Synapse
Energy Economics, Inc.

Indian Point Energy Center Nuclear Plant Retirement Analysis

Replacement Options, Reliability Issues and Economic Effects

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Table of Contents

1. Executive Summary

This report was prepared by Synapse Energy Economics, Inc. at the request of the Natural Resources Defense Council, Inc. and Riverkeeper, Inc.[1] The report provides an assessment of the alternative energy resources that are available to replace Indian Point Energy Center Units 2 and 3 ("Indian Point") if the Nuclear Regulatory Commission does not relicense these facilities when their current licenses expire.[2]

The two units at Indian Point, located in Buchanan, New York in Westchester County, each have the capacity to generate approximately 1,020 MW of electricity, or 2,040 MW combined. Our analysis is based upon existing literature regarding electricity resource development in New York, particularly the New York Independent System Operator (NYISO) Gold Book, which contains forecasts of peak demand as well as a comprehensive queue of electricity resources that are currently being proposed by developers.[3] We also review a recent report from Charles River Associates for the New York City Department of Environmental Protection ("CRA Study") that addresses many of the same issues in this report.[4]

We note at the outset that this report provides an overall assessment of the potential opportunities and costs associated with replacing Indian Point's energy and capacity, based upon readily available current data. The actual impacts of retiring Indian Point 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.[5]

Our key findings include the following:

- There is currently a surplus of electricity capacity in the regions near Indian Point,[6] and if Indian Point were not relicensed, there is no need for new capacity to maintain reliability until 2020.
- Con Edison, serving New York City, currently relies on only a small portion of Indian Point to meet its reliability requirement. The other two distribution companies in the regions near Indian Point (Long Island Power Authority and Central Hudson Gas & Electric) do not currently rely upon any Indian Point capacity to meet their reliability needs.

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1 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.

2 The Indian Point units' two federal operating license expire in September 2013 and December 2015, although they may be administratively extended by the Nuclear Regulatory Commission beyond those dates if currently pending relicensing proceedings are not resolved by those dates.

3 New York Independent System Operator, *2011 Load and Capacity Data*, April 2011 (Gold Book).

4 Charles River Associates, *Indian Point Energy Center Retirement Analysis*, prepared for the New York City Department of Environmental Protection, Report, August 2, 2011 ("CRA Study").

5 This report does not address the policy arguments for or against relicensing of the Indian Point units or the environmental, public health and safety issues associated with Indian Point.

6 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 "regions near Indian Point" to refer to the lower Hudson Valley, New York City and Long Island (i.e., NYISO zones G through K). We use the term "rest of the state" to refer to the rest of New York State (i.e., NYISO zones A through F).

- Energy efficiency resources, beyond those currently planned for, could provide as much as 1,570 MW of capacity savings in the Indian Point region, and additional savings are available in the rest of the state.
- Renewable resources could also play a role in replacing Indian Point capacity, with roughly 1,154 MW of capacity available for reliability purposes already in the NYISO interconnection queue. To provide a conservative estimate of the amount of this renewable capacity that might likely be built and actually be available, we assume that only 50% of these projects are completed.
- In addition to the renewable resources currently in the NYISO interconnection queue, there is a large potential for rooftop solar and off-shore wind resources, most of which would be located within the regions near Indian Point and close to the high energy load centers.
- There is substantial potential for existing, older natural gas plants in New York City to be repowered or replaced with new efficient combined cycle power plants on the same site. If necessary, new, efficient natural gas combined cycle facilities could also play a role in replacing Indian Point capacity, and would be particularly helpful in providing dispatchable generation and voltage support in the Indian Point region.
- New transmission lines, several of which are already in progress, can play a role in replacing Indian Point capacity, particularly transmission facilities that can eliminate the congestion between the Indian Point region and the rest of New York State.
- The costs of replacing Indian Point energy and capacity will depend upon the choice of replacement resources. Energy efficiency will help significantly reduce replacement power costs by reducing the wholesale prices of energy and capacity, and reducing customer bills. New renewable resources will help lower the cost of replacement power, to the extent that they are required anyway to comply with the state's renewable portfolio standard.
- The CRA study overstates the likely costs of replacing power from Indian Point, by presenting a limited set of replacement options, especially a limited amount of energy efficiency opportunities.
- The percentage increase in electricity customers' bills from replacing Indian Point will be roughly half of the percentage increase in wholesale electricity prices, because wholesale energy represents roughly half of electricity customers' total bills.
- The impact on customers' electricity bills is likely to be on the order of one to three percent under the scenarios discussed in this report. For those customers who participate in energy efficiency programs, this increase in electricity bills would be more than offset by reductions in bills due to energy efficiency savings.

We find that there are likely to be ample existing and new resources available to replace Indian Point if it were to retire; and that neither New York City's nor New York State's electricity reliability would be jeopardized. A replacement scenario focusing on cost-effective demand-side resources, local renewable resources, repowering of existing older inefficient power plants and new efficient generation as necessary would maintain reliability at a low cost to electricity customers.

Reliability and Replacement Options

Both New York State and New York City currently have a substantial surplus of capacity—well above and beyond the minimum reserve margin required for reliability—that is expected to last for several years. Even if Indian Point is retired, there is no need for new capacity until 2020 for meeting reliability needs, either in New York State or the City.[7]

We investigate several replacement resources available both in the regions near Indian Point and in the rest of the state. Resources located in the regions near Indian Point will most readily and directly replace power from Indian Point, but resources located in the rest of the state may be able to play a role as well, especially if combined with transmission upgrades between the two regions.

There are several types of resources available to replace Indian Point, including increased energy efficiency, new renewable resources, new gas-fired generation, repowering existing gas-fired generation and new transmission capacity. Our analysis indicates that there is ample capacity available from demand-side and renewable resources alone to meet reliability requirements if the Indian Point units are not relicensed. In particular:

- We estimate that over the next decade there is enough energy efficiency in the regions near Indian Point to reduce peak demand by nearly 1,570 MW – above and beyond the efficiency savings currently assumed by NYISO in their load forecasts. This estimate is based on the assumption that existing efficiency activities in New York would be increased enough to reduce peak demand by roughly 1.5 percent per year from 2015 through 2021. This level of efficiency savings is well within what could be considered reasonably achievable; additional efficiency savings could be obtained with increased efforts. Energy efficiency savings are, of course, free of carbon pollution and other air and water pollution impacts.

- There are currently roughly 5,500 MW of renewable resources in the NYISO interconnection queue, the majority of which (5,365 MW) are wind projects. Only a portion of the wind capacity is considered to be available for purposes of the NYISO reliability planning. Therefore, the 5,365 MW of wind capacity is roughly equivalent to 1,154 MW of capacity that can be used to meet the state's summer peak reliability requirements. Even if only one-half of this capacity is eventually developed, it would provide roughly 244 MW of renewable resources in the regions near Indian Point, and 333 MW of renewable resources in the rest of the state.[8]

- In addition to the renewable resources in the NYISO interconnection queue, there is a large potential for roof-top solar photovoltaics and additional offshore wind, both of which are highly concentrated in the regions near Indian Point and near the

7 This finding is based on our reserve margin analysis, which relies on the load forecast from the 2011 Gold Book. The CRA Study states that new capacity will be needed to meet reliability requirements in 2016. However, the CRA's finding is apparently based upon an outdated load forecast from the 2010 Gold Book. This issue is addressed in more detail in Section 2.2 below.

8 The extent to which the renewable resources in the rest of the state can help replace Indian Point power will depend upon transmission enhancements, as discussed in Section 2.6 below.

highest electricity loads in New York. Pending legislation in the New York State legislature, if enacted, would establish a program to develop approximately 5,000 MW of solar power capacity in New York State by the year 2025, which could mean as much as 2,500 MW of solar power in the regions near Indian Point. The Long Island–New York City Offshore Wind Collaborative sees the potential for an offshore wind project of up to 350 MW, potentially growing to 700 MW.

- The expansion of demand response (DR) resources in the downstate region could also assist in replacing Indian Point.[9] DR has gone from a somewhat experimental initiative a decade ago to now playing an increasingly valuable role in New York's electrical system. There are now over 2,000 MW of DR enrolled with the NYISO Special Case Resource program, which were largely responsible for averting a new all-time record for peak load in July 2011.[10] As market rules expand in accordance with FERC mandates designed to ensure fair compensation of DR, there will be an increasingly valuable role for these resources to play in meeting the energy and reliability needs of the state – particularly in New York City and the other regions around Indian Point.
- Combined heat and power (CHP) facilities are a highly-efficient, clean, distributed generation resource that could play a key role in replacing Indian Point. These projects can range from as small as 100 kW to as large as 10-20 MW, and are sized according to a building's electrical and heating/cooling needs (or in the case of district energy, the needs of a cluster of buildings). To date, the New York State Energy Research and Development Authority (NYSERDA) incentives have supported a number of high-profile CHP projects in the region near Indian Point, but the state has only begun to scratch the surface of its CHP potential. The environmental and reliability benefits of this technology are proven and well-established, leading New York City to include a goal to install 800 MW of CHP as part of its PLANYC sustainable energy strategy.[11,12]

In addition, new efficient, combined-cycle gas-fired power plants with state of the art pollution controls can help meet reliability requirements in the absence of Indian Point. There are currently 4,208 MW of new gas-fired plants in the NYISO interconnection queue, not including the recently completed 550 MW Astoria II facility. The majority of this capacity, 3,908 MW, is located in the regions near Indian Point.[13] Assuming that 50 percent of the remaining gas-fired projects come on line as scheduled, there will be1,954

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9 DR programs provide customers with financial incentives to reduce their load at times of high electrical demand, e.g., by controlling lighting, air conditioning or water heating end-uses.

10 NYISO Management Committee Heat Wave presentation, July 27, 2011. http://www.nyiso.com/public/webdocs/committees/mc/meeting_materials/2011-07-27/2011_Heat_Wave_July_20_22.pdf

11 *A Greener, Greater New York. PLANYC,* page 113. *http://nytelecom.vo.llnwd.net/o15/agencies/planyc2030/pdf/planyc_2011_energy.pdf*

12 While an aggressive expansion of CHP was not explicitly incorporated into this analysis, the technology further highlights the range of cost-effective options for replacing Indian Point while maintaining system reliability. If NYC were to meet even a portion of their 800 MW CHP target in the near term it would play a significant role in any Indian Point replacement power portfolio.

13 500 MW of this capacity is actually located in New Jersey, but it is connected directly to New York City and counts towards local reliability requirements; we therefore include it in our analysis.

MW of new natural gas capacity in the regions near Indian Point New York, nearly enough to replace Indian Point.

Repowering existing gas-fired generation plants is another available option with important environmental benefits for replacing Indian Point energy. Repowering existing gas plants involves replacing or rebuilding the existing plant with a new, more efficient combined cycle gas-fired plant, which can produce more electricity while using gas more efficiently and producing less air and water pollution. There are 230 MW of planned plant repowerings that were once in the NYISO interconnection queue but have been removed. These projects could be revisited should it become clear that Indian Point would retire, and if New York State provided incentives for Con Edison and other utilities to enter into long-term contracts with the developers of repowered generation plants.

Furthermore, there are currently 8,210 MW of new transmission capacity proposed in the NYISO interconnection queue. Of these projects, 5,010 MW terminate in New York City, and 2,000 MW (West Point Transmission and NY Power Pathway) will terminate in the region where Indian Point is located. It is difficult to predict the likelihood that any one of these projects will be approved and come on-line. Nonetheless, it is safe to conclude that some of these transmission lines are likely to be developed prior to 2020 and would assist in replacing the capacity from Indian Point.

Economic Impacts

The CRA Study estimates the likely costs of replacing Indian Point under several replacement scenarios that include different combinations of new natural gas combined cycle units, off-shore wind feeding directly into New York City, and a DC transmission line from Quebec into New York City. The study estimates that the increased costs of Indian Point replacement will range from roughly \$11.5 billion to \$14.3 billion, in present value dollars over a 15-year planning period.[14]

Our analysis indicates that the CRA Study may overstate the likely economic impact of Indian Point replacement options. This is primarily because their scenarios do not include any energy efficiency or land-based wind resources, which can significantly reduce the costs associated with new resource needs.

The ultimate cost of replacing Indian Point will depend upon the choices that are made by policymakers in the wake of a decision not to relicense the units. We propose several Indian Point replacement scenarios to illustrate the opportunities available from energy efficiency and renewable resources. One scenario includes enough energy efficiency, from the regions near Indian Point and the rest of the state, to replace all of Indian Point's capacity. This scenario is likely to be the lowest cost option, and would result in no additional CO_2 emissions. Another scenario would include 500 MW of new and repowered natural gas combined-cycle facilities and 1,537 MW of energy efficiency, both located in the regions near Indian Point. This scenario offers generation support in the regions near Indian Point, combined with the relatively low cost of efficiency and natural gas. A third scenario includes 1,390 MW of efficiency in both the regions near Indian Point and the rest of the state combined with 647 MW of wind in the rest of the state. This scenario, which may require resolving the current transmission constraints between

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[14] CRA Study, pages 25-26. These increased costs are based on increases in the wholesale electricity and capacity markets in New York, combined with the "contractual support" costs needed to implement those resources that would not be developed based on revenues from the market alone.

east and west New York, may offer the best balance between providing generation support, maintaining low replacement costs, and preventing any increase in CO2 emissions.

All of these scenarios will cost less than those modeled in the CRA Study. The introduction of energy efficiency as replacement power for Indian Point should significantly reduce the increases in the wholesale energy and capacity markets from Indian Point retirement. Energy efficiency typically has a benefit-cost ratio of 2.0 or 3.0, meaning every dollar spent on efficiency will reduce costs by two to three dollars.[15] Therefore, increased energy efficiency will reduce electricity costs – above and beyond the reduced costs in the wholesale energy and capacity markets.

In addition, the CRA study assumed that only 50 percent of the energy efficiency savings in the NYISO Gold Book forecasts are actually achieved.[16] The authors do not explain why they made this assumption, but it increases the cost of replacing Indian Point.

Furthermore, the only scenario modeled by CRA that included renewable resources to replace Indian Point included only off-shore wind combined with a large transmission line from Quebec to New York City. It is likely that other scenarios with lower-cost wind and less transmission expansion would result in lower costs for replacing Indian Point.

Finally, we note that the impacts on typical electric customer bills in New York are likely to be significantly less than the percentage increases presented in the CRA study. We estimate that the percentage impact on a customer's retail electric bill could be as little as half the percentage impact on the wholesale electricity markets, and thus would be on the order of roughly two to five percent – for the scenarios studied by CRA. For scenarios that include more energy efficiency and renewable resources, the impacts on retail bills would be significantly less than this, on the order of one to three percent. For those customers that participate in energy efficiency programs, this increase in electric bills would be more than offset by reductions in bills due to energy efficiency savings.

2. Reliability Issues and Replacement Options

2.1 The Recipients of Indian Point Power

One of the main concerns regarding Indian Point's retirement has revolved around the degree to which it supplies power to New York City. In general, this concern is misplaced.

There are two important considerations to understand when evaluating the extent to which New York City relies upon power from Indian Point. First, there is no way to know exactly where the physical power from Indian Point flows at any point in time. The flow of power will be dictated by many factors at any time, including the volume of generation from Indian Point, the operation of other generation facilities in the region, constraints on the regional transmission system, and the locations and levels of electricity demand in

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15 Optimal Energy et. al., *Economic Energy Efficiency Potential, New York Service Territory*, prepared for Orange and Rockland Utilities, June 2008, page 4. American Council for an Energy-Efficient Economy, *Saving Energy Cost-Effectively: a National Review of the Cost of Energy Saved Through Utility-Sector Energy Efficiency Programs*, September 2009, pages 7-9.

16 CRA Study, page 35.

the region. Some of Indian Point power will likely flow to New York City in some hours due to its proximity, but there are also constraints on transmission into the City that could significantly limit the power from Indian Point from flowing there. In sum, the power from Indian Point could flow at times into New York City, but it could also flow over all the regions near Indian Point, to other parts of New York State, and even to other regions outside the state.[17]

Second, the electric distribution companies in the regions near Indian Point have contracted for power from Indian Point, indicating some reliance upon power from the plant. These contracts are economic constructs only – they do not ensure that any power from Indian Point necessarily flows to the contracting parties. The contracts typically include purchases of energy, capacity or both.[18] Energy contracts do not provide the buyers any assurance that the power will be available for reliability purposes. Instead, they provide the buyer with prices for certain quantities of energy, so that the buyer does not have to rely upon the less predictable wholesale spot market prices. Capacity contracts, on the other hand, are specifically designed to assure the buyers that Indian Point will be available to operate during system peak demands, and therefore will play a role in meeting reliability requirements. Therefore, it is instructive to review the capacity contracts that electric distribution companies in the regions near Indian Point have with the facility.

We reviewed the energy and capacity contracts of Con Edison, Central Hudson Gas and Electric (CHG&E), and the Long Island Power Authority (LIPA). These distribution companies represent the majority of customers served in the regions near Indian Point. Con Edison is especially important, because it serves New York City and Westchester County. The most recent contracts indicate a relatively small and decreasing reliance on Indian Point both for energy and capacity purposes:

- Con Edison contracted for 850 MW of Indian Point's generation and capacity from 2001 through 2010.[19] However, in 2011 and 2012, the amount of contracted capacity will decline to 350 MW. That Con Edison is decreasing the amount of capacity it contracts from Indian Point suggests that it sees less of a need for Indian Point to meet reliability requirements. Prior to 2011, Indian Point made up 26 percent of Con Edison's contracted capacity. It now only makes up 12 percent of Con Edison's contracted capacity, as indicated in Figure 2.1.
- Central Hudson Gas and Electric, whose service territory lies just north of Indian Point, has contracted for Indian Point energy, but not capacity, through 2013. The fact that CHG&E is purchasing only energy indicates that it does not need Indian Point to meet its own reliability needs.
- The Long Island Power Authority, which serves power to a more constrained region than even New York City, does not rely at all on Indian Point to meet either

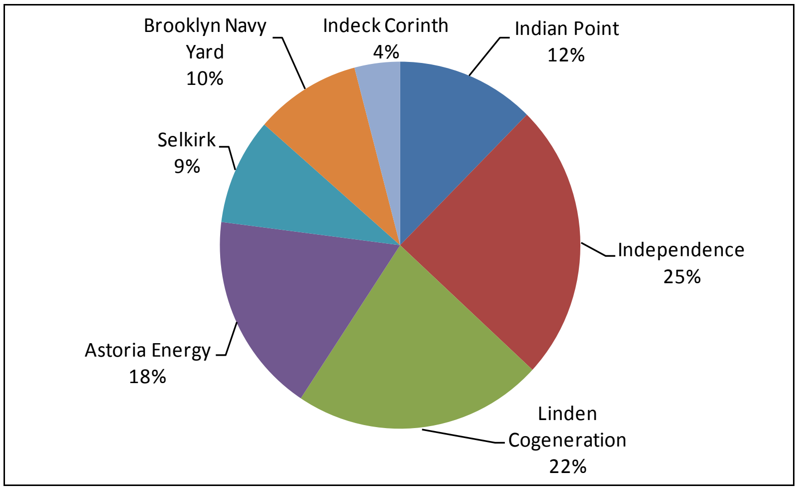
[17] CRA Study, page 1.

[18] Electric capacity is defined as the amount of power than can be generated by a power plant in any one instant. It is typically measured in terms of kilowatts (kW) or megawatts (MW). Electric energy is defined as the amount of power generated by a power plant over a certain period of time, typically one hour. It typically is measured in terms of kilowatt-hours (kWh) or megawatt hours (MWh).

[19] Con Edison 2010 Annual Report, page 119.

its capacity or energy obligations. LIPA does contract some power from the Nine Mile Point nuclear facility, which is located on the shore of Lake Ontario.

Figure 2.1. Current Con Edison Contracts for Capacity



In addition, the New York Power Authority[20] (NYPA) has contracts for 200 MW of generation and capacity from Indian Point through 2013.[21] This is a relatively small fraction of NYPA's total supply portfolio of over 5,000 MW of generation resources in New York. Therefore, it is unlikely that the retirement of Indian Point would threaten NYPA's ability to meet its obligations.

The electric utilities and load serving entities in New York City are required to meet 80 percent of their peak load requirement with local generation (including some generation in New Jersey which is tied directly to New York, and so qualifies as local capacity for the purposes of reliability). Indian Point does not qualify toward this locational requirement because it lies outside of the city. The remaining 20 percent of New York City's peak load requirement can be met with generation located outside of the city, either through bilateral contracts or through purchases in the capacity market. Twenty percent of New York City's peak load-based capacity requirement in 2011 is approximately 2,200 MW.[22] This suggests that the 350 MW of capacity contracted from Indian Point serves a small portion (16 percent) of New York City's external capacity requirement.

If Indian Point were to be retired, then New York City would need to find another source of capacity to meet this portion of its external capacity requirement. However, as discussed in the following section, there is currently a surplus of capacity in New York State and the regions near Indian Point. Therefore, New York City should be able to

20 NYPA sells wholesale power to municipal, state government and industrial customers in New York State, with a small portion of its power sold to out-of-state municipal entities.

21 "New York Relying Much Less on Indian Point for Energy", http://urbanenergy.blogspot.com/2010/12/new-york-relying-much-less-on-indian.html

22 Based on a Zone J capacity requirement of roughly 11,000 MW (NYISO 2010 Reliability Needs Assessment, September 2010, page 20).

replace its 350 MW of capacity from Indian Point from *existing* capacity in the region. New capacity would not be required until roughly 2020.

In sum, our review of the 2011 contracts indicates that only 350 MW of Indian Point capacity is expected to meet the reliability requirements in New York City, and none of the Indian Point capacity is expected to be used to meet the reliability requirements of the other regions near Indian Point. This 350 MW is roughly 17 percent of the Indian Point capacity, and represents only about three percent of the *total* reliability requirement of New York City, and about 16 percent of the *external* capacity requirement of New York City.

2.2 The Need for New Capacity in New York State and New York City

New York State

In order to ensure reliability of electricity supply, the NYISO currently requires that the New York State electric industry maintain a reserve margin of 15.5 percent above expected summer peak demand.[23] Figure 2.2 presents the NYISO forecast of peak demand for New York State, including this reserve margin. This line represents the amount of capacity needed in New York State to meet reliability requirements.[24] Figure 2.2 also presents the amount of existing installed capacity in the state, as well as the reserve margin that would result if no new generation capacity were added to the system. The amount of installed capacity includes the Indian Point Units 2 and 3.

As indicated, New York does not currently need any new capacity to meet reliability needs through 2021 and beyond. The reserve margin remains well above the required 15.5 percent in all years.

Figure 2.3 presents the same information, but with the Indian Point units retired in 2013 and 2015. As indicated, the reserve margin is expected to remain above 15.5 percent through 2020, and it is not until 2021 that the system will require more capacity in the absence of Indian Point. This information is critical to the consideration of Indian Point retirement, as it indicates that the state policymakers will have some time to develop Indian Point replacement resources.[25]

Figure 2.4 presents the amount of capacity surplus in New York State, both with the Indian Point units operating and retired. Note that in 2021, the amount of new capacity

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23 New York State Installed Capacity Reliability Council, Installed Capacity Subcommittee, *New York Control Area Installed Capacity Requirements for the Period May 2011 Through April 2012*, Technical Study Report, December 2010, page 1.

24 Note that the state has to meet reliability requirements in terms of loss of load expectations (LOLE), where the LOLE for each reliability zone must remain lower than 0.1, which is equivalent to a loss of load occurrence once every ten years. The reserve margin requirements are set by NYISO such that these LOLE standards are met, based upon NYISO's probabilistic dispatch modeling of the electric system. Our assessments here are based on the reserve margin requirements, which is a reasonable approximation of the LOLE reliability requirements. We note that our findings here are generally consistent with those of the CRA Study, which is based on modeling LOLE requirements.

25 The heads of the New York State Public Service Commission and other state agencies agree that modeling based on 2011 demand projections indicates that Indian Point's retirement would not cause reliability concerns until 2020. Joint Statement from PSC Chairman Garry Brown, DEC Commissioner Joe Martens, NYPA Trustee John S. Dyson, and NYSERDA President and CEO Francis J. Murray Jr., 7/07/11.

needed to meet reliability requirements is roughly 350 MW, not the full capacity of Indian Point.

Figure 2.2 Peak Demand and Reserve Margin Forecasts – With Indian Point Operating

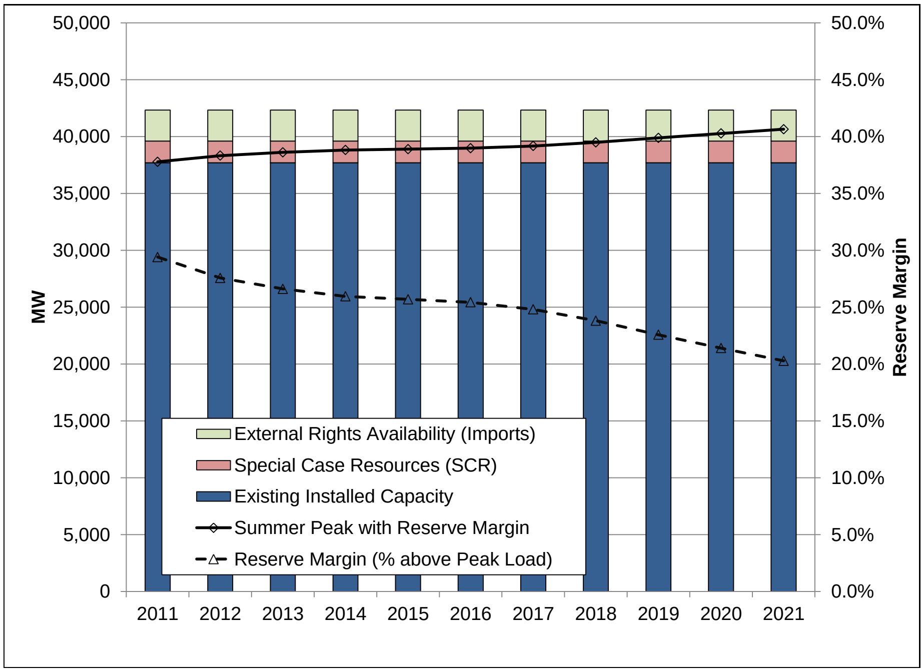


Figure 2.3 Peak Demand and Reserve Margin Forecasts – With Indian Point Retired

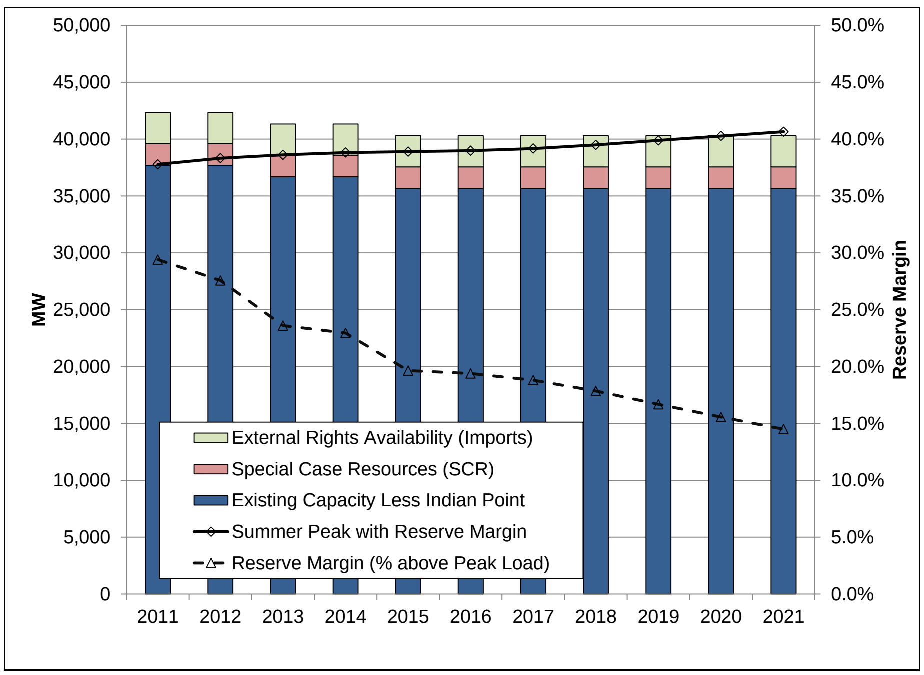
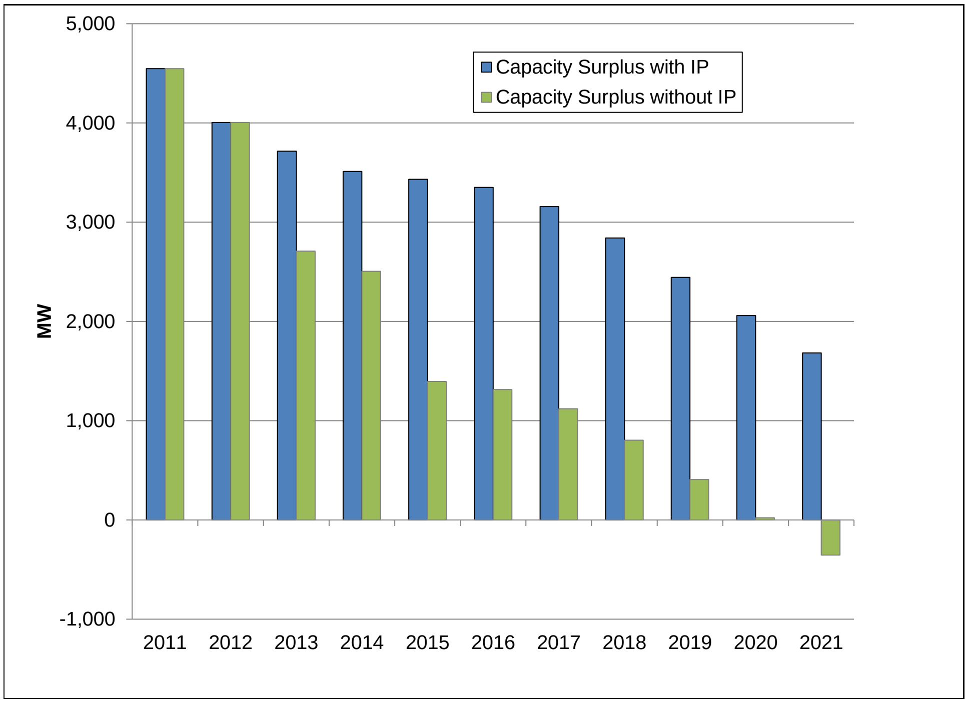


Figure 2.4 New York State Capacity Surplus With and Without Indian Point



It is important to reiterate that the figures above do not include any new capacity installed after 2011. As described in more detail below, there is a large amount of new capacity in the NYISO queue, a portion of which is likely to be installed during the next ten years. A more complete forecast of peak demand and reserve margins would include this new capacity. Instead, we present these figures without any new capacity, to provide a baseline for comparison with our estimates of new capacity potential provided in the following sections.

We note that the CRA Study claims that if Indian Point units 2 and 3 were to be retired in 2013 and 2015, then there would be a need for new capacity to meet reliability requirements by 2016.[26] This is based on the study's LOLE analysis for each NYISO reliability zone and the state as a whole. The CRA study claims that their LOLE analysis is based on the load forecast in the 2011 Gold Book.[27] However, the CRA Study also indicates that their base case LOLE analysis is based on the load forecast in the earlier 2010 Gold Book. In particular, the report states: "In addition to analyzing the LOLE in our base-case load forecast, we also undertook an analysis using the most recent 2011 Gold Book forecast from the NYISO, shown in Table 39."[28] We were unable to clarify this discrepancy with the information provided in the CRA Study. We note, however, that the CRA Study's LOLE results based on the more recent 2011 Gold Book, presented in Table 39, are consistent with our results, indicating that no new capacity resources are required for reliability purposes until 2020. Based upon this, it appears that our results

26 CRA Study, page 12.

27 CRA Study, page 12.

28 CRA Study, page 65.

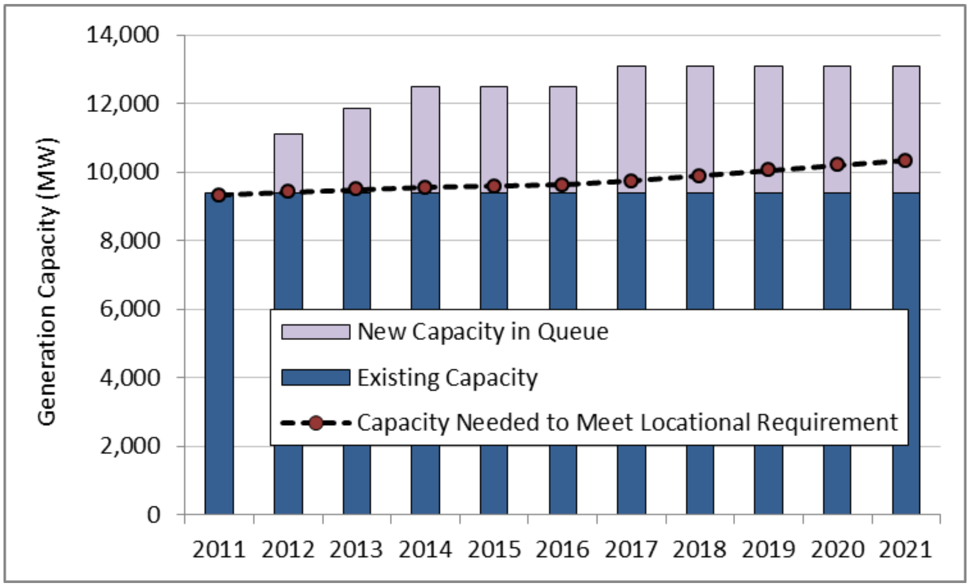
are consistent with those of the CRA Study, once the more recent load forecast is accounted for.

New York City and Long Island

In addition to the statewide reserve margin requirements, the electric utilities and other load-serving entities in New York City and Long Island are subject to locational requirements, due to the constraints on transmission serving those regions. For 2011/2012 New York City and Long Island are required to maintain local generation capacity equal to 81 percent and 101.5 percent of their peak demands, respectively. As with the state as a whole, these two regions are expected to remain well above these reliability requirements through 2020 or 2021.

Figure 2.5 presents the total capacity that could potentially be available through 2021 in Zone J, which is the NYISO zone that is roughly equivalent to New York City, and to which the 81 percent locational requirement is applied. Also presented is the amount of capacity that will be required in Zone J in order to meet the 81 percent locational requirement. As indicated, the amount of capacity that could potentially be available is well above the locational requirement, with the potential for 2,000 to 3,000 MW of capacity in excess of the requirement throughout most of the period.

Figure 2.5 Generation Capacity in Zone J Relative to the Locational Requirement



It is important to note that Indian Point is not located within either the New York City or the Long Island reliability regions. Therefore, the retirement of Indian Point will not affect the ability of New York City or Long Island to meet these local reliability requirements.

2.3 Energy Efficiency Resources

New York has a long history of implementing cost-effective energy efficiency resources.[29] The state has adopted a "15 by 15" goal for electric energy efficiency savings, which will require a 15 percent reduction in forecast 2015 electricity sales. This goal is expected to be met with a combination of existing ratepayer-funded energy efficiency programs, new ratepayer-funded energy efficiency programs, building codes and appliance standards.[30] In order to help achieve this goal, the New York Public Service Commission established the Energy Efficiency Portfolio Standard (EEPS).

The NYISO explicitly identifies projected energy efficiency savings in its load forecasts, by first creating a load forecast without new energy efficiency savings, and then creating a second forecast that includes expected efficiency savings from future ratepayer-funded energy efficiency programs administered by investor-owned utilities, NYSERDA, LIPA and NYPA, as well as anticipated energy savings from improvements in building codes and appliance standards. The forecasted annual savings[31] amount represents roughly 1.1 percent of statewide electricity sales in the early years, then declines to roughly 0.7 percent of electricity sales in 2017, and then declines even further to 0.3 percent of electricity sales in 2019-2021.[32]

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 efficiency savings that are being planned for and achieved by other leading states. The results of our estimates are presented in Figures 2.5 and 2.6 below.

Our estimate of the reasonably achievable efficiency potential in New York is based on the assumption that the state will be able to implement enough energy efficiency to reduce electricity sales in each year by 1.5 percent (relative to the prior year's sales). This amount of energy efficiency would be achieved through a combination of expanded ratepayer-funded energy efficiency programs and new building codes and appliance standards. In order to account for the time needed to ramp up to this level of savings, we assume that the efficiency savings in years 2012, 2013 and 2014 equal 1.2 percent, 1.3 percent and 1.4 percent of sales respectively, and that the 1.5 percent level is reached by 2015.

We have chosen 1.5 percent as a conservative estimate for annual savings assumptions for several reasons. First several utilities (Hawaii and Vermont) have already (as of 2008) achieved efficiency savings of two percent per year through ratepayer-funded

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29 See, for example, New York State Energy Planning Board 2009, Volume I, pages 11-12.

30 New York Energy Planning Board 2009, Energy Efficiency Analysis, pages 24-25.

31 Annual Efficiency savings is the amount of efficiency savings occurring in any one year as a result of the efficiency activities of that year. Cumulative efficiency savings is the amount of efficiency savings occurring in any one year as a result of the cumulative efficiency activities of the previous years.

32 It is not clear why NYISO assumes these declining savings in future years. It may be because of the uncertainty associated with the funding, the availability and the regulatory support for energy efficiency savings that far in the future.

energy efficiency programs alone.[33] Several utilities in other states (e.g., Massachusetts, Rhode Island and Vermont) are planning to achieve efficiency savings equal to two percent of demand, or more, in 2011 and 2012.[34] We believe that New York can also realistically achieve this level of cost-effective efficiency savings, especially given its history with and infrastructure for implementing electric energy efficiency. However, we have chosen to use a lower estimate of 1.5 percent here, in order to present efficiency estimates that are clearly feasible and well within the reach of state policymakers and energy efficiency program administrators.

Second, our assumption of 1.5 percent annual savings is conservative relative to recent estimates of energy efficiency potential in New York. A 2008 report by Optimal Energy Inc. concluded that the state has an achievable potential of 26,000 GWh through 2015 from ratepayer-funded efficiency programs, as well as the potential for an additional 11,000 GWh through 2015 from improved building codes and appliance standards.[35] Our analysis results in roughly 26,000 GWh of energy efficiency savings by 2021. In general, our savings assumption includes a longer period for phasing in the potential efficiency savings identified in the 2008 Optimal report from ratepayer-funded programs and codes and standards.

Third, our reasonably achievable assumption is conservative relative to the state's "15 by 15" goal for electric efficiency savings. That goal will require roughly 25,000 GWh of electricity savings by 2015, from a variety of efficiency initiatives.[36] Our reasonably achievable scenario results in roughly 11,000 GWh by 2015 and 26,000 GWh by 2021. Thus, our assumption is conservative in that it assumes, for this purpose, that New York State does not meet the "15 by 15" target until 2021.

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33 American Council for an Energy Efficient Economy, *2010 State Energy Efficiency Scorecard*, October 2010; Garvey, *Minnesota's Demand Efficiency Program*, 2007; California Public Utility Commission, *Energy Efficiency Verification Reports*, February 2009 and October 2009.

34 Massachusetts Electric Efficiency Program Administrators, *Three-Year Energy Efficiency Plan*, October 2009; Vermont Efficiency Investment Corp, *Vermont Energy Efficiency Utilities Investment Report*, April 2011; Narragansett Electric Company, *Three Year Energy Efficiency Plan: 2012-2014*, forthcoming September 2011.

35 New York State Energy Planning Board 2009, Volume I, pages 12-13.

36 New York Energy Planning Board 2009, Energy Efficiency Analysis, pages 24-25. New York Public Service Commission, Order Establishing Energy Efficiency Portfolio Standard and Approving Programs, CASE 07-M-0548, June 23, 2008.

Figure 2.6 Annual Statewide Efficiency Savings (MW)

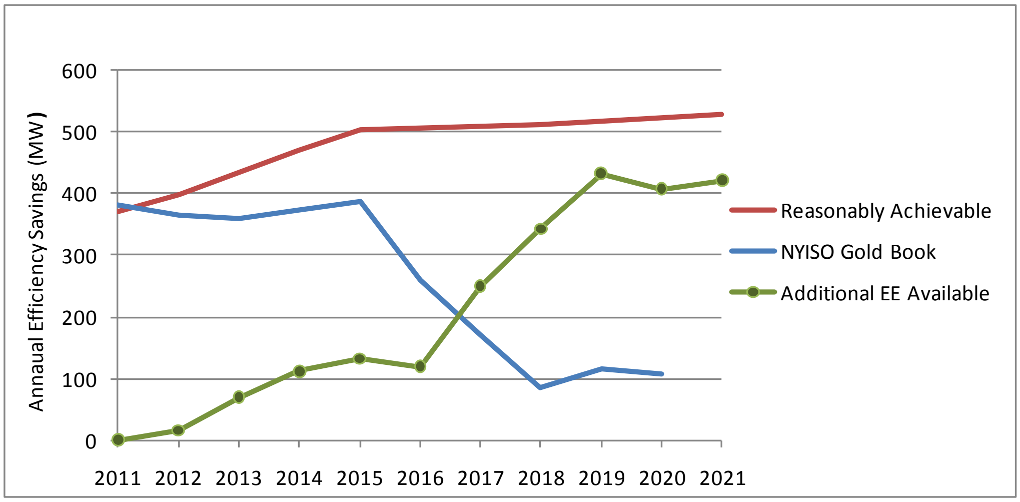
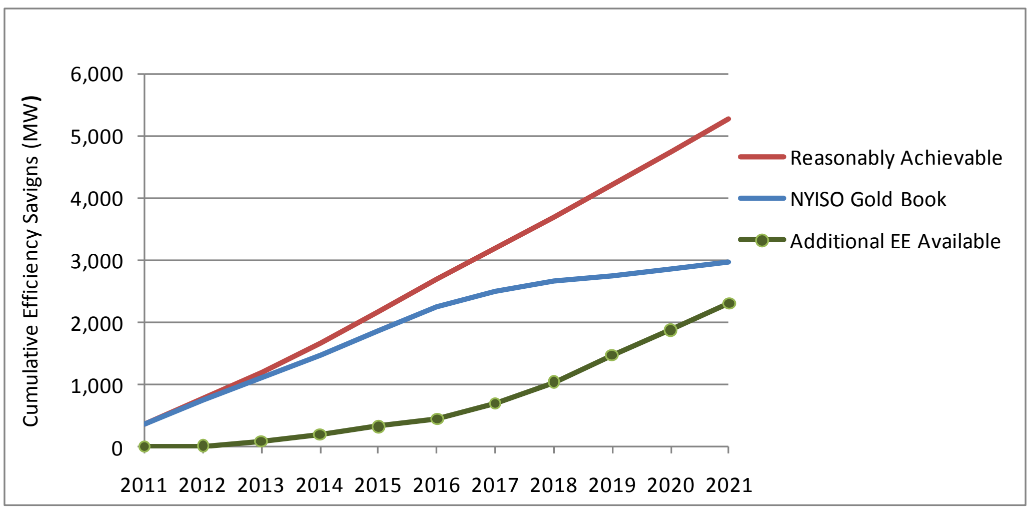


Figure 2.7 Cumulative Statewide Efficiency Savings (MW)



Finally, we assume that the state will be able to reduce its peak demand (in MW) by the same amount (i.e., 1.5 percent) that it reduces electricity sales (in GWh). In practice, there may not be such a one-to-one correspondence between the amount of energy and capacity saved by energy efficiency initiatives. In some cases, the amount of capacity savings may be harder to achieve than the energy savings, depending upon the hours of use of the end-use measures that are replaced. We expect that the state will be able to introduce demand response programs specifically designed to encourage customers to reduce electricity demand during high-cost, peak hours.[37] Such demand response

[37] Demand response programs differ from energy efficiency programs in that customers are provided financial incentives to reduce demand only during peak hours, using either behavioral measures or technological measures. Therefore, demand response programs are more directly targeted to peak savings than energy efficiency programs.

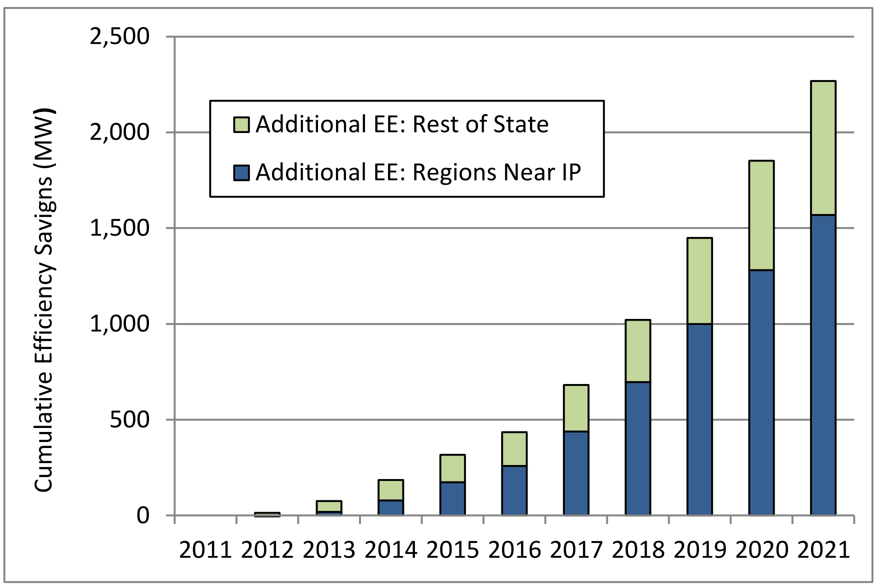
programs are assumed to be included in our reasonably achievable potential scenario, thereby making it easier for the state to achieve the assumed capacity savings.

Figures 2.6 and 2.7 present the annual and cumulative efficiency savings (in MW), comparing the results from the NYISO forecast and our reasonably achievable estimate. As indicated, the additional capacity savings are significant at roughly 500 MW per year, and reaching a cumulative amount of over 2,000 MW by 2020. Note that the biggest difference between our two forecasts occurs in the years after 2015, when we assume that New York maintains a sustained effort to implement cost-effective energy efficiency resources through 2021.

Figure 2.8 shows the cumulative energy efficiency capacity available under our reasonably feasible scenario, broken out by the regions near Indian Point and the rest of the state. Note that the potential in the regions near Indian Point is significantly larger than elsewhere, because of the larger electricity demand there. The extent to which the energy efficiency located in the rest of the state can help replace Indian Point power may depend upon transmission enhancements, as discussed in Section 2.6.

Note that there could be as much as 1,570 MW of capacity from energy efficiency resources in the regions near Indian Point by 2021. As indicated in Figure 2.4 above, the capacity shortfall in 2021 in the absence of Indian Point is expected to be only on the order of 350 MW. Thus, the capacity savings from energy efficiency in the regions near Indian Point alone could clearly meet this anticipated capacity shortfall in 2021 if Indian Point were retired.

Figure 2.8 Cumulative Additional Efficiency Savings (MW); By Location



2.4 Renewable Resources

The current interconnection queue contains 6,291 MW of renewable generation, nearly all of which are new wind resources. The majority of these resources (5,030 MW) are due to come online by 2015. These renewable resources are presented in Table 2.1 below. Note that all of the solar resources are photovoltaics located in regions near Indian Point.

Also, all of the wind resources located in these regions are off-shore wind projects, equal to 1,293 MW in 2017.

Because of their predominance in the queue, we focus our analysis below on the potential for new wind resources. For reliability purposes we are interested in the amount of capacity from each wind project that can be counted on as contributing capacity at the time of peak demand. The NYISO uses estimated capacity factors from wind resources to determine how much capacity will be available from them for reliability purposes.[38] Off-shore wind – the type of wind projects proposed in the regions near Indian Point – is assumed to have a capacity factor of 38 percent, while land-based wind statewide is assumed to have a capacity factor of 10 percent.[39]

Table 2.1 New Renewable Resources in the NYISO Interconnection Queue (Nameplate Capacity in MW)

	Hydro	Methane	Solar	Solid Waste	Wind	Wood	Total (MW)
2011	8	12	32		774		826
2012	3	11		23	1,012		1,049
2013					1,258	47	1,305
2014					249		249
2015					810		810
2016					660		660
2017					601		601
Total (MW)	**11**	**23**	**32**	**23**	**5,365**	**47**	**5,500**

Using the same approach we "de-rate" the wind capacity in the queue. Thus, the 5,365 MW of nameplate wind capacity in the queue is reduced to 1,154 MW of wind capacity that can contribute to reliability. Furthermore, it is unlikely that all of the renewable projects currently in the interconnection queue will be developed. In order to account for this, we make the simplifying general assumption that roughly 50 percent of the renewable capacity in the queue will actually be developed.[40] After applying this assumption the 1,154 MW of de-rated capacity in the queue is reduced to 577 MW of capacity.

Figure 2.9 presents the amount of renewable capacity that could be available to replace Indian Point under these assumptions. It shows that there could be a total of 577 MW available by 2017, which includes 244 MW of offshore wind in waters off New York City and Long Island and 333 MW of renewable resources in the rest of the state. The extent

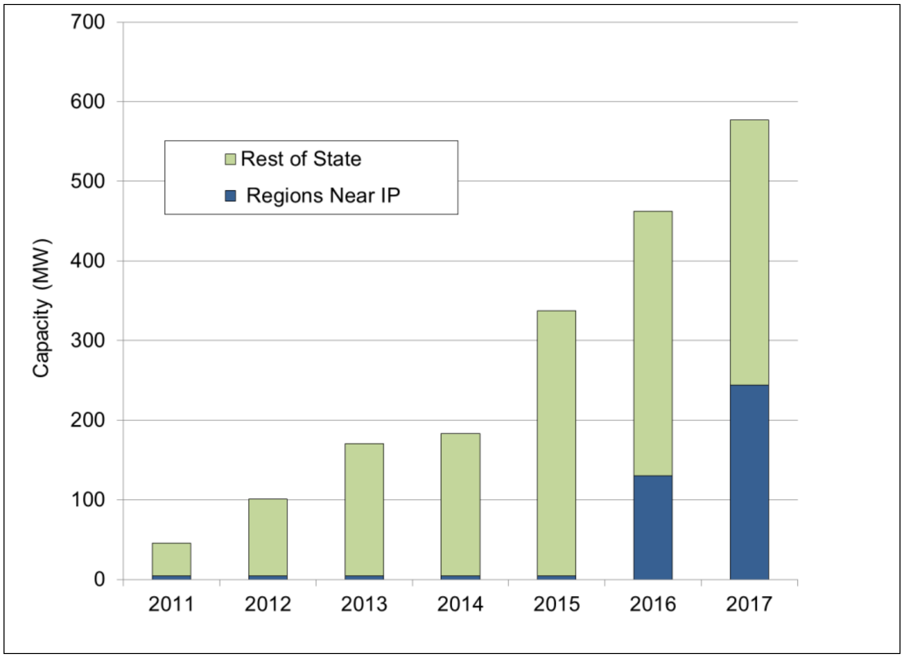
38 All NY generating facilities—both renewable and non-renewable—have an "unforced capacity value" or UCAP for purposes of the capacity markets, which are used for reliability planning. This UCAP value is some percentage of a resource's "nameplate" MW value; for wind and solar this number is based on an initial NYISO designated rating for Year 1 of operation, and on actual historical energy output for every year thereafter. The values are facility specific, but modeling has shown offshore wind in NY to have a UCAP of 38% for both the winter and summer peaks; the UCAP for onshore wind in NY in 10% for the summer peak and 30% for winter peak. *NYISO 2011 Installed Capacity Manual*.

39 New York State Installed Capacity Reliability Council, Installed Capacity Subcommittee, *New York Control Area Installed Capacity Requirements for the Period May 2011 Through April 2012*, Technical Study Report, December 2010, page 58.

40 This is for illustrative purposes only; a more accurate assessment of the development of renewable facilities over the next decade is beyond the scope of this study.

to which the renewable resources in the rest of the state can help replace Indian Point power will depend upon transmission enhancements, as discussed in Section 2.6.

Figure 2.9 Renewable Capacity in the NYISO Queue; Capacity Derated, 50% Developed



New York State currently has a Renewable Portfolio Standard (RPS) requiring that 30 percent of generation come from renewable resources by 2015. Nuclear resources are not eligible for the RPS, so the retirement of Indian Point will not affect New York's ability to meet its RPS goals.[41] Hydropower is eligible so long as it is low-impact run-of-river and has a capacity of 30 MW of less. All of the hydropower currently in the queue would potentially qualify.

The RPS requires NYSERDA to procure 10,398 GWh of renewable energy by 2015. As of December 31, 2010 it had procured 4,007 GWh,[42] leaving a shortfall of 6,391 GWh. If 100 percent of the wind projects currently in the interconnection queue are developed, they could be expected to approximately meet this shortfall of 6,391 GWh. Therefore, our assumption that only 50 percent of the wind projects in the queue is developed is conservative; and if these projects are not developed then presumably other renewable projects will be developed to meet the RPS.

New York's goal of generating 30 percent of sales from renewable resources by 2015 is entirely achievable. In fact, the 2009 New York State Energy Plan found that much more generation from renewable resources is technically achievable. The Plan found that, assuming the state met its '15 by 15' energy efficiency goals, New York could meet as much as 75 percent of its electric generation needs (141,400 GWh) with renewable

[41] Case 03-E-0188; Proceeding on Motion of the Commission Regarding a Retail Portfolio Standard, "Order Regarding Retail Portfolio Standard", issued and effective September 20, 2004.

[42] "New York State Renewable Portfolio Standard Performance Report: Program Period December 31, 2010", May 24, 2011, pg 9

resources by 2018.[43] Moreover, this estimate was conservative as it did not include solar thermal, geothermal, and other renewable resources now eligible for participation in the RPS program, and it did not include the potential for imports of renewable energy from out of state.

We note that our estimates of the amount of renewable resources potentially available to replace Indian Point are conservative in two important ways.

First, we do not include the potential for a significant increase in electricity generated from solar photovoltaic systems (rooftop and utility-scale solar) that could take place if New York State enacts the New York State Solar Industry Development and Jobs Act, which was introduced in the legislature in 2011.[44] The New York solar bill would establish a program to develop approximately 5,000 MW of solar power capacity in the New York State by the year 2025. That's equivalent to 3 percent of the statewide electric load, or enough to power half a million households. Because the regions near Indian Point constitute over 50 percent of the statewide electricity load, the New York solar bill could lead to roughly 2,500 MW of solar energy deployed in that area by 2025.

Second, there is potential for development of significantly greater offshore wind resources in federal waters off New York State than is currently indicated by the offshore wind projects in the NYISO queue to date. Offshore wind offers the very important advantage of being located relatively close to the highest electricity loads in New York City and Long-Island. It also offers an advantage over land-based wind because it generally provides greater generation over the year and higher capacity availability during the summer peaking period.

On September 15, 2011, the New York Power Authority, on behalf of the Long Island–New York City Offshore Wind Collaborative (which consists of Con Edison, the Long Island Power Authority and the New York Power Authority) filed a preliminary lease application with the federal government for offshore wind development rights on a proposed site 13 to 17 miles off the coast of the Rockaway Peninsula and Long Island. The Collaborative sees the potential for an offshore wind project of up to 350 MW, potentially growing to 700 MW.[45] At least two major offshore wind developers, NRG Bluewater Wind and Deepwater Wind, have expressed interest in submitting bids to build this project and also developing other significant offshore wind projects on the Atlantic Coast. According to the National Renewable Energy Laboratory, New York's combined Atlantic and Great Lakes offshore wind resource could provide as much as 147 GW of capacity.

If Indian Point is retired, it would likely increase the opportunities for developers of new generation in the region to participate in the wholesale capacity market. Our analysis of the resources currently available in the NYISO queue is conservative in that it does not reflect the extent to which the queue may expand in response to Indian Point retirement. This point holds true for the likely development of renewable resources, natural gas facilities and transmission projects.

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43 "2009 State Energy Plan: Volume 1", State Energy Planning Board, December 2009, pg 40-41.

44 http://assembly.state.ny.us/leg/?default_fld=&bn=A05713&Summary=Y&Text=Y

45 http://www.nypa.gov/Press/2011/110915a.html.

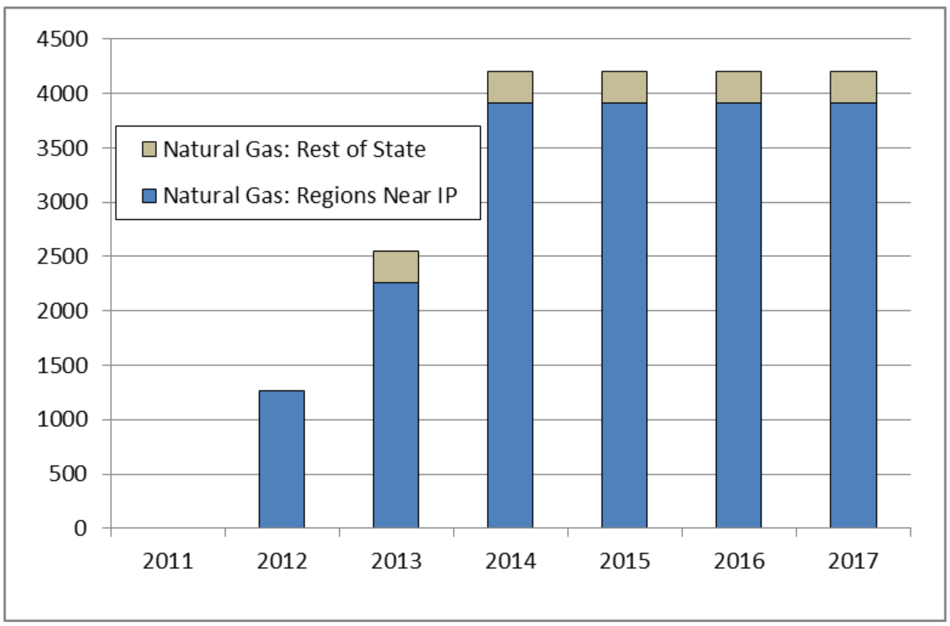
In sum, we find that there is a significant amount of renewable resources, particularly wind, available in New York that can play a role replacing the capacity and energy from Indian Point. Off-shore wind and rooftop solar resources can most directly provide power into the regions near Indian Point, while the rest of the state offers a significant amount of land-based wind.

2.5 Repowered and New Efficient Natural Gas Facilities

There currently are 4,208 MW of natural gas facilities in the interconnection queue, nearly all of which are located in the regions near Indian Point.[46] In fact, only 300 MW of natural gas capacity in the queue is not planned for these regions – the Russell Station facility, located in Western NY. One of the projects in the regions near Indian Point – Bayonne Energy Center (500 MW) – will actually be located in New Jersey. However, the Bayonne plant will be directly tied to New York City and will count towards the city's locational capacity requirement, and so we do include it in our analysis.

Figure 2.10 presents the amount of natural gas capacity that is currently in the interconnection queue, by the regions near Indian Point and the rest of the state. As with the renewable resources, it is not likely that all of these natural gas projects will be completed. Nonetheless, the large quantity of gas projects currently in the queue indicates that gas projects could easily replace the capacity and energy of Indian Point. Even if only half of these proposed gas plants are eventually completed, they would nearly equal the total capacity of the Indian Point facility.

Figure 2.10 Overview of Natural Gas in NYISO Queue



[46] We have excluded TransGas Energy's 1,100 MW combined cycle plant in Brooklyn, NY from our list, because the New York State Siting Board denied TransGas' siting application in 2008. Case 01-F-1276, *Application of TransGas Energy Systems LLC for a Certificate of Environmental Compatibility and Public Need to Construct and Operate a 1,100 Megawatt Combined Cycle Cogeneration Facility in the Borough of Brooklyn, New York*, Order on Rehearing, July 15, 2008.

Repowering existing gas-fired generation plants is another option with important environmental benefits for replacing Indian Point energy. Repowering existing gas plants involves replacing or rebuilding the existing plant with a new, more efficient combined cycle gas-fired plant, which can produce more electricity while using gas more efficiently and producing less air and water pollution.

For example, in 2003 New York State approved the Astoria Repowering Project, the repowering of a natural gas plant in Astoria, Queens that would replace an existing 1,253 MW generating facility with a 1,816 MW gas-fired combined cycle generating facility with oil back-up.[47] However, the project is not in the NYISO interconnection queue and has not been built yet due to lack of long-term financing. Other plans to repower plants in NYC have been withdrawn from the interconnection queue in recent years; including a 130 MW uprate to a 1,000 MW natural gas plant (technically located in Linden, NJ, though considered local capacity in NYC for the purposes of reliability) and a 100 MW uprate to the 640 MW Astoria East Energy natural gas plant in Astoria, Queens.

It is likely that these repowering plans would be reevaluated if it becomes clear that the Indian Point facility will not be relicensed, as the wholesale market prices increase and these repowering projects become more economic. Also, policies could be adopted to facilitate the financing of these repowering projects, especially if Indian Point is not relicensed.

Of the more than 11,500 MW of capacity located in New York City, more than 9,000 MW were built before 2001. It is likely that many of these have the potential for capacity increases through repowering. Increasing the capacity of each of these plants by 10 percent would offset half of Indian Point's entire capacity.

Table 2.2 Natural Gas Facilities in the Interconnection Queue

Project Name	Fuel Type	Capacity (MW)	In-Service Date	Location	Status
Bayonne Energy Center	Dual Fuel (CT)	500	2012	New Jersey	12
CPV Valley Energy Center	Natural Gas (CC)	656	2012	Westchester County	9
South Pier Improvement	Natural Gas (CT)	105	2012	Brooklyn, NY	9
Berrians GT III	Natural Gas (CC)	744	2013	Queens, NY	9
Russell Station	Natural Gas (CC)	300	2013	Rochester, NY	6
Spagnoli Road CC Unit	Natural Gas (CC)	250	2013	Long Island	8
AP Dutchess (Cricket Valley)	Natural Gas (CC)	1,002	2014	Dutchess County	9
Berrians GT	Natural Gas (CC)	200	2014	Queens, NY	9
Berrians GT II	Natural Gas (CC)	50	2014	Queens, NY	9
Luyster Creek Energy	Natural Gas (CC)	401	2014	Queens, NY	2

The majority of new natural gas projects in the interconnection queue are located in New York City and Long Island. Most of these new projects, moreover, are far along in their development process. In Table 2.2 we show all natural gas projects currently in the queue. The project status may range from 1 to 14; the higher the status, the further along the project is.

47 See http://www.dps.state.ny.us/reliant_energy.html. The project developer is now NRG.

In sum, there is a large potential for natural gas facilities to replace the energy and capacity of Indian Point. Natural gas generation may play an important role in maintaining reliability requirements and grid operating standards if there is a need for baseload or dispatchable generation in the area near Indian Point.

New York State recently enacted the "Power NY Act of 2011",[48] which, among other things, reinstates and updates New York's Article X power plant siting law. Article X centralizes and simplifies the power plant siting process. This should make it easier to develop generation projects throughout the state; as long as a proposed project meets certain regulatory requirements; including illustrating the ability to meet a soon-to-be-promulgated CO2 performance standard that was part of the Article X legislation. The process will provide an expedited and more certain timeframe for developers to receive approvals (or denials) of an application to build. Under this bill, the New York State Board on Electric Generation Siting and the Environment is granted the ability to override local ordinances if found to be "unduly burdensome", which should make it easier to develop projects in relatively dense regions of the state, like Westchester and New York City. In addition, the threshold for project size has been lowered from the prior limit of 80 MW to 25 MW, which should make it easier to develop wind and solar projects.

Reactive Power Requirements[49]

A sufficient amount of reactive power is essential for smooth operation of the electricity transmission grid, as it helps to keep the voltage to desired levels. Reactive power cannot be transmitted over great distances, and therefore it must be provided locally. Some concerns have been raised that retirement of Indian Point would result in insufficient levels of reactive power, suggesting that either Indian Point needs to continue operation or that it needs to be replaced with a similar generation facility in the same general location.

It appears that these concerns are unfounded. While a thorough review of reactive power needs in the region of Indian Point is beyond the scope of this study, we are able to reach some general conclusions about the options available if additional reactive power is needed.

If Indian Point retirement were to create a need for additional sources of reactive power, there are two options available. First, a new natural gas generator located near Indian Point could provide some of the increased need for reactive power. As described above, there is currently over 4,000 MW of new gas-fired capacity in the regions near Indian Point; some of this may be located in the area that requires additional reactive power support.

Second, in the absence of local generation, reactive power needs can be met through the installation of capacitors. This provides transmission operators with significant flexibility in how they address reactive power needs, because capacitors can be installed at or near the area that requires reactive power support. The National Academy of Sciences study estimates that the cost of supplying the reactive power that Indian Point is capable

[48] State Assembly Bill AO8510/State Senate Bill S5844, signed into law on August 4, 2011. For full text see http://assembly.state.ny.us/leg/?default_fld=&bn=A08510&term=2011&Summary=Y&Memo=Y

[49] For an excellent description of reactive power and its role in the electricity grid, see National Academy of Sciences, *Alternatives to the Indian Point Energy Center for Meeting New York Electric Power Needs*, 2006, page 43. Much of this discussion is taken from there.

of supplying would cost on the order to $30 to $45 million.[50] While this is not an insignificant amount of money, it is small relative to the other costs of replacing Indian Point.

In sum, ensuring sufficient reactive power is an important consideration, and must be addressed if and when Indian Point is retired. But the need for reactive power does not pose a constraint on whether or when to retire Indian Point, nor is it likely to have large cost implications if Indian Point is retired.

2.6 Transmission Expansion

There are currently 8,210 MW of transmission projects in New York's interconnection queue. This includes only new projects, and not upgrades or reinforcements to existing transmission lines. Of these projects, 5,010 MW terminate in New York City, and 2,000 MW (West Point Transmission and NY Power Pathway) will terminate in the region where Indian Point is located. Table 2.3 provides a summary of the transmission projects currently in the interconnection queue.

It is difficult to predict the likelihood that any one of these projects will be approved and come online as the transmission development process is lengthy and complex, especially for high capacity lines that extend across long stretches of land. The 660 MW Hudson Transmission project, which connects generation in New Jersey to New York City, is the furthest along in the development process and is almost certain to come online on schedule. The 1,000 MW Transmission Developers NYC line, also known as the Champlain Hudson Power Express, is proposed to run down the Hudson River and would connect Quebec to New York City. It has made fast progress, though recent regulatory delays may push the target in-service date off by a year.[51] It will bring a significant amount of renewable generation directly to New York City, and would offset half of Indian Point's lost capacity, so if Indian Point were to retire it is likely that this project would see increased attention.

Table 2.3 Transmission Projects in the NYISO Interconnection Queue

Project Name	Summer Capacity (MW)	Target In-Service Year	Regions Affected
Cross Hudson II	800	2013	New York City
Hudson Transmission	660	2013	New York City
Clay HVDC	2,000	2014	Western NY, New York City
Champlain Wind Link II	600	2014	Western NY State
Champlain Wind Link I	600	2014	Western NY State
New York Wire-Phase 1	550	2014	New York City
West Point Transmission	1,000	2015	Eastern NY State
Transmission Developers NYC	1,000	2015	New York City
NY Power Pathway	1,000	2016	Eastern NY State
Total	8,210		

50 National Academy of Sciences, *Alternatives to the Indian Point Energy Center for Meeting New York Electric Power Needs*, 2006, page 65.

51 John Jordan, "Power cable project delayed", Westfair Online, May 6, 2011, http://westfaironline.com/2011/12959-power-cable-project-delayed/

The two projects in eastern New York State, West Point Transmission and NY Power Pathway, are both relatively new, and neither have progressed very far in the development process. Nevertheless, if Indian Point were to retire these projects could get a significant boost. Together they add enough capacity to completely offset the loss of Indian Point, and they bring that capacity to a highly constrained area.

Currently there is not enough transmission capacity to bring much additional generation in from northern and western New York State. These regions, however, are where the hydro and wind potential are greatest. The transmission constraint that has the most significant impact on the ability to deliver energy to the regions near Indian Point is located just north of Indian Point. Two projects in the interconnection queue (NRG Energy's 1,000 MW NY Power Pathway, and Anabaric Northeast's 1,000 MW West Point Transmission) would directly address this transmission constraint. Both are due to come online by 2016, though neither have gotten very far in their development process. If these or similar projects are developed, then the potential supply of energy efficiency and renewable resources available to replace Indian Point would expand to include all existing and planned wind generation in update New York.

2.7 Potential Retirements

In its 2010 Reliability Needs Assessment, NYISO examined the potential for retirements due to various upcoming environmental initiatives. It is worth emphasizing up front that NYISO's analysis looks only at the cost of complying with new initiatives, and not whether generation owners earn enough in the energy and capacity markets to support the necessary retrofits while remaining profitable. The fact that a particular generator is, as NYISO defines it, at risk for retirement, does not mean that retirement is always the most economically rational choice. Moreover, NYISO—in conjunction with the Public Service Commission—will only allow a generator to retire if a determination is made that doing so would not have a negative impact on reliability.

NYISO analyzes four environmental programs: Reasonable Available Control Technology for Oxides of Nitrogen (NO_X RACT); Best Available Retrofit Technology (BART); Maximum Achievable Control Technology (MACT); and Best Technology Available (BTA). Each program has different, though at times overlapping, requirements. As a result, a particular unit may face the need for environmental upgrades under one set of rules and not face the need under another.

NYISO goes on to define three category levels to qualify the degree of impact of each program on a given generator. Category 1 plants are those that already comply with the environmental program. Category 2 plants are those that need upgrades to comply with the environmental program, but whose cost to upgrade are in line with other capital expenses necessary to stay online regardless. Category 3 plants are those that need upgrades and whose upgrade costs are above what they would otherwise have to spend to stay online. NYISO considers Category 2 and 3 plants to be at risk for retirement.

Table 2.4 NYISO Estimate of Capacity at Risk for Retirement (MW)

Environmental Program	Location	Category 2	Category 3
NOX RACT	Rest of State	2,672	419
	Regions near IP	1,224	948
MACT	Rest of State	1,921	840
	Regions near IP	2,321	6,009
BART	Rest of State	1,686	92
	Regions near IP	2,873	233
BTA	Rest of State	1,211	2,992
	Regions near IP	4,032	4,384

In Table 2.4 we show NYISO's estimate for capacity at risk for retirement under each of the four environmental programs. These estimates do not necessarily indicate the amount of capacity that will be retired. The Category 2 plants are those that need upgrades that are comparable in cost to typical on-going capital additions required for power plants. These upgrades might have little effect in promoting plant retirement, depending upon the economics of each plant. Category 3 plants will experience costs above those typically required by power plants, but this also does not mean that a plant will retire. NYISO did not factor the market revenues available to these power plants, which will play a big role in evaluating retirement options.

It is worth emphasizing again that an individual plant may face the need for upgrades under more than one of these programs, and so these figures are not cumulative. NYISO estimates that 2,152 MW of capacity (statewide) would need to install upgrades under all four of these programs; a larger subset of plants would need upgrades under two or three of these programs.

Note that the CRA Study includes assumptions about future coal plant retirements, based on their modeling of the introduction of the HAPS rules in 2015. That study estimates that only 462 MW of coal-fired capacity will be retired, all of which is located in the rest of the state.[52]

2.8 A Note About Recent Estimates of Alternatives to Indian Point

There have been several studies in recent years to assess the potential alternatives to Indian Point.[53] Our finding here is generally consistent with the findings of those studies. In addition, we note that there have been several developments since those studies were conducted that have served to increase the opportunities to replace Indian Point with alternative capacity options. In particular:

- New York State has placed increasingly greater emphasis on implementing cost-effective energy efficiency resources, with the "15 by 15" electric efficiency goal and the establishment of the EEPS.

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52 CRA Study, pages 54-56.

53 In particular, the National Academy of Sciences, *Alternatives to the Indian Point Energy Center for Meeting New York Electric Power Needs*, 2006; Synapse Energy Economics, *Report on the Availability of Replacement Capacity and Energy for Indian Point Units 2 &3*, November, 2007; and Synapse Energy Economics, *The Impact of Retiring Indian Point on Electric System Reliability*, May 2002.

- New York State has placed greater emphasis on implementing renewable resources, with increasingly stringent requirements for its RPS.
- Electricity demand has grown at significantly lower rates than expected in previous years, due primarily to the economic downturn beginning in 2008.
- Gas prices have been lower than expected in recent years, increasing the opportunities to repower existing fossil-fired units or build new gas-fired units.

All of these developments serve to increase the likelihood that there will be sufficient capacity available to replace Indian Point.

3. Cost Implications of Indian Point Retirement

3.1 Introduction

The previous sections clearly demonstrate two important points. First, if Indian Point is retired, there is likely to be no need for new capacity to meet reserve margin requirements until 2020 at the earliest. Second, there are a large amount of energy efficiency and renewable resources available to replace Indian Point, and to the extent they are not fully utilized to replace Indian Point then natural gas and transmission expansion projects could make up any difference.

Drawing conclusions about the costs of replacing Indian Point will be much more challenging. There are many factors that can affect these costs, and there is a great deal of uncertainty about these factors, especially in the mid- to long-term future. In this section we make some general points about the likely direction and magnitude of some of the costs of replacing Indian Point, in order to illustrate the range of potential impacts from different policy decisions.

The CRA Study estimates the likely costs of replacing Indian Point under several replacement scenarios, including: (a) one 500 MW gas combined cycle (CC) facility in Lower Hudson Valley; (b) one 500 MW gas CC in Lower Hudson Valley and one 500 MW gas CC in New York City; and (c) a 1,000 MW DC transmission line from Quebec to New York City combined with a 400 MW offshore wind project (the Low Carbon scenario). The study finds that the increased costs of Indian Point replacement could range from roughly $11.5 billion to $14.3 billion, in present value dollars over a 15-year planning period.[54] These increased costs are based on increases in the wholesale electricity and capacity markets in New York, combined with the “contractual support” costs needed to implement those resources that would not be economic if they relied upon revenues from the wholesale markets alone.

Our analysis indicates that the CRA Study may overstate the likely economic impact of Indian Point replacement options; primarily due to the scenarios that they have chosen to model. Their scenarios do not include any energy efficiency, which is the lowest-cost replacement resource available and can help reduce customer bills. The CRA Study scenarios also do not include renewable resources, except for relatively expensive off-shore wind in the Low Carbon scenario, despite the fact that land-based wind and solar in New York can help in providing carbon-free replacement power for Indian Point.

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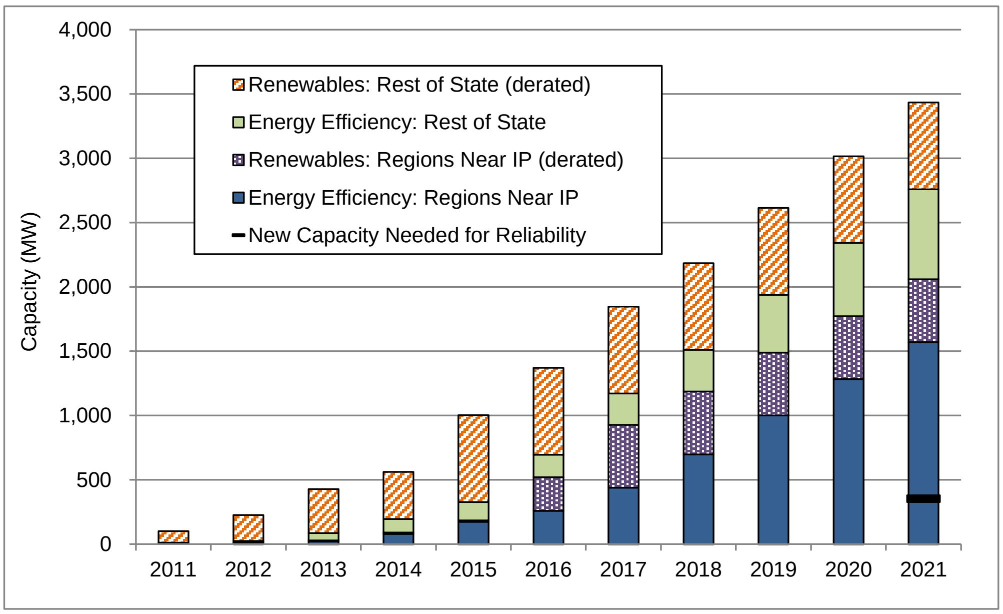
[54] CRA Study, pages 25-26.

3.2 Indian Point Replacement Scenarios

The eventual cost of replacing Indian Point will depend upon choices made by policymakers about whether and how to promote new resources if and when Indian Point retires. At one end of the spectrum, policymakers could decide to let the existing market forces combined with NYISO reliability requirements decide which new electricity resources are developed in order to ensure reliability by 2020 and beyond. At the other end of the spectrum, policymakers could proactively attempt to encourage the development of Indian Point replacement power, in order to meet specific public policy goals such as minimizing cost or minimizing CO2 emissions. In order to evaluate the potential increase in costs from Indian Point retirement, we develop several scenarios below that fall along different points in this spectrum.

Figure 3.1 summarizes our analyses of energy efficiency and renewable resource options from Sections 2.3 and 2.4 above. In 2021 the need for new capacity to meet reliability requirements is expected to be less than 500 MW. Meanwhile, by 2021 there is the potential for sufficient energy efficiency and renewable resources in the regions near Indian Point to replace all of the 2,000 MW of Indian Point. Additional energy efficiency and renewable resources are available in the rest of the state, especially if new transmission is built to relieve existing transmission congestion.

Figure 3.1 New Efficiency and Renewable Resources Available to Replace Indian Point



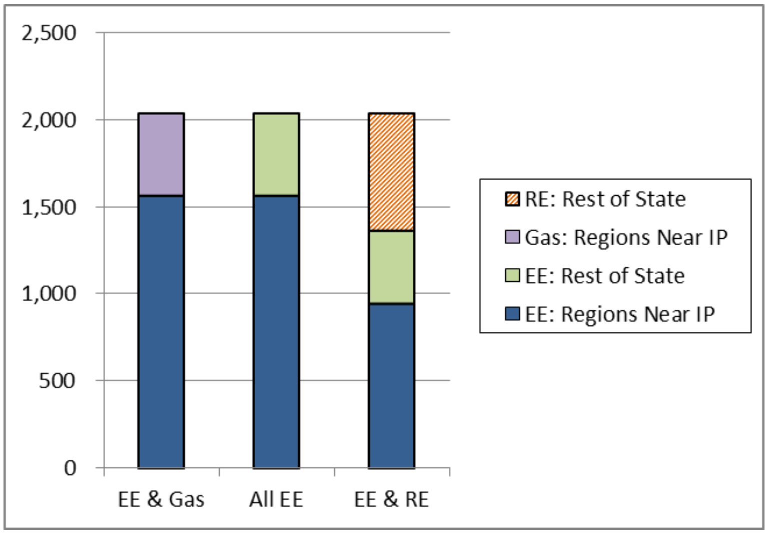
We construct three scenarios to illustrate potential replacement options. The mix of resources for each scenario is illustrated in Figure 3.2.

Energy Efficiency and Gas. This would include a 470 MW gas CC combined with roughly 1,570 MW of energy efficiency, both located in regions near Indian Point. The gas facility could be located at or close to the Indian Point site, and would be able to provide generation, voltage support and grid support directly in the vicinity of current Indian Point generation. The energy efficiency would also be located in the region where Indian Point is currently located. This selection of resources would minimize concerns about local reliability constraints in New York City and Long Island. It would also be feasible without new transmission capacity.

All Energy Efficiency. This would include roughly 1,570 MW of efficiency in the regions near Indian Point, combined with roughly 470 MW of efficiency in the rest of the state. This scenario would be the lowest cost approach to replacing Indian Point power (see next section), would not result in any increase in CO2 emissions, and could be achieved through a set of policy directives focused solely on increased energy efficiency efforts. In order for the energy efficiency located in the rest of the state to be fully utilized in replacing Indian Point, this scenario may require new transmission capacity.

Energy Efficiency and Renewables. This would include roughly 674 MW of wind in the rest of the state, combined with energy efficiency developed proportionately in the regions near Indian Point (942 MW) and the rest of the state (420 MW). While there are likely to be wind resources available in the regions near Indian Point, particularly off-shore wind, we do not include them here in order to present a relatively conservative scenario. This scenario would lead to a more balanced mix of resources than the all efficiency scenario, would be consistent with the state's goals of implementing energy efficiency and renewable resources, and would not result in any increase in CO2 emissions. In order for the wind in the rest of the state to be fully utilized in replacing Indian Point, this scenario may require new transmission capacity.

Figure 3.2 Three Scenarios for Replacing Indian Point Power



3.4 Potential Cost Impacts of Replacing Indian Point

Estimating specific costs of Indian Point replacement power is very challenging due to the various factors that will affect these costs, the complex interactions of new resources in the electricity markets, and the uncertainty inherent in electricity forecasts.[55] Here, we

55 For a very helpful overview of the challenges of estimating Indian Point replacement power costs, see National Academy of Sciences, *Alternatives to the Indian Point Energy Center for Meeting New York Electric Power Needs*, 2006, pages 45 and 46.

describe how different replacement scenarios might affect the replacement power costs, particularly in relation to the cost estimates provided in the CRA study.

There will be three primary types of costs associated with Indian Point replacement power: impacts on the wholesale energy prices; impacts on the wholesale capacity prices; and costs associated with public policies necessary to encourage resources that would not be implemented through market forces alone. We will address each of these below. While there are likely to be other costs involved with replacing Indian Point – such as costs associated with ancillary services markets and costs associated with voltage support – we expect these to be significantly lower than the other three.

Wholesale energy market. Given that Indian Point produces a large amount of baseload, infra-marginal energy in many hours of the year, removing this resource from the New York generator supply curve will likely cause the energy prices to increase in many hours. The extent to which wholesale energy prices rise will depend upon the type of resources that replace Indian Point. In theory, if Indian Point is replaced with an identical generator that operates in the same hours with infra-marginal costs, then there would be little or no change in the energy prices.[56] If, on the other hand, it were replaced with a peaking facility that operated few hours and occasionally set the market price, then there would be a significant increase in the wholesale energy prices for many hours of the year. Any increase in the wholesale energy market price for any one node would lead to increased energy costs throughout that zone, as all customers within the zone pay the same marginal price. We would expect the retirement and replacement of Indian Point to affect the prices in the energy zones in the regions near Indian Point more so than in the regions north of Indian Point, and to have little impact on the western energy zones. However, the actual impact in the different zones will depend upon many complex factors – such as the timing and location of new generation, the timing and location of new transmission facilities, transmission constraints, transmission hedging practice, the amount and location of energy efficiency resources, and the retirement of existing resources – each of which can change over time.

Wholesale capacity market. A similar dynamic occurs in the wholesale capacity market. The retirement of Indian Point would increase the Installed Capacity Requirement that is used to determine the demand for new capacity and thus the price paid for new capacity. New York State is currently divided into three capacity market zones: Long Island, New York City and the rest of the state (ROS). Indian Point is located in the ROS zone. The effects of Indian Point retirement on wholesale capacity prices would be felt throughout New York State, but the effects in New York City would be somewhat tempered because of the surplus of supply in that region.[57]

Public policy mechanisms and additional financial support. 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.[58] This is currently achieved through a variety of public policy mechanisms, including the system benefits charge for energy

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56 Note that the CRA Study includes a scenario – the "One-for-One" scenario – that demonstrates this point. CRA Study, pages 84-88.

57 CRA Study, page 21.

58 The CRA study refers to such additional financial support as "contractual support costs."

efficiency, the RPS for renewable resources, and long-term contracts for renewable generation projects. As discussed below, some of the new resources to replace Indian Point might require public policy support, and may result in increased costs for electricity customers. New transmission capacity, to the extent that it is not developed by market signals alone, may require increased charges on the transmission portion of retail customer electric bills.

The impacts of Indian Point retirement on these three types of costs would depend significantly on the timing and type of replacement resources. As noted above, a one-for-one replacement of Indian Point generation with baseload gas generation would have little impact on the energy and capacity market prices. However, this scenario might result in constructing more capacity than is needed and more capacity than what can be supported by market prices alone, and therefore would require additional financial support in order to be achieved. A more likely scenario for gas generation development would be for a portion of Indian Point generation and capacity to be replaced by gas generation, leading to increased costs for wholesale energy and capacity.

Energy efficiency would have different cost implications as an alternative to Indian Point. New efficiency resources influence wholesale energy and capacity prices in the same way that new generation does, except that the efficiency savings will likely occur at different hours and thus have a different impact on prices than a generator. Energy efficiency savings that occur during peak hours will typically reduce both energy and capacity prices by a greater amount than those that occur during off-peak hours. More importantly, energy efficiency typically has a benefit-cost ratio of 2.0 or 3.0, meaning every dollar spent on efficiency will reduce costs by two to three dollars. Therefore, the public policy costs associated with energy efficiency are actually savings. This makes energy efficiency the lowest-cost option to replace Indian Point.

Renewable resources also would have different cost implications as an alternative to Indian Point. Their impacts on the energy market would depend upon the timing of their generation. Their impacts on the capacity market will depend upon how much of their nameplate capacity will be operating during peak hours. Since renewable resources typically cost more than gas facilities to construct, they would likely require additional financial support beyond that provided from the New York wholesale markets. On the other hand, if the renewable resources are to be developed anyway for reasons other than replacing Indian Point, e.g., in the RPS, then there may be little additional financial support required for the new renewable resources to replace Indian Point.

Off-shore wind and solar resources may have a bigger impact on reducing energy prices, relative to land-based wind, because they tend to have a higher capacity factor during peak hours. However, off-shore wind and solar resources are typically more costly to build than land-based wind, and may require additional financial support. Furthermore, new renewable resources will provide long-term economic benefits to electricity customers in terms of fuel diversity, price stability, and mitigating the cost of compliance with future environmental regulations.

As noted above, the CRA study finds that the increased costs of Indian Point replacement could range from roughly $11.5 billion to $14.3 billion, in present value dollars over a 15-year planning period. This range of costs was based on two scenarios that included natural gas CCs, and one low carbon scenario that included off-shore wind and a large DC transmission line. A summary of the CRA Study economic findings is presented in Table 3.1.

Table 3.1 CRA Estimates of Economic Impact of Indian Point Retirement ($ million PV)[59]

	500 MW CC in LVH and 500 MW CC in NY City	500 MW CC in Lower Hudson Valley	400 MW of Off-Shore and 1000 MW DC transmission
Energy and Capacity Market Costs	10,822	12,179	12,262
Contractual Support Costs	691	0	2,109
Total Costs	11,513	12,179	14,371

The CRA study also includes a One-for-One scenario, which the authors do not include in their range of likely costs presented in the Executive Summary. The study finds that the change in energy prices from this scenario would be minimal, because the new resources are so much like Indian Point, by design.[60] The study estimates that the additional financial support, or "contractual support" costs, for this scenario would be on the order to $1.4 billion present value dollars. These findings combined suggest that this scenario would likely cost on the order of two to three billion dollars in total, significantly less than the other three scenarios presented in the Executive Summary of the CRA report. We make this point to emphasize (a) the difficulty in estimating the cost implications of Indian Point replacement, and (b) the sensitivity of the cost estimates to the choice of replacement options.

An exhaustive review of the CRA Study cost estimates is beyond the scope of this study. However, we can draw several conclusions about how the cost of our alternative scenarios might compare to the cost estimates in the CRA study.

Any scenario that includes energy efficiency as a replacement option will result in lower replacement costs, for two reasons. First, all else being equal, energy efficiency will reduce the prices for both wholesale energy and capacity. Our Energy Efficiency and Gas scenario is comparable to the CRA scenario with 500 MW of gas CC in the Lower Hudson Valley, except that our scenario includes 1,500 MW of energy efficiency. This will result in significantly lower energy and capacity costs than the $12.2 billion estimate of the CRA Study. Second, energy efficiency will result in a net reduction in public policy costs, which will further reduce the cost of Indian Point replacement. We estimate that the amount of energy efficiency in our replacement scenarios could result in public policy benefits ranging from $0.7 to $1.0 billion, in present value terms.[61]

The cost implications of using renewable resources to replace Indian Point are more difficult to predict. Off-shore wind will likely require higher financial support – e.g., in the form of long-term contracts – than land-based wind, due to its higher costs. Wind located in the rest of the state might require transmission support to directly replace the generation from Indian Point. On the other hand, renewable resources are expected to be developed anyway in New York State in order to comply with the RPS, and thus may require little additional financial support costs in the event of Indian Point retirement.

From this discussion, we can draw the following general conclusions:

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59 CRA Study, pages 25-26.

60 CRA Study, page 87.

61 This is based on assuming a levelized cost of saved energy of roughly six cents/kWh, an average benefit cost ratio of 2.5, and a 65 percent capacity factor for the efficiency savings.

- The CRA Study estimates of the economic impact of Indian Point retirement are likely to represent the high end of the range of actual cost impacts.
- Any scenario that includes energy efficiency to replace Indian Point will result in significantly lower costs than those presented in the CRA Study.
- Renewable resources that are constructed to comply with the state's RPS can play a role in replacing Indian Point power, with little or no additional financial support costs.
- It is possible to develop a low carbon replacement scenario with significantly lower costs than those presented in the Low Carbon scenario in the CRA study, by including much more energy efficiency along with lower-cost land-based wind.
- Given the current surplus of supply, both for the state as a whole and for the local New York City and Long Island regions, along with the expected development of new renewable resources to meet the state's RPS targets, it appears to be feasible to replace all of the Indian Point power with new energy efficiency resources combined with renewable resources developed for the RPS. This approach is likely to cost significantly less than any of the scenarios presented in the CRA Study, and will result in no additional CO2 emissions.

3.4 Potential Impacts on Retail Electric Bills

The CRA study also presents the estimates of replacement power costs in percentage terms. The scenario with one gas CC is expected to increase annual wholesale electric costs by roughly ten percent in the early years, declining to seven percent in the later years; the scenario with two gas turbines is expected to increase annual wholesale electricity prices by nine percent in the early years and four percent in the later years; and the Low Carbon scenario is estimated to increase annual wholesale electricity prices by eleven percent in the early years and four percent in the later years.[62]

The percentage impact on customer bills will be significantly less than those percentage impacts presented in the CRA Study. First, as the CRA Study notes, *retail* electric bills include several costs beyond those associated with *wholesale* commodity costs, and thus the percentage increase will be less than those for the wholesale cost increases. Second, as described in the previous section, the CRA study overstates the likely increase in wholesale costs associated with Indian Point replacement power.

We estimate that the percentage impact on a customer's *retail* electric bill would be roughly half of the percentage impact on *wholesale* electricity prices. This is based on a review of recent residential bills for residential customers of Con Edison and CHG&E that indicate that the commodity portion of the bill represents roughly half of the total bill. (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.)

Therefore, the *wholesale* price impacts estimated in the CRA Study of roughly ten percent in the early years to four percent in later years would translate into *retail* bill impacts of roughly five percent in the early years to two percent in the later years. The

62 CRA Study, page 24. These numbers do not include the costs associated with contractual support, because those costs were not allocated on an annual basis.

lower cost scenarios outlined in our report would have a much lower impact on retail bills, possibly on the order of three percent in the early years and only one percent in the later years.

A typical Con Edison residential customer using 300 kWh per month pays a monthly bill of roughly $81.00. For such a typical customer, a one to three percent increase in electric bills would translate into roughly $0.81 to $2.43 extra per month. For those customers that participate in energy efficiency programs, this increase in electric bills would be more than offset by reductions in bills due to energy efficiency savings. Under the higher, and less realistic, estimates provided by CRA, a two to five percent increase in electric bills would translate into roughly $1.62 to $4.05 extra per month.

Finally, customers that are currently served through contracts, including standard offer customers, would see a delay before any wholesale market price changes affect their bills. This delay would persist as long as the contract remains in effect. After that, one would expect any new contract prices to reflect recent and anticipated changes in the wholesale market prices.

4. Conclusion

We find that there are likely to be ample existing and new resources available to replace Indian Point if it were to retire; and that neither New York City's nor New York State's electricity reliability would be jeopardized. A replacement scenario focusing on cost-effective demand-side resources, local renewable resources, repowering of existing older inefficient power plants and new efficient generation as necessary would maintain reliability at a low cost to electricity customers.

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