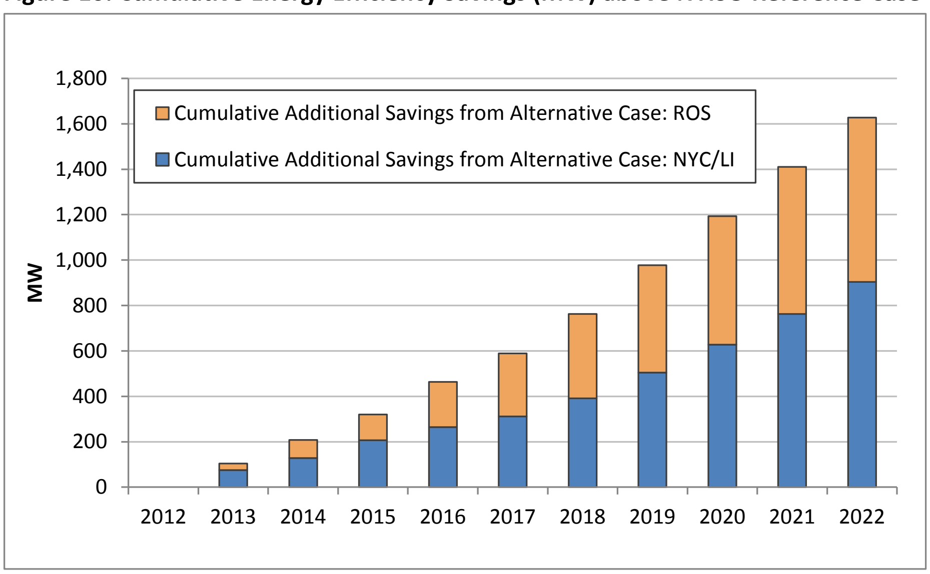
Figure 9: Annual Net Energy Savings: Reference Case vs. Alternative Case



Source: Derived from NYISO 2012 Gold Book

This analysis was conducted for two regions in the state: New York City/Long Island (NYC/LI) and the Rest of State (ROS).[11] In addition, both energy and summer peak load savings resulting from energy efficiency were estimated. To derive peak load reduction, we used the energy efficiency load factors derived from NYISO's reference case assumption for energy and capacity savings each year. The load factors differ by year and region and range from 55 percent to 65 percent. Our estimates of achievable energy efficiency capacity savings (above NYISO's assumed efficiency savings) are presented below, for each of the two regions.

Figure 10: Cumulative Energy Efficiency Savings (MW) above NYISO Reference Case



[11] NYC/LI corresponds to NYISO zones J and K.

The results of our analysis indicate that more than 1,600 MW in cumulative savings above what the NYISO forecasts is reasonably achievable by 2022. The implication of this additional reduction in energy demand is substantial: it implies that more than 80 percent of IPEC's capacity could be met by energy efficiency by 2020. Moreover, much of this energy efficiency – 904 MW – is projected to be available in the New York City/Long Island region, further reducing constraints on the electric system.

3.4 Policies to Support Additional Initiatives

While New York already has a good set of policies to promote the development of energy efficiency, there is more that can be done to access the significant amount of untapped cost-effective energy efficiency in the state. Here we list some of the key policies that will help New York reach the higher levels of efficiency that we identify above.

Energy Efficiency Programs

The State can significantly ramp up the energy efficiency programs that are currently offered by the investor-owned utilities, NYSERDA, NYPA, LIPA, and others. These programs already have the regulatory policies, institutional infrastructure, and market actors in place to identify and deliver cost-effective energy efficiency programs. We recommend the following policies designed to use the existing efficiency programs and practices to reach significantly higher levels of savings.

Update the EEPS goal. We recommend that the State update the EEPS goal, given that it is nearly 2015 and it is clear that the *15 by 15* goal will not be achieved. This update should occur soon, i.e., in the spring of 2013, so that utilities and other market actors have time to prepare for achieving the new goal. The standard should establish the goal of achieving all cost-effective energy efficiency, and should require a minimum level of annual electricity savings of 1.5 percent per year.

Improve the energy efficiency screening process. The Commission currently requires that energy efficiency measures be screened by applying the Total Resource Cost test to each efficiency measure. In addition, the TRC test is applied to each measure in the field, i.e., at the time of an efficiency audit in a customer's home or business. This practice does not account for the interdependent effects of efficiency measures, does not account for lost-opportunities, significantly limits the ability to provide whole-house efficiency services, deprives a large portion of customers from adopting efficiency savings, and substantially limits the amount of efficiency savings that can be achieved in each year. We recommend that for program planning and screening purposes efficiency programs be screened at the program level, not at the measure level (Woolf, Malone, Takahashi, & Steinhurst, 2012). We also recommend that efficiency measures be screened in the field using the Participant's Cost test, to ensure that the measure is appropriate from the perspective of the relevant customer.

Allow for spending the full energy efficiency budgets. As noted above, a large portion of the funding for the jurisdictional energy efficiency programs has been collected but not spent. The State should work with the efficiency program administrators to assess the barriers to spending these funds and identify ways to overcome them.

More fully utilize the Implementation Advisory Group (IAG). The IAG was established to allow all program administrators to collaborate on their energy efficiency initiatives and share lessons learned and best practices. Many states successfully utilize this type of collaborative to significantly enhance the planning and implementation of energy efficiency programs. We recommend that the IAG be enhanced to make it more effective in helping meet the more challenging EEPS goals. In particular, we suggest that the IAG:

- allow for meaningful input from relevant energy efficiency stakeholders;
- meet on a regular basis to evaluate successes and failures so as to constantly improve the results of the energy efficiency programs;
- hire an independent consultant, using a very small portion of the energy efficiency program budgets (e.g., 0.5 percent), to help coordinate activities;
- introduce best practices from other states;
- assist with the development of more comprehensive efficiency programs;
- support activities to meet the new EEPS goals; and
- be provided with the authority to promote settlements among efficiency stakeholders and bring findings and recommendations to the Public Service Commission in the context of the energy efficiency program reviews.

Improve coordination between NYSERDA and the other program administrators. NYSERDA and the other program administrators currently compete for energy efficiency services customers. This approach can create inefficiencies in program planning and delivery, as well as customer confusion. We recommend that NYSERDA and the other program administrators identify separate sectors for each to serve, e.g., NYSERDA could serve the large commercial and industrial customers, while the other program administrators serve the remaining customer classes.

Maintain and expand support for NYPA. NYPA currently offers all-fuels efficiency services to its customer base. This is a highly valuable effort that should be maintained and even expanded. The reductions in energy bills experienced by state agencies will result in increased state budgets or reduced state tax burdens.

Enable energy efficiency to participate in the wholesale electricity markets. We recommend that the State allow the energy efficiency resources implemented by the program administrators to be bid into the New York wholesale capacity and energy markets. This approach has been successfully implemented by several other Independent System Operators and has been encouraged by the Federal Energy Regulatory Commission (FERC, 2011). Allowing energy efficiency to participate in the wholesale electricity markets will result in several benefits to the market itself in terms of improved efficiency and reduced costs, and will provide a stream of revenues to help fund the program administrators' energy efficiency activities.

Building Codes and Appliance Standards

Update Codes on a Frequent Basis. We recommend that the State update the building codes and appliance standards as soon as they are published from the relevant sources. Some of the recently published codes have not yet been adopted in New York (ASHRAE 90.1 2010 version and IECC 2012 version) (Online Code Environment and Advocacy Network, 2012). The New York codes should be updated as soon as is practical. This is especially important for building codes, because buildings that are installed with outdated codes can last many years, resulting in significant lost opportunities.

In order to hasten adoption of the 2010 building code, NYSERDA is currently offering support for architects, engineers, and builders, as well as providing trainings for code officials, home builders, designers and energy modelers (NY DPS Staff, 2011). We recommend that NYSERDA maintain and expand this support, and be provided with the funding and resources necessary to update this support as new codes and standards are implemented.

4. Opportunities for Renewable Resources

4.1 Current Policies Supporting Renewable Resources

Over the past decade, New York has begun to tap into its significant renewable energy resource base through implementing policies to support the development of wind, solar, and other renewable resources. These policies address grid integration, targets for the proportion of electricity generated by renewables, and incentives for investment in specific technologies such as solar photovoltaic energy (PV).

Integration of Renewables into the Electric Grid

New York currently supports the integration of renewable resources into the electric grid through exempting intermittent generators from certain day-ahead bidding and scheduling obligations; maintaining a centralized wind forecasting system (through NYISO); and enabling new energy storage technologies, such as flywheels and advanced battery systems, to participate as frequency regulation providers in the wholesale electricity markets (NYISO, 2012c).

Renewable Portfolio Standard: "30 by 15"

In 2004, following an extensive stakeholder process, the Public Service Commission issued an order adopting a state renewable portfolio standard (RPS), with the goal of increasing the proportion of renewable energy consumed in New York from 19.3 percent to 25 percent by the end of 2013. The policy called for approximately 85 percent of the new renewable energy to be procured centrally, with at least 15 percent provided by the voluntary green market.[12] In 2010, the Commission expanded the RPS goal to 30 percent of electricity consumed by New York customers, extended the terminal year of the program to 2015, and authorized a new program designed to encourage additional customer-sited installations (NYSERDA, 2012c). Although the total amount of renewable energy to be procured did not substantially change, the revision of the RPS goal to 30 percent was designed to more accurately capture the contribution of energy efficiency from the Energy Efficiency Portfolio Standard.[13]

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[12] The voluntary market was expected to provide an increase in renewable energy equal to 1 percent of total energy demand, with central procurement making up the remainder 5.7 percent to reach 25 percent of total demand (NY Public Service Commission, 2012).

[13] The incorporation of the EEPS goal into the electricity forecast resulted in a much lower baseline for 2015, and thus the expansion of the RPS goal from 25 percent to 30 percent increased the total MWh to be procured from 10.0 million MWh to 10.4 million.

To achieve the *30 by 15* RPS goal, NYISO estimates that 47,100 GWh of electricity used statewide will need to be produced by renewable resources in 2015. This represents an increase of nearly 14,000 GWh of renewable electricity over 2011 levels (NYISO, 2012c).

Renewable energy purchased to meet the RPS is expected to come from a combination of procurement (by NYSERDA), state agencies' purchases under Executive Order 111, and voluntary renewable purchases by retail customers. New York uses a central procurement model where NYSERDA is responsible for obtaining the Main Tier (utility-scale resources) and Customer Sited Tier (smaller, behind-the-meter resources). The NYSERDA program target as set by the Commission in 2010 is approximately 10,400 GWh by 2015 (NYSERDA, 2012c).

NYSERDA has conducted seven Main Tier solicitations to date. In December 2010 the Commission authorized NYSERDA to conduct at least one annual Main Tier solicitation (more if deemed necessary and contingent upon funding availability) without Commission approval subsequent to consultation with Staff and approval by the Director of the Office of Energy Efficiency and the Environment. The Commission also directed NYSERDA to obtain resources in the most efficient and cost-effective manner.

The Customer-Sited Tier of the state RPS includes technology-specific programs. In 2011, the Solar PV Program committed $32.9 million in incentives, with additional funding available for customer-sited installations of larger-scale renewable generation in the regions near New York City through the Geographic Balance Program (NYSERDA, 2012c).

NY-Sun Initiative

The NY-Sun Initiative, introduced in Governor Cuomo's 2012 State of the State address, was launched with the goal of doubling the amount of customer-sited solar power installed annually in New York, and quadrupling that amount by 2013. The initiative plans to invest $800 million through 2015 to expand solar photovoltaic deployment, advance technology, and reduce system costs (NYSERDA, 2012b).

Governor Cuomo's NY-Sun Initiative brings together and expands existing solar programs administered by NYSERDA, LIPA, and NYPA. Through the program, NYSERDA will provide approximately $40 million annually and LIPA will provide $27 million annually to fund small-to medium scale systems. Larger and aggregated systems will receive approximately $70 million annually (outside of Long Island) through NYSERDA via a competitive bidding, performance-based program. This program will focus primarily on businesses, colleges and universities, and other large buildings located in New York City, Westchester, and the lower Hudson Valley, which will help alleviate demand in the New York City metropolitan area. In addition, LIPA plans to purchase up to 50 MW of customer-sited solar generation using a feed-in tariff through June 30, 2014 (NYSERDA, 2012b).

On August 17, 2012, Governor Cuomo signed three additional bills to further the NY-Sun Initiative. The new laws include statewide tax credits for the leased solar equipment and power purchase agreements, sales tax exemptions for commercial solar equipment, and extending a property tax abatement for solar installations in New York City (Press Office of Gov. Cuomo, 2012).

Power NY Act of 2011

The *Power NY Act of 2011* is likely to provide additional impetus for the development of renewable energy in New York. The Act directed the Department of Environmental Conservation to promulgate carbon dioxide emissions standards for all new power plants or capacity additions of 25 MW or greater, which were finalized in the summer of 2012. It also reestablishes New York's power plant siting process, which, if implemented in an effective manner, will accelerate the approval process and construction of renewable projects, particularly wind. In addition, the Act directed NYSERDA to study potential policy approaches to increasing solar energy development in New York (Press Office of Gov. Cuomo, 2011).

Offshore Wind Collaborative

The Offshore Wind Collaborative was formed in 2009 to advance the Long Island–New York City Offshore Wind Project and is composed of the Long Island Power Authority (LIPA), Consolidated Edison of New York (Con Edison), and the New York Power Authority (NYPA). The Collaborative proposes to develop an offshore wind project on a proposed site 13 to 17 miles off the coast of the Rockaway Peninsula and Long Island. The facility would have a nameplate capacity of 350 MW and is anticipated to generate approximately 1,226 GWh per year.

In support of this goal, LIPA and Con Edison conducted a feasibility study of offshore wind potential near New York City. As a result of that study, LIPA and Con Edison concluded that up to 700 MW of offshore wind would be feasible following appropriate transmission system upgrades. In September 2011, the Collaborative advanced the project further by filing a lease application with the U.S. Bureau of Ocean Energy Management, Regulation, and Enforcement. The Collaborative intends to seek proposals from private developers for the project construction and purchase of associated energy.

4.2 Renewable Generation and Capacity from Current Initiatives

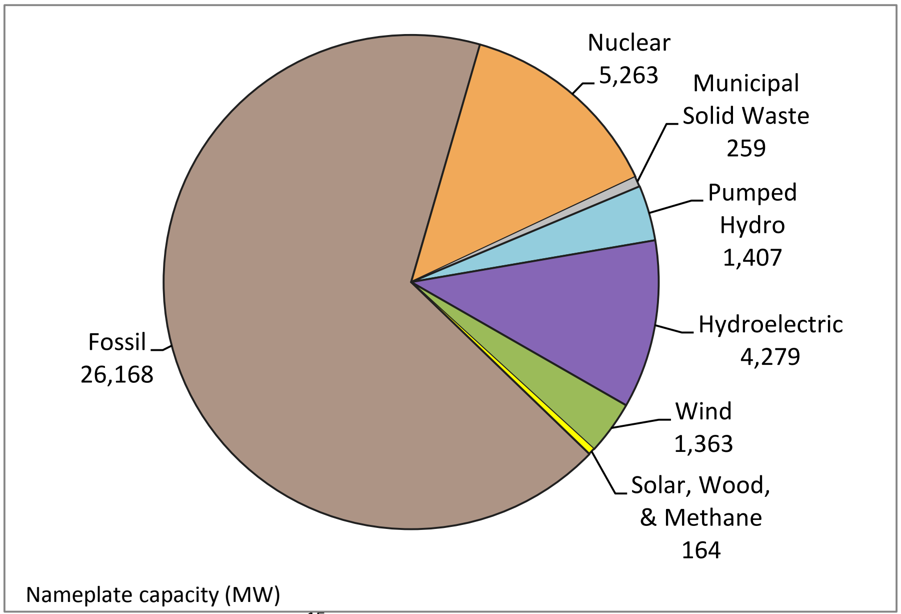
New York State currently has 5,806 MW (nameplate) of renewable resource capacity available, comprising approximately 15 percent of its total generation resource base, as shown in Figure 11.[14] At present, renewable capacity is primarily composed of hydropower and wind. Although New York has long made use of its hydroelectric resources, much of the development of other

[14] NYISO defines renewable resources more broadly and thus reports a larger proportion of generation capacity as renewable. The definition of "renewable" used by NYISO does not correspond to that employed by the Public Service Commission in the RPS.

renewables has only occurred recently, spurred by a combination of regulatory initiatives, rising costs of new traditional generation, and falling costs of renewable capacity.

The state's renewable portfolio standard Main Tier component is responsible for the addition of 46 currently operating projects totaling 1,456 MW (nameplate), with another 384 MW (nameplate) under development and/or construction. The Customer Sited Tier (including pending contracts) totals 104 MW (nameplate) as of December 31, 2011 (NYSERDA, 2012c).

Figure 11: Electricity Generating Capacity in New York State by Fuel Source (MW)



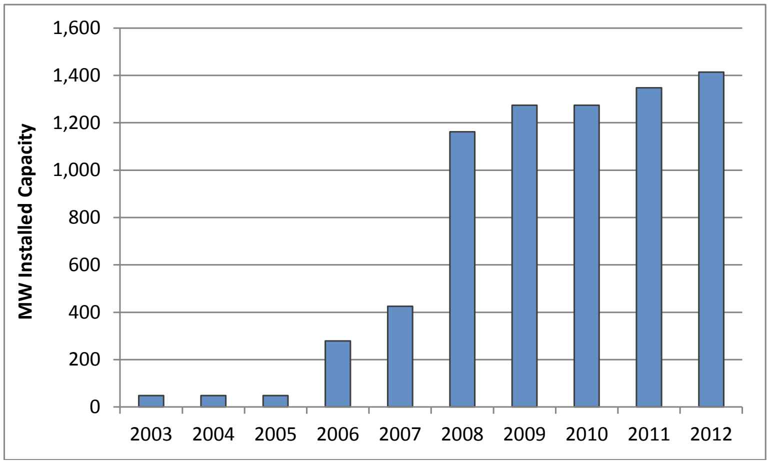
Source: NYISO Gold Book 2012.[15]

Since 2004, wind power capacity has expanded rapidly in New York State (Figure 12). As of March 2012, New York State has developed 1,414 MW (nameplate) of wind-powered generation capacity. In 2011, energy produced by these wind power projects totaled 2,787 GWh (NYISO, 2012c).

In total, approximately 24 percent (33,251 GWh) of electricity consumed in New York in 2011 was generated by renewable resources. To meet the RPS target, NYISO estimates that an additional 13,849 GWh of electricity will need to be supplied by renewables in 2015, for a total of approximately 47,000 GWh (NYISO, 2012c, p. 38).

[15] Renewables here include conventional hydroelectric resources, although these do not qualify as new renewable resources under the RPS.

Figure 12: Installed Wind Capacity in New York



Source: NYISO Gold Book 2012

New York is not currently on track to meet its RPS goals. As of December 31, 2011, NYSERDA's Main Tier and Customer Sited Tier programs had procured less than 5,000 GWh of the estimated 10,398 GWh (47%) that NYSERDA estimates is needed to meet the *30 by 15* goal (NYSERDA, 2012c). This shortfall may be even greater when NYISO's revised estimates of 2015 demand are taken into account, indicating that more than 18,000 GWh rather than 10,000 GWh of renewable energy should be procured by the RPS.[16]

4.3 Renewable Resource Opportunities from Additional Initiatives

Statewide, a significant amount of new utility-scale renewable energy is projected to come online over the next decade. Currently 1,288 MW (143 MW derated) of renewable capacity is listed in the 2012 NYISO *Gold Book.* An additional 1,312 MW (215 MW derated) of renewable capacity is in varying stages of development in Interconnection Queue (excluding those listed in the 2012 *Gold Book*).

In response to the governor's Energy Highway RFI, another 1,047 MW (335 MW derated) of renewable capacity (low estimate) was recently proposed for future development.[17] Furthermore, the Governor's NY-Sun Initiative could spur the development of 490 MW (211 MW

[16] NYISO anticipates the meeting the RPS will require 13,849 GWh beyond what was supplied in 2011. By 2011, the RPS had successfully procured 4,917 GWh. Together these amounts total 18,766 GWh of renewable energy required to meet the RPS.

[17] This estimate is computed using only the low end of the range of capacity proposed by each renewable energy developer that responded to the RFI.

derated) of distributed solar photovoltaic capacity, much of it located in New York City.[18]

A summary of proposed renewable generation capacity available from the Interconnection Queue, the Energy Highway RFI, and the NY-Sun Initiative is provided in Table 4. In terms of nameplate capacity, projects from these various proposals would provide a total of 4,137 MW (875 MW derated) of new renewable capacity, of which the dominant source is expected to be onshore wind, followed by offshore wind. When the resources' differing UCAP values are factored in, offshore wind would contribute the largest amount of derated new renewable capacity in New York. Onshore wind's UCAP value is 0.10, while offshore wind's UCAP value is 0.38, due to the fact that offshore wind typically enjoys much greater capacity and peak coincidence factors than onshore wind. After offshore and onshore wind, the next largest proposed resource (by derated capacity) is solar PV, in part due to its UCAP value of approximately 0.42 for utility-scale photovoltaic installations and 0.37 for residential and commercial PV.[19]

Table 4: Proposed Renewable Capacity from Interconnection Queue, Energy Highway RFI, & NY-Sun Initiative

	Interconnection Queue 2022		Energy Highway RFI (Low)		NY-Sun		Total	
	Nameplate (MW)	UCAP (MW)	Nameplate (MW)	UCAP (MW)	Nameplate (MW)	UCAP (MW)	Nameplate (MW)	UCAP (MW)
Onshore Wind	2,322	232	293	29	0	0	**2,615**	**262**
Offshore Wind	245	93	600	228	0	0	**845**	**321**
Solar	0	0	121	45	490	181	**611**	**226**
Biofuel	7	7	13	13	0	0	**20**	**20**
Methane	11	11	0	0	0	0	**11**	**11**
Hydro	15	15	20	20	0	0	**35**	**35**
Total	**2,600**	**358**	**1,047**	**335**	**490**	**181**	**4,137**	**875**

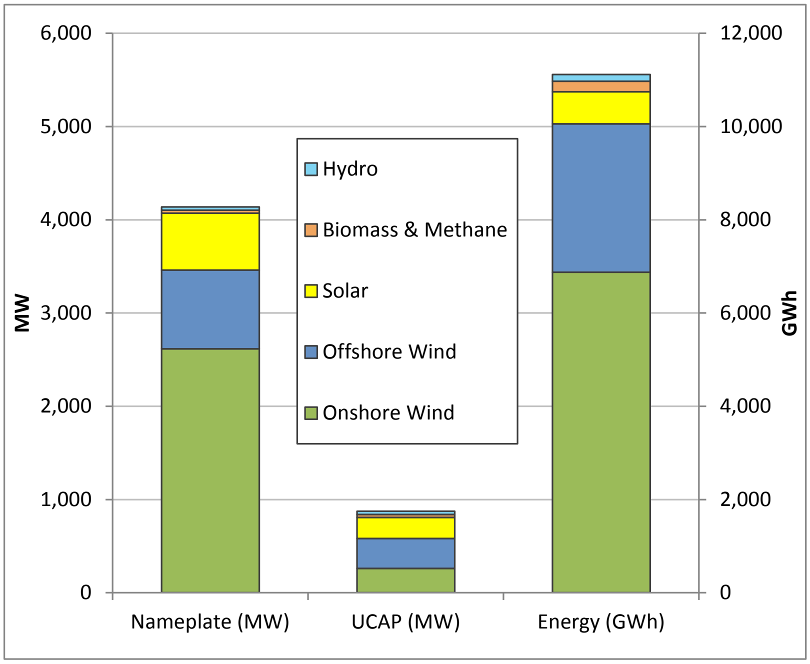
Figure 13 presents the statewide total results from Table 4, including the nameplate capacity, the UCAP capacity and the energy generation. We use this mix of renewable capacity and

[18] In 2012, the NY-Sun Initiative aims to double the amount of customer-sited PV that was installed in 2011, and then quadruple that amount in 2013. Funding for additional installations will continue through 2015 (NYSERDA, 2012b). According to the Interstate Renewable Energy Council, New York installed 68.3 MW of PV in 2011 (Sherwood, 2011). Doubling this amount results in approximately 137 MW to be installed in 2012 and quadrupling it results in 273 MW to be installed in 2013. For 2014 and 2015, NYSERDA estimates that CST installations attributable to NY-Sun (above what would have occurred without NY-Sun) will total 38 MW in 2014 and 42 MW in 2015.

[19] As noted above, these UCAP values are NYISO's default first-year values and are not adjusted based on actual resource performance; therefore the derated capacity values are conservative.

energy as a starting point to determine our IPEC clean energy replacement scenario in the following section.

Figure 13: Proposed New Renewable Capacity and Energy



While onshore wind resources have been the focus of the majority of renewable generation development in New York over the past decade, the resource mix proposed by utilities and independent developers described above represents the potential of additional resources, especially offshore wind and solar, to provide a valuable component of the state's future clean-energy portfolio. Developments in both offshore wind and solar have been accelerating rapidly over the past few years, and studies indicate that New York has extensive potential in these areas. A 2010 study estimated that New York's Atlantic coast could provide 4,700 MW of offshore wind capacity and generate more than 12 percent of its energy (Mahan, Pearlman, & Savitz, 2010).

An example of the potential for offshore wind is the Deepwater Wind Energy Center (DWEC), a 900 MW offshore wind farm that is scheduled to begin operation in 2017. The Deepwater Wind Energy Center plans to be located in an area that has undergone a comprehensive ocean planning and baseline study process over the past three years, and which is characterized as among the most robust wind energy sites along the East Coast. The proposed wind farm would consist of between 150 and 200 wind turbines, each with a nameplate capacity of 6 MW. DWEC's developers have commenced project permitting and have engaged in detailed design and engineering work, with the expectation of securing site control, permits, and the remainder of the design and engineering work by the end of 2013 and completing construction by 2017 (Deepwater Wind, 2012).

In addition to New York's offshore wind potential in the Atlantic Ocean, the Great Lakes could provide another source of offshore wind energy. Overall, there is enormous potential for offshore wind in New York State, with the National Renewable Energy Laboratory estimating that New York's offshore wind resource from both the Great Lakes and Atlantic coast could total 147,000 MW of capacity.

New York has already begun to tap its solar resources, and under Governor Cuomo's NY-Sun Initiative, the state will ramp up investment in customer-sited PV significantly in the near future. Utility-scale PV also shows substantial promise for future development. Currently the largest photovoltaic array in the eastern United States, a 32 MW solar farm, is located on Long Island. Utility-scale solar is also being considered by New York City officials for construction on Staten Island at the former Fresh Kills landfill. It is estimated that up to 20 MW of renewable power could be accommodated at that location (NYISO, 2012c).

Development of traditional onshore wind will likely continue to occur over the next decade. Possible impacts on the reliability of the New York electric grid have been studied in depth in a 2010 report published by the NYISO, which found that up to 8,000 MW of wind generation could be added to the New York power system with "no adverse reliability impact" (NYISO, 2010, p. 51) Furthermore, based on the economic assumptions used in the study, NYISO found that spot prices would decline significantly with increased wind penetration, writing "For the 2018 simulations, the NYISO system average LBMP prices are 9.1% lower for the 8 GW wind scenario when compared to the base case or 1,275 MW of installed wind" (NYISO, 2010, p. 57).

4.4 Policies to Support Additional Initiatives

While New York already has a good set of policies to promote the development of renewable resources, there is more that can be done to access the significant amount of untapped renewable potential in the state. Here we list some of the key policies that will help New York reach the higher levels of renewable generation that we identify above.

<u>Update the Renewable Portfolio Standard</u>. We recommend that the State update the RPS structure and goals soon, i.e., in the spring of 2013, so that NYSERDA and renewable project developers have time to prepare for compliance with the RPS after 2015. We recommend that the new RPS include an annual goal of renewable generation to allow NYSERDA, the PSC and others to more easily and more frequently assess compliance with the RPS. For example, the goal for 2016 could be set at 30 percent of annual electricity sales, and could increase by one percent each year after that. This approach also provides more certainty and predictability for renewable project developers.

<u>Improve the NYSERDA REC solicitation process</u>. The current process whereby NYSERDA solicits proposals for long-term contracts for RECs has not resulted in sufficient proposals to ensure enough renewable generation to meet the RPS target. We recommend several modifications to the solicitation process to encourage better proposals and the development of more renewable projects. For example:

- NYSERDA could issue solicitations on a more predictable and regular basis than in the past.[20] This would provide renewable project developers with greater certainty and predictability for developing project proposals.
- NYSERDA could offer higher prices for long-term REC contracts than in the past. It is our understanding that NYSERDA applied a price cap when selecting among the renewable proposals and this may have limited the amount of renewable development to date.
- NYSERDA could coordinate with NYPA and LIPA to optimize the solicitations for new renewable projects in New York. For example, NYSERDA could occasionally bundle together its funds with funding from NYPA and LIPA to issue a large state-wide RFP for long-term contracts.

Modify the RPS to support specific technologies. We recommend that the RPS be modified to support specific renewable technologies. The Main Tier of the RPS is currently the only place where large-scale renewable developers can bid for long-term REC contracts. However, the more expensive renewable resources, such as offshore wind and PV, are at a distinct disadvantage because of their higher costs. Meanwhile, these renewable resources offer significant advantages over some lower-cost renewables because of their location near the high load centers. We recommend that separate tiers in the RPS be created for offshore wind and large-scale PV resources.[21] An alternative approach would be to establish a separate tier for renewables located in regions near New York City and Long Island, to account for the additional benefits they offer by being close to high-load areas, and to ensure that offshore wind plays a prominent role in capacity additions being pursued by LIPA. Furthermore, the State should explore the potential for providing long-term contracts for purchasing power from those renewable resources (e.g., offshore wind) where long-term contracts are needed for financing purposes.

Extend the NY-Sun Initiative. The NY-Sun Initiative largely runs out in 2015 when the state's current goals for its renewable energy portfolio expire. We recommend that the NY-Sun Initiative be extended and bolstered. This initiative could be expanded to run for 10 years and provide $1.5 billion in support for solar projects, and could promote roughly 2,000 MW of solar installations. Furthermore, the State could focus on supporting the development of PV projects near IPEC to help meet reliability needs in the event of its retirement.

Support and Expand the Offshore Wind Collaborative. We recommend that the State support the on-going activities of the Offshore Wind Collaborative to maximize the development of wind resources in the regions near New York City, Long Island, and IPEC. The Collaborative should

[20] The previous seven solicitations have been conducted at varying intervals (ranging from four months to 25 months between solicitations) with varying levels of funding and procurement (MW and MWh).

[21] Note that the current RPS programs and the NY-Sun Initiative focus on behind-the-meter photovoltaics, and do not support large-scale (i.e., above 2 MW) projects.

establish a goal of developing 5,000 MW of offshore wind by 2020, and support this goal with siting and long-term financing support for offshore wind.

Optimize the Impacts of the Energy Highway RFI. The Energy Highway RFI has the potential to support the development of new renewable resources in New York. We recommend that the State account for the many benefits offered by renewable resources when selecting among resource options to support through the RFI process, and to give priority to renewable resources where it is due. We also recommend that the State give priority to renewable projects that are located in the regions near IPEC to assist in meeting reliability needs in the event of its retirement.

Promote Innovative Public Partner Financing Programs for Renewable Energy and Energy Efficiency. New York State should also do more to leverage its support for efficiency and renewables by creating the right market conditions for the private sector to step in. This should include implementation of more public-private partnerships such as a Green Bank and other financing strategies such as commercial Property Assessed Clean Energy (PACE) financing programs

5. Replacing Indian Point with a Clean Energy Portfolio

5.1 IPEC Replacement Scenarios

The previous sections demonstrate two important points. First, there is sufficient existing and forthcoming capacity to enable the retirement of IPEC and ensure sufficient electricity capacity in New York until at least 2020 and perhaps beyond. Second, a large amount of clean energy resources are available in New York to replace the nuclear reactors at Indian Point. More than 1,600 MW of energy efficiency potential has been identified as reasonably achievable by 2022, while 4,137 MW (875 MW derated) of renewable capacity has been proposed to be added to the New York electric system in the near future. Furthermore, if IPEC is retired, it would increase the opportunities for developers of new generation (renewable and non-renewable) in the region to participate in the wholesale capacity market, thereby stimulating additional development of new generation capacity.

The precise mix of resources that would replace IPEC will remain unknown without knowing (a) what actions the State may take in the near-term to promote energy efficiency, promote renewable resources, and replace IPEC; and (b) how the wholesale electricity markets will react to an announcement of IPEC's retirement. For our purposes here, we have assembled an illustrative portfolio of clean energy resources that could replace IPEC in order to indicate what that portfolio could consist of and what it might cost.

Our illustrative clean energy replacement portfolio includes 1,030 MW of energy efficiency and 1,030 MW of renewable energy (derated), for a combined capacity equal to that of IPEC. The renewable energy resource mix is based on the relative percentages of resources that have been recently proposed for New York, as well as an assessment of the current policies affecting renewable investments in the state, such as the NY-Sun Initiative.

Table 5, Figure 14, and Figure 15 present the resources that we assume in the clean energy replacement portfolio. We developed resource estimates for two separate regions, New York City/Long Island (NYC/LI), and the rest of the state (ROS), as well as for the state as a whole. For each resource type in each region we present the nameplate capacity, the derated capacity, and the energy available.

Table 5: Efficiency and Renewable Resources in the Clean Energy Replacement Portfolio

Resource Type	Nameplate Capacity (MW)			Derated Capacity (MW)			Energy (GWh)		
	NYC/LI	ROS	Statewide	NYC/LI	ROS	Statewide	NYC/LI	ROS	Statewide
Energy Efficiency	572	458	1,030	572	458	1,030	2,777	2,637	5,414
Onshore Wind	-	2,000	2,000	-	200	200	-	5,256	5,256
Offshore Wind	750	-	750	285	-	285	2,825	-	2,825
Utility Solar PV	140	560	700	58	232	291	179	716	894
C&I Solar PV	175	175	350	65	65	130	198	198	397
Res Solar PV	175	175	350	65	65	130	198	198	397
Total	**1,812**	**3,368**	**5,180**	**1,045**	**1,020**	**2,065**	**6,178**	**9,005**	**15,183**

In terms of statewide nameplate capacity, the portfolio includes 2,000 MW of onshore wind, 750 MW of offshore wind, 700 MW of utility-scale solar PV, and 350 MW each of commercial and industrial PV and residential PV. These resources are broken out by geographic region in Figure 15. As indicated in Figure 15, the offshore wind component is located entirely in the New York City / Long Island region, while onshore wind is located entirely in the rest of the state, and the PV resources are distributed more evenly across both regions.

Figure 14: Efficiency and Renewable Resources in the Clean Energy Replacement Portfolio

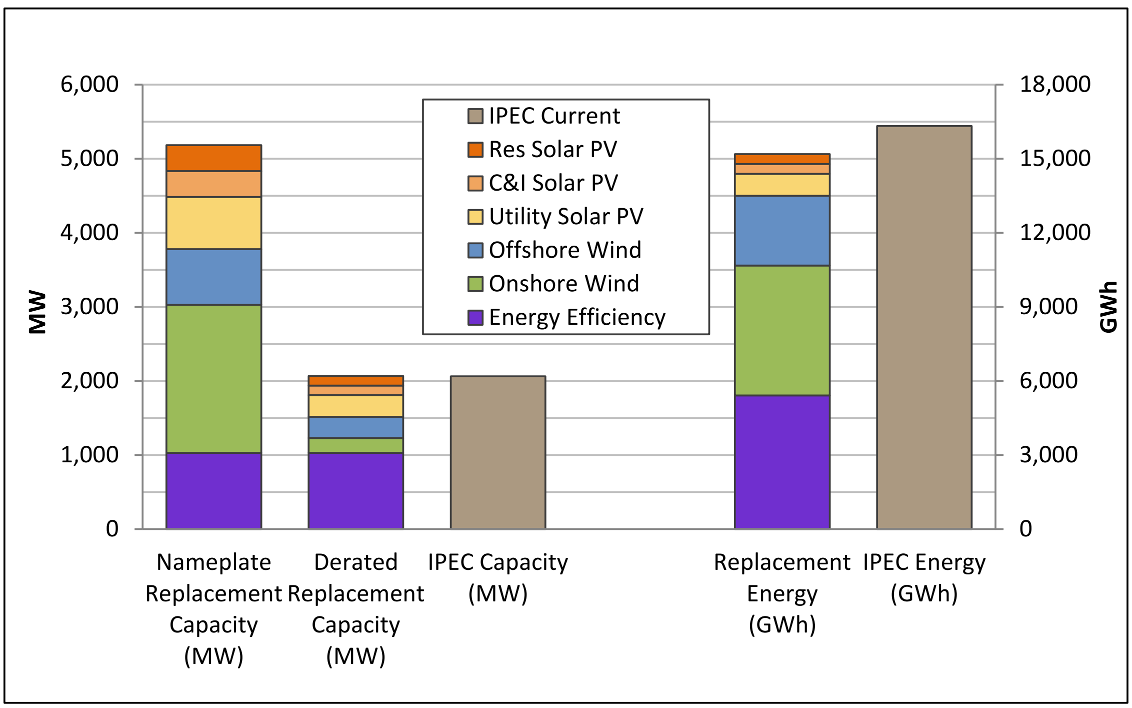
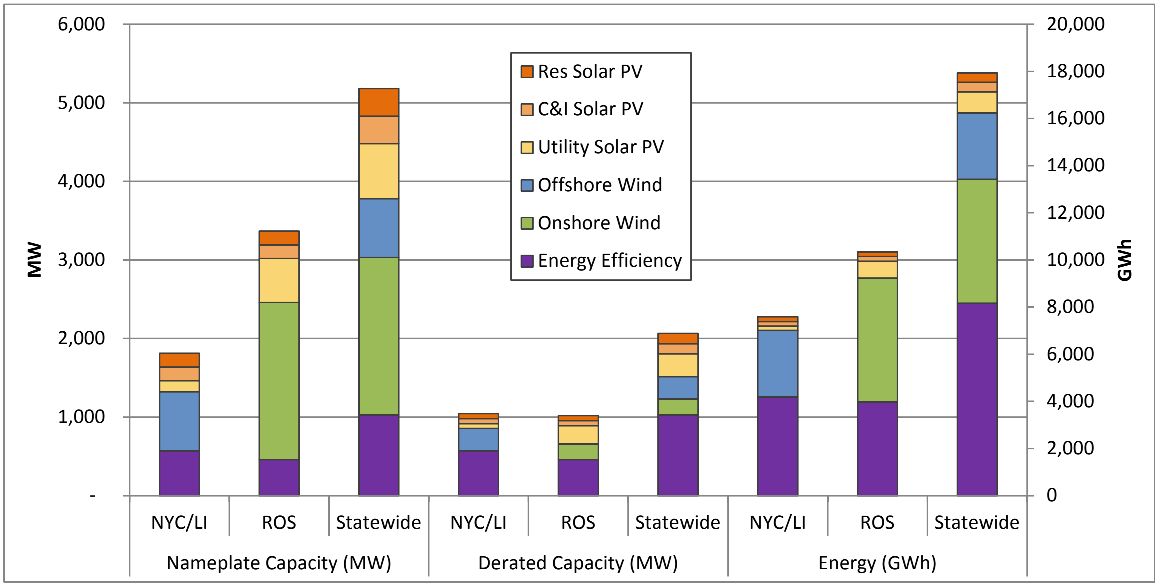


Figure 15: Efficiency and Renewable Resources in the Clean Energy Portfolio – By Region



We note that our analysis of the resources potentially available for this portfolio is conservative in several ways. First, the portfolio includes 2,060 MW of replacement capacity by 2022, even though our analysis of the NYISO forecasts in Section 3 indicates that only 540 MW of replacement capacity would be needed by 2022, suggesting that 2,060 MW of new capacity will not be needed until well after 2022. Second, the portfolio does not include the full amount of energy efficiency capacity (1,600 MW) that could be available by achieving savings of 1.5 percent per year. Finally, the portfolio does not account for the availability of renewable energy imports from out-of-state.

5.2 Cost Implications of IPEC Replacement

The retirement of IPEC and replacement with a portfolio of clean energy resources will have two primary impacts on costs facing New York electricity customers. First, wholesale market costs for capacity and energy will be impacted by a combination of generation supply mix changes and demand reduction. To the extent that the marginal costs of capacity and energy purchased in the wholesale market change, wholesale electricity prices will be directly affected.

Second, additional costs will be incurred to support the development of expanded energy efficiency programs and renewable generation. We refer to these latter costs as "public policy" costs because they will be incurred as a result of the public policy mechanisms used to support the energy efficiency and renewable resources. Most of these public policy costs will be collected from electricity customers through (a) increases in the System Benefit Charge to fund energy efficiency programs, and (b) increases in the costs of renewable energy credits to developers of renewable generation. In the case of energy efficiency, however, the net costs are likely to be negative (i.e., result in net benefits to customers) due to the ability of low-cost energy efficiency to displace higher-cost energy market purchases.

5.3 Wholesale Market Cost Impacts

To determine the wholesale market cost implications of our clean energy replacement portfolio, we estimated the likely effects in 2022 of modifying the mix of electricity resources in New York State by removing 2,060 MW of nuclear capacity and replacing it with 1,030 MW of renewable resources and 1,030 MW of efficiency resources. We assess the market costs separately for the wholesale energy market and the wholesale capacity market. All costs are reported in constant 2011 dollars.

Wholesale Energy Market Impacts

For the wholesale energy market, we began by constructing reference case supply curves for energy in 2022. These system supply curves represent an ordering of resource blocks, from lowest marginal cost to highest marginal cost, and take into account the net effect of resource additions and retirements; fuel prices (primarily natural gas and coal); assumed heat rates; assumed variable operation and maintenance costs; and the output of variable resources across season and time of day.

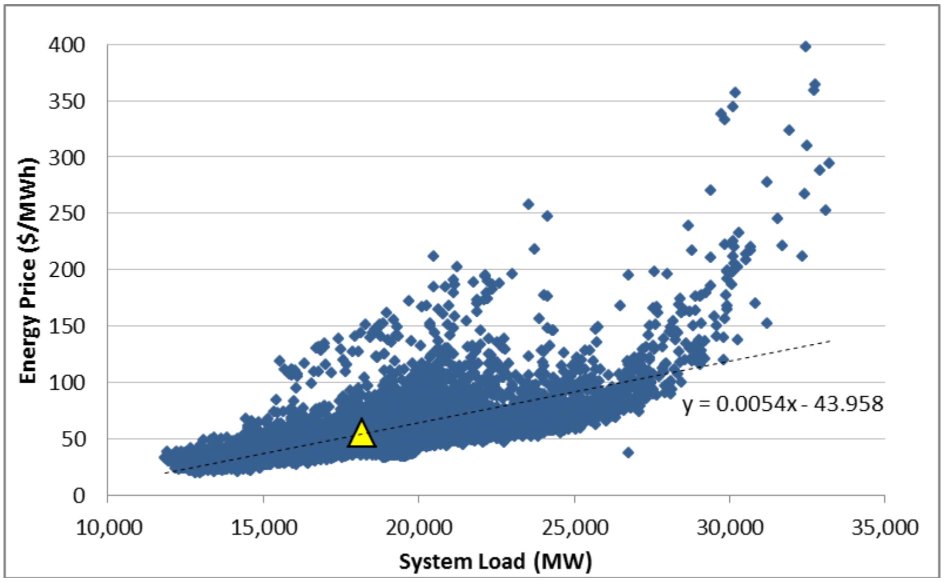
The first step in constructing an energy supply curve was to examine hourly prices for 2011 aggregated over the two regions of our study: New York City/Long Island (NYC/LI) and Rest of State (ROS).[22] We chose these two regions because the resource mix and the energy costs are significantly different between these two regions. The 2011 supply curve for NYC/LI is shown in Figure 16. This figure shows the hourly energy prices (in $/MWh) that occur at different load levels throughout the year. Each point in the curve represents the price, and thus the marginal cost of generation, for one hour. In the annual supply curve there are 8,760 points; one for each hour of the year.

We constructed four such supply curves for 2011 (annual, summer, winter, and spring/fall), in order to represent the variation in prices throughout the year. For each of these seasons, we constructed one curve for the NYC/LI area and one curve for the Rest of State. We recognize that this is a relatively simplistic assessment of the wholesale energy market supply curves in New York, which can vary considerably by zone and by time of year. Nonetheless, we believe that we have captured enough variation by season and by the two most important regions to provide a useful illustration of the potential cost impact of replacing IPEC.

As noted above, each point in a supply curve represents the marginal cost of generation for the load in that particular hour. By comparing all of the hours together in our supply curves we can develop an indication of the extent to which energy costs change as a function of changes in loads.

[22] NYC/LI includes NYISO Zones J and K, while ROS includes all of the other NYISO zones combined.

Figure 16: 2011 Supply Curve for New York City and Long Island Zones



Source: NYISO

For our purposes, we are most interested in the average energy prices across each season. In 2011 the average load in New York was 18,194 MW, with a standard deviation of 3,450 MW. The change in loads around this average load is what mostly determines the average energy price for the year or for the season. For each year and for each season, there will be high-load and high-price hours, but these are relatively few in number and thus are not sufficient to significantly influence the average price for the year or the season.

We have considered the resources that correspond to the different levels of load in the 2011 annual supply curve. At the lower end (i.e., about 12,000 MW) there are a few coal units in upper New York, but the bulk of the marginal resources are natural gas combined cycle units throughout the state, followed by natural gas steam units and then natural gas and oil peaker units at the highest load levels.

To derive a general measure of the effects of a change in electricity resources, we fit a linear trend to each supply curve.[23] The slope coefficient represents how much the average wholesale market price would change in response to a 1 MW change in load. We then converted this slope to a normalized coefficient representing the change in average price in response to average load by calculating the percentage change in price divided by percentage change in load. Our results from the 2011 supply curves are presented in Table 6. These price-response coefficients enable us to apply the proportional price responsiveness observed today to future situations, while adjusting for other factors that affect various generation technology prices.

[23] We use a linear trend as opposed to an exponential trend due to the fact that we are interested in the annual average marginal price as opposed to the price in any particular hour.

Table 6: Price-Response Coefficient (%Price/%Load)

Season	NYCLI	RoS
Summer	2.36	1.64
Winter	2.01	1.43
Spring/Fall	1.53	1.04
Annual	1.86	1.28

Our next step was to create an illustrative supply curve for 2022. In general, the 2022 supply curve is unlikely to look much different from the supply curve observed in 2011. Some coal units may retire, but most new additions will be natural gas combined cycle units filling in the lower portions of the active supply region. We made two adjustments to the 2011 supply curves. First, we adjusted the supply curves to account for projected capacity changes in the 2012 NYISO *Gold Book*. Second, we escalated the fuel prices from 2011 to 2022 using the fuel price forecasts from the 2012 *Annual Energy Outlook* reference case (US Energy Information Administration, 2012).

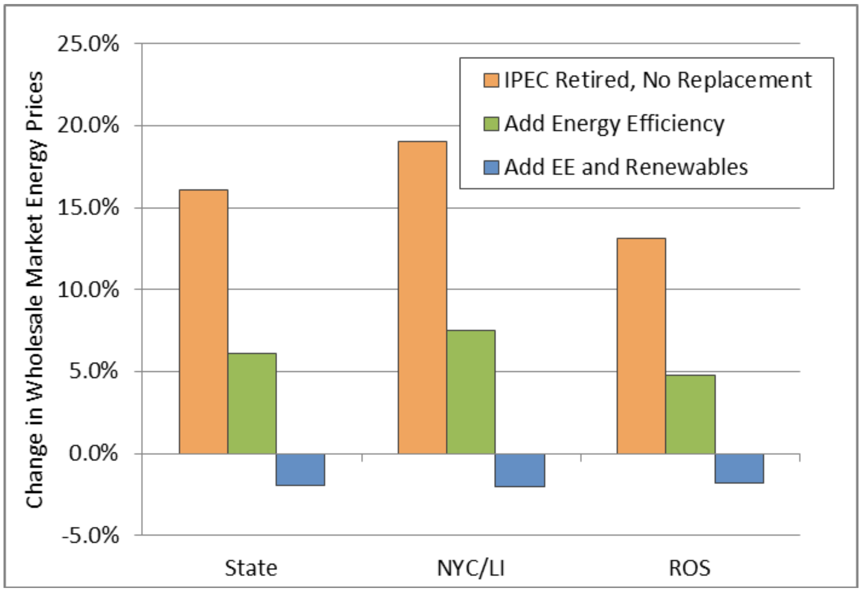
We then used demand forecasts from the 2012 *Gold Book* as a reference case, adjusting for hourly and seasonal fluctuations. The intersection of these supply and demand curves provided our estimates of the likely reference case wholesale market costs in 2022.

To simulate the retirement of IPEC and the addition of our clean energy replacement portfolio, we modified the 2022 energy supply curves in three steps: (1) we removed 2,060 MW of IPEC capacity; (2) we introduce the energy efficiency from our clean portfolio by altering the 2022 demand forecast to reflect peak load reductions and declines in energy use; and (3) we introduce 1,030 MW of the renewable energy resources from our clean portfolio. For each of these steps we modeled the net market clearing price changes that may occur, using our estimated price-response coefficient.

Our results are summarized in Figure 17. We find that for the state as a whole, removing IPEC without any replacement resources results in an increase in annual average market prices of roughly 16 percent. For the NYC/LI region the increase would be higher at approximately 19 percent, and for the Rest of State the increase would be lower at roughly 13 percent. When we introduce the 1,030 MW of energy efficiency resources, combined with the removal of IPEC, the increase in average annual market prices is reduced significantly, to roughly five to seven percent. Finally, when the 1,030 MW of renewable capacity is introduced (following the removal of IPEC and the addition of the efficiency resources), there is a net reduction of approximately two percent in average wholesale energy market prices.

As noted above, this analysis was conducted for the two regions of the state and for the three seasons of summer, winter, and spring/fall. The results presented in Figure 17 represent the summation of the effects for the three seasonal periods.

Figure 17: Wholesale Energy Market Price Impacts of IPEC Retirement and Clean Energy Portfolio



Source: Synapse analysis of New York supply curves

From these results we conclude that replacing IPEC with our clean energy portfolio is likely to have a very modest impact on the wholesale energy prices: roughly equal to a two percent reduction in annual costs. The reason that the impact is so modest is that we have replaced the full IPEC capacity with an equivalent amount of capacity and nearly equivalent amount of energy. While there may be more significant differences in prices during some peak hours of the year (e.g., when IPEC would have operated but some of the renewable resources would not be operating), these hours are few compared to the total 8,760 hours of the year that determine the annual average wholesale energy market costs. For most of the hours of the year, either the efficiency and renewable resources would be operating, or the price differentials as a result of them not operating would be small.

Wholesale Capacity Market Impacts

We conducted a similar, but much simplified, analysis of the wholesale capacity market. We began by reviewing the structure and prices of the 2011 New York capacity market. We then constructed a capacity supply curve for 2022, by adjusting the current generation mix by the projected capacity changes in the 2012 NYISO *Gold Book*. In general, we find that the retirement of IPEC and introduction of our clean energy portfolio will result in negligible impacts on the capacity market clearing price. This is because our replacement portfolio is specifically designed to match the IPEC capacity. In the wholesale capacity market, replacing 2,060 MW of nuclear capacity with 2,060 MW of capacity from renewable and efficiency resources should have little to no effect on market prices, in general.

In practice, there would likely be effects on the wholesale capacity markets as a result of the location of the replacement resources. That is, IPEC will have the greatest impact on the market zones closest to it, while the efficiency and renewable resources will have the greatest impact on the zones where they are located. However, with the new transmission investments that are expected over the next several years, particularly as part of the New York Energy Highway Initiative, we expect that the differences in prices between the wholesale market zones will begin to decline. Also, our clean energy portfolio is designed to include a significant amount of capacity in the zones near IPEC, and some of the resources (e.g., energy efficiency, offshore wind, and rooftop PV) might be better able to provide capacity to Zones J and K, the zones are currently most constrained and most expensive.

For these reasons we conclude that replacing IPEC with our clean energy portfolio is likely to have a negligible impact on the wholesale capacity prices. While there may be a very modest increase on wholesale capacity prices, a modest decrease is just as likely.

5.4 Public Policy Cost Impacts

For those resources that would not be developed on the basis of market price signals alone, i.e., where the expected future revenues from the wholesale markets would not be sufficient to cover the construction costs, operating costs, and profit of a new generator, it would be necessary to provide them with additional financial support. This is currently achieved through a variety of public policy mechanisms, including the system benefits charge for energy efficiency, the RPS for renewable resources, and long-term contracts for renewable generation projects.

Incremental Costs of Energy Efficiency

Although energy efficiency is widely recognized as one of the most cost-effective energy resources, the current electricity market structure in New York does not lead to market procurement of energy efficiency. The fact that energy efficiency must be procured indirectly through public funds rather than directly through the market means that there will be public policy costs related to implementing energy efficiency programs. These funds represent an initial cost to ratepayers which is collected through increased system benefits charges. To the extent that the energy saved is less expensive than that which would have otherwise been purchased in the market, however, these investments lead to net savings for electricity customers.

In order to calculate the cost impacts of the energy efficiency portion of our clean energy portfolio, we have assumed a cost per MWh equivalent to the weighted average of the projected costs approved by the Commission for jurisdictional programs for 2011 through 2015 (NYPSC, 2011). This weighted average energy efficiency cost per MWh is approximately $30.[24]

Based on our assessment of the wholesale energy and capacity markets described above, we estimate that the average wholesale market price in 2022 (including both energy and capacity)

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24 As noted above, all of the costs presented in this report are in constant 2011 dollars. This estimate of the cost of energy efficiency will increase with inflation by 2022.

will be roughly $70/MWh. Therefore, we estimate that the $30/MWh spent on energy efficiency resources will result in roughly $70/MWh in avoided cost savings, resulting in a net savings of roughly $40/MWh. Applying this figure to the amount of GWh savings assumed in our clean energy portfolio indicates that the energy efficiency resources will result in roughly $200 million in annual savings, which would be a *reduction* of roughly one percent in annual New York electric system costs.

Incremental Costs of Renewables

In order to encourage the development of the new renewable energy generation included in our clean energy portfolio, project developers will need to be provided sufficient economic incentives. Currently a form of this is done through payments for renewable energy certificates (RECs) purchased by NYSERDA. Future incentives may need to be higher than those available today in order to achieve the type and level of renewable resources in our clean energy replacement portfolio.

Table 7 shows the energy costs we assume for new renewable resources in the clean energy portfolio. These costs are in levelized terms, which means that they represent a constant amount of annual costs that will be incurred over the operating life of the resource. We expect the cost of offshore wind and PV projects to fall during the ten-year study period, and our costs represent the average cost of projects installed over this period. We also assume that the federal production tax credit and investment tax credit are not available for the majority of the study period, and therefore our costs in Table 7 do not include these federal tax credits.

Table 7: Renewable Energy Cost Assumptions

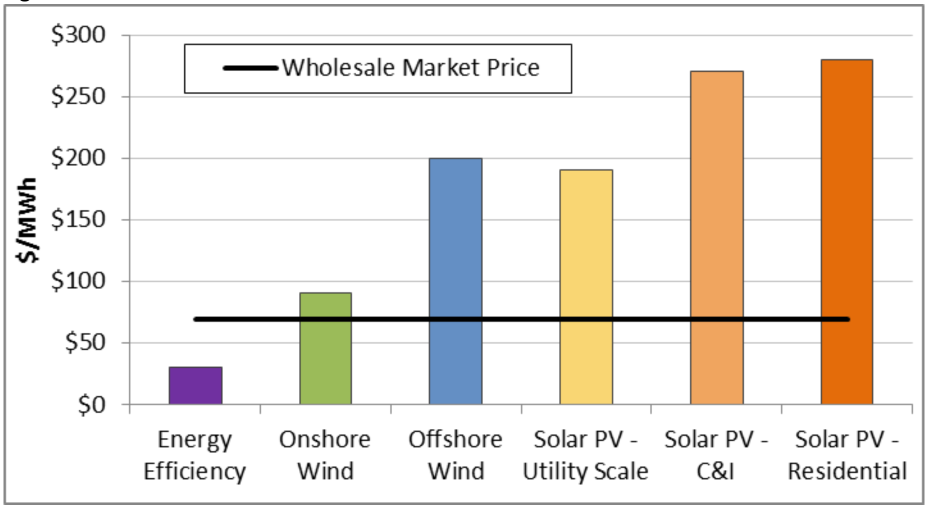
Renewable Technology	Cost (2011$/MWh)
Onshore Wind	$90
Offshore Wind	$200
Ground-Mounted PV	$190
Commercial PV	$270
Residential PV	$280

Source: These costs are based on publicly available information from utilities and government agencies and on discussions with project developers.

The costs in Table 7 represent the full cost of developing and operating these renewable resources, and thus do not represent the incremental public policy costs that will be incurred by electricity customers to develop these resources.

Project developers will be able to earn revenues from the wholesale electricity markets to help offset these costs. As noted above, we estimate that that the average wholesale market price (energy and capacity) in 2022 will be roughly $70/MWh. Thus, we estimate that the public policy costs associated with each of the renewable resources will be the costs presented in Table 7, minus $70/MWh. Figure 18 below displays the levelized costs per MWh for both renewable and energy efficiency resources, as well as the approximate price received in the wholesale market.

Figure 18: Levelized Resource Costs and Wholesale Market Price



We then multiply these public policy costs per MWh by the energy generation assumed from the renewable resources in our clean portfolio to estimate the likely public policy costs associated with those resources. Our projected public policy costs for the renewable resources in our clean portfolio total approximately $750 million per year, which would be an *increase* of roughly 2.7 percent in annual New York electric system costs.

The total public policy costs of our clean energy portfolio will equal the sum of the energy efficiency costs and the renewable resources costs. Incorporating energy efficiency resources reduces the total projected public policy costs due to the avoidance of energy and capacity market purchases through lower-cost efficiency investments. We estimate the total public policy cost of the portfolio to be roughly $550 million per year, which would be an *increase* of roughly two percent in annual New York electric system costs.

5.5 Potential Impacts on Retail Electric Bills

To summarize, our analysis indicates that the clean energy replacement portfolio is likely to have two primary cost impacts: (1) a modest *reduction* in average wholesale electricity prices statewide by roughly two percent; and (2) a modest *increase* in electric system costs by roughly two percent attributable to the public policy costs necessary to implement the portfolio.

These two cost effects will have different impacts on customers' retail electric bills. The change in wholesale electricity market costs will affect only the generation portion of a customer's bill; it will not affect the portion of the bill for recovering distribution costs and other charges. The change in public policy costs will affect a customer's entire bill because these costs (e.g., a system benefits charge or the costs for RECs) tend to be collected across the entire amount of kWh consumed.

In general, the generation portion of a residential customer's electric bills represents roughly half of the total bill.[25] Therefore, a two percent reduction in wholesale electricity costs would roughly translate into a one percent reduction in a customer's bill.

An increase in public policy costs would impact the customer's entire bill. Thus our projected increase in public policy costs would result in total customer bill increases of roughly two percent. Combined with the impacts of lower costs from the wholesale market, we can expect a very slight impact on overall customer bills on the order of a one percent increase.

A typical residential customer in New York using 610 kWh per month in 2022 will pay a monthly bill of roughly $116. For such a typical customer, a one percent increase in electric bills would translate into approximately $1.16 per month in increased costs (in 2011 dollars).

We recognize that there are many simplifications and many uncertainties in our cost estimates. The eventual cost impact of our clean energy replacement scenario could be somewhat more or less than the one percent increase that we have estimated. Also, some types of customers and some regions of the state may experience cost changes that vary from this statewide average. Nonetheless, our analysis indicates that the eventual cost impact of our clean energy replacement portfolio is likely to be very small in general. Furthermore, those customers that participate in the expanded energy efficiency programs in our portfolio will see reductions in electricity bills that will outweigh any of the cost increases that we estimate here.

[25] This is based on a review of recent residential bills for residential customers of Con Edison and CHG&E. Customers that consume less electricity will see a larger portion of the bill driven by commodity costs, and vice versa, because of the fixed cost portion of the bills.

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