



Replacing Indian Point

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July, 2019

ABOUT THE AUTHOR

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Mr. Specter has been Chairman of two national committees on emergency planning and was a guest lecturer for several years on emergency planning at Harvard's School of Public Health. He led an effort as a consultant to Entergy analyzing emergency responses during a hypothetical terrorist attack on Indian Point. Mr. Specter has presented testimony at the National Academy of Sciences on the Fukushima accident and on other nuclear safety matters and has been a guest speaker at many universities on matters of energy policy. Today he is one of 14 Topic Directors in Our Energy Policy Foundation, a group of about 1500 energy professionals who seek to bring unbiased and comprehensive energy information to our political leaders and members of the public.

Mr. Specter has been active on social and environmental matters. He has been a Big Brother and in 1971 had the honor of being selected as "Big Brother of the Year" for all of the USA and Canada. He also received a personal letter of commendation from the President of the United States for his work with the Youth Conservation Corps.

Mr. Specter was born in White Plains, NY and lives there now.

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1.0 Executive Summary

The Indian Point 2 nuclear power plant is scheduled to be permanently shut down on April 30, 2020 and Indian Point 3 a year later on April 30, 2021. These two large nuclear plants are safe and highly reliable, producing electricity over 90% of the time and generating over 16,300 Gigawatt hours (GWh) per year. To truly replace Indian Point (IP), any replacement scheme must also be (1) carbon-free, (2) highly reliable, and (3) productive enough to match the 16,300 GWh/year output of these nuclear plants. **At this time no plan has been put forth by New York State or any other group that meets all three criteria.**

The purpose of this report is to provide an outline on how the Indian Point might be replaced with a combination of actions that together meet these environmental, reliability, and sufficiency requirements. Further, it is the intention of this outline to stay within the boundaries of the 2017 IP Closure Agreement reached by NY State, Entergy, and Riverkeeper. Finally, implementing this outline would be beneficial to all IP stakeholders, as described later.

Achieving the goals of this outline will not be easy since it would require major changes from groups deeply invested in closing down Indian Point. There are major technical challenges too. However, people and their governments are increasingly responding to the existential threat of climate change and everyone wants to keep New York City and surrounding areas economically viable with a reliable electricity system. This calls for a rethinking of how to proceed. People have created the present unacceptable IP closure situation and people can fix it.

2.0 Background

2.1 Criterion One - Protecting the Environment

Fear of climate change leading to the destruction to all life on this planet has sparked environmental and energy discussions across the globe. In the USA a number of state governments have now issued clean energy mandates to reduce greenhouse gas releases by specific amounts by specific dates. As grim news of increasing carbon dioxide levels in the atmosphere and the oceans continues to roll in, many of these states have increased their goals and shortened the time to get there.

On January 9, 2017 the Governor of New York announced the agreement reached by NY State, Entergy, and Riverkeeper to permanently close the two Indian Point units. At that time the Governor made the following commitment to the people of New York State: ***“Replacement Power Will Be In Place That Adds No New Carbon And Will Have Negligible Cost Impact to Ratepayers”***. This commitment has failed to materialize. In December, 2017 the New York Independent Systems Operator, NYISO, reported¹ that because of severe transmission constraints, Indian Point could not be replaced by electricity from upstate New York (north and west of the Lower Hudson Valley) or from electricity generated on Long Island. NYISO then identified three gas plants under construction that might be used as replacement electricity for Indian Point. Using a fossil fuel, natural gas, to replace greenhouse gas-free Indian Point has raised objections from people

¹ “Generator Deactivation Assessment Indian Point Energy Center”, NYISO, December 13, 2017.

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concerned about the effects of climate change. Riverkeeper², one of the three parties to the Closure Agreement, has objected to using gas to replace Indian Point. In spite of his earlier commitment, the Governor did not react to NYISO's announcement about switching from Indian Point to gas. Silence is consent. However, it is still possible for the Governor's environmental commitment to be met while maintaining the electricity system's reliability.

If gas is used to fully replace Indian Point this would lead to a release of about 7 million metric tons of greenhouse gases (GHG) each year. In less than three years this annual insult to the environment would totally negate all the cumulative GHG reduction benefits achieved by all of the State's wind turbines and solar panels since 2003. Further, NY State is planning to build an unprecedented 9000 MW off-shore wind farm. It would take until around 2038 before the cumulative GHG reductions from this mammoth off-shore wind farm matched the cumulative GHG releases from the natural gas used to fully replace Indian Point. The break-even date of around 2038 is far too late when climate scientists warn us that the existential threat of climate change must start to be turned around in just 12 years from now. A great deal of time and money will be wasted, with significant harm to the environment, if gas replaces carbon-free Indian Point.

The NYISO plan to replace Indian Point with gas fails to meet the first criterion, to protect the environment.

2.2 Criterion Two - Assuring a Reliable Electricity System

For years the New York Independent Systems Operator (NYISO) has warned that without IP the State's own reliability criterion would immediately not be met, a situation that would further deteriorate in subsequent years. Because of the requirement to have a reliable electricity system and because neither renewable energy nor energy efficiency would be sufficient to offset the loss of IP at this time, NYISO, in 2017, turned to the use of three gas plants³ then under construction.

However, a closer look at this NYISO gas option has shown that this approach is unlikely to prevent significant reliability issues. Even with all three gas plants operating there would be a 14% shortfall in electricity capacity (Gigawatts) and a 21% shortfall in electricity output (Gigawatt-hours) relative to the IP power plants. Further, it appears that Bayonne Uprate and CVP Valley gas plants are not actually available to replace IP since they are already dedicated to serving New York City. Without these two gas plants there would be about a 50% shortfall in electricity capacity and about a 53% shortfall in electricity output. Additionally, it would be advantageous, environmentally and from a reliability standpoint, if the Cricket Valley plant, when completed in 2020, would also serve New York City. **It appears that NYISO's gas replacement scheme for Indian Point does not work.**

Emergency measures might be taken if there was a major reliability issue brought on by the closure of the IP plants. During peak demand periods NYISO might have to increase the use of

² "Riverkeeper pledges legal action against efforts to replace Indian Point with gas", Thomas C. Zambito, LoHud newspaper, April 6, 2018.

³ The Bayonne Energy Center Uprate, the CPV Valley Energy Center, and the Cricket Valley Energy Center.

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highly polluting peaker plants in New York City. These peaker plants might be divided into two groups. The first group of peaker plants might increase their use of natural gas, using whatever gas still available in the pipeline. If this is not enough, a second group of peaker plants would then be activated and run on oil, which is even more polluting than gas. The additional health effects of these stop-gap manoeuvres could be significant.

Even if shortfall problems did not exist, a reliable electricity system is far from being assured. Sudden shortages can also occur, especially in Westchester County, even if all the gas plants were available. Of all the zones in New York State, Zone H, which includes Westchester County, is particularly vulnerable. In NYISO's 2018 Reliability Needs Assessment Report (RNA), Figure 28, "Zonal Capacity at Risk", Zone H is identified with the letters EZR, which means "Exceeds Zonal Resources".

As NYISO has pointed out, it is not enough to just count the total number of megawatts in an area to establish system reliability, i.e., to determine if a sudden shortage of electricity might occur. A Zonal Capacity at Risk Assessment is essential, according to NYISO. The 2018 NYISO RNA Report stated: *"The zonal capacity at risk assessment identifies a maximum level of capacity that can be removed from each zone without causing NYCA LOLE criterion violations. However, the impacts of removing capacity on the reliability of the transmission system and on transfer capability is highly location dependent. Thus, in reality, lower amounts of capacity removal are likely to result in reliability issues at specific transmission locations. The NYISO did not attempt to assess a comprehensive set of potential scenarios that might arise from specific unit retirements. Therefore, actual proposed capacity removal from any of these zones would need to be further studied in light of the specific capacity locations in the transmission network to determine whether any additional violations of reliability criteria would result. Any transmission security analysis, such as N-1-1 analysis, would need to be performed for any contemplated plant retirement in any zone"*.

Zonal Capacity at Risk Assessments are highly location dependent, according to NYISO. Therefore the physical locations of electricity generators within the overall grid are important, as are all the associated connecting lines and grid components. Indian Point is sited at a specific location within the NY State grid. IP's actual operation has shown that this location and IP's large electricity output provides a stable and sufficient result. As a matter of proven practice, IP would meet with approval if subjected to a Zonal Capacity at Risk Assessment. By comparison, the combined three gas plant replacements are undersized both in capacity and in electricity generation. They are highly dispersed with one gas plant in Bayonne, New Jersey, another in Orange County, NY and the third in Dutchess County, NY. Without a specific Zonal Capacity at Risk Assessment there is no proof that this particular arrangement within the grid would be reliable and would not lead to sudden shortages of electricity.

NYISO has stated that a Zonal Capacity at Risk Assessment is necessary, but it has not performed one. Why not? It seems unlikely that this undersized, highly dispersed gas replacement scheme would successfully pass a Zonal Capacity at Risk Assessment. **At this time NYISO can not assure the people of New York that their electricity future will be reliable, once IP closes.**

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2.3 Criterion Three - Sufficiency

In addition to the shortfalls described above, there are other supply and demand situations that challenge the sufficiency of New York State's and New York City's electricity supply systems. A large fraction of New York City's gas power plants are significantly over-aged. Already 22% of the gas plant capacity in New York City is beyond the age where 95% of power plants with a similar technology would have already been retired. For combustion turbine plants the 95th percentile age is 46 years and for steam turbines the 95th percentile age is 63 years: many gas plants in New York City are already beyond these ages. By 2026 the percentage of over-aged capacity in New York City is projected to rise to 41%. Such over-aged infrastructure is in a condition of "imminent deactivation" according to NYISO, i.e., they could fail at any time. Loss of one or more over-aged power plants might cause a sudden electricity shortage, especially if this happens during times of peak demand. Further stress on the New York City electricity supply system will occur in the next few years when 2,946 MW of generation have to face prohibitions on the use of oil for combustion.

In addition to situations that could lead to a decreasing supply of electricity, simultaneously, there are increasing demand situations. In New York State 83% of the released greenhouse gases come from the end use sectors of transportation, residential, commercial, industrial, and others. In order to eliminate the GHG releases from these sectors large increases in the use of electricity will be needed. This is already happening. In 2019, as reported in NYISO's 2019 Power Trends report, the growth of electric vehicles in the State has already caused a significant change. For many years the State's electricity demand has been slowly decreasing, largely because of the impact of greater efficiency. This downward trend now has ended due to the growing demand for electricity in the transportation sector. NY State has reached a point of inflection. Going forward the demand for electricity will increase as we move towards a low carbon future. Once space heating and hot water production in the residential and commercial sectors become fully dependent on electricity, the demand for electricity will soar.

At this time no plan has been announced on how NY State will meet the high demands for electricity associated with a low carbon future. Closing Indian Point, with its annual production of 16,300 GWh, exacerbates the sufficiency issue. **Criterion three is not being met.**

3.0 Meeting All Three Replacement Criteria

3.1 Introduction

This report takes a first step in outlining a process that might fulfil the Governor's commitment to the people of New York to replace Indian Point with emissions-free sources of electricity while maintaining system reliability and sufficiency.

3.2 Guiding Principle

Providing all safety requirements are met, the two IP plants should continue to operate within the time limits established by the Closure Agreement reached by NY State, Entergy, and Riverkeeper. The goal here is not to modify the Closure Agreement, but to use it to its fullest.

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3.3 The Closure Agreement

The Closure Agreement permits an extension of the closure dates of IP2 and IP3 of up to four years, if certain conditions are met. With such extensions IP2 could be permitted to operate until April 30, 2024 and IP3 up to April 30, 2025. In September 2018 the Nuclear Regulatory Commission extended the licenses of IP2 and IP3 so that these licenses now match these extended 2024 and 2025 dates in the Closure Agreement.

The main conditions for extending the operation of IP2 and IP3 in the Closure Agreement are: *“... if NYS determines that an emergency exists by reason of war, terrorism, a sudden increase in the demand for electric energy, or a sudden shortage of electric energy or of facilities for the generation or transmission of electric energy, the operation of IP2 may be extended upon mutual agreement of NYS and Entergy, but in no event beyond April 30, 2024, and the operation of IP3 may be extended upon the mutual agreement of NYS and Entergy, but in no event beyond April 30, 2025, in accordance with applicable law and regulatory requirements.”*

The key phrase above is **“...or a sudden shortage of electric energy or of facilities for the generation or transmission of electric energy...”**. NYISO has repeatedly warned about a sudden shortage of electric energy. For example, in NYISO’s 2016 RNA stated *“This scenario simulates the retirement of the Indian Point energy center by removing about 2600 MW of capacity from Zone H and finds that significant violations of resource adequacy would occur immediately in 2017.”* (emphasis added) The closure of Indian Point itself creates the sudden shortage the Closure Agreement identifies as a cause to extend the IP2 and IP3 closure dates. With two of the three gas plants in the NYISO replacement scheme apparently not available to replace Indian Point because they are already serving New York City, sudden electricity shortages upon closure of Indian Point are inevitable, particularly during peak summer demand periods. Further, as discussed in Section 2.3, there are additional supply and demand issues that could trigger sudden shortages.

It appears that the intent of the Closure Agreement to have a reliable electricity system could be met by extending the operation of IP2 and IP 3 by four years, during which time a replacement scheme would be put in place that meets all three of the above criteria.

3.4 2019 versus 2017

When the Closure Agreement was drafted in 2017 it did not contain concerns about climate change. Yet this issue today is of paramount concern as witnessed by the passage of the CCPA⁴ and other indications from a fearful public. It is entirely plausible that if the Closure Agreement were written today there would be words in it beyond just reliability issues. Specifically, extensions of IP2 and IP3 might have been justified based on the impact of their closure on the release of GHG. When considering extending the operation of IP2 and IP3, consideration should be given on how rapidly the State’s environmental programs would be negated by replacing IP with gas.

Extending the operation of IP2 and IP3 for four years would not only be consistent with the Closure Agreement, it is consistent with present State public policies and with the goals of the CCPA.

⁴ CCPA: “The Climate and Community Protection Act”.

4.0 Implementation

4.1 Introduction

In order to achieve an IP replacement scheme that meets the three criteria described above, several non-carbon energy actions would be integrated. With regard to non-carbon sources of electricity, use would be made of solar panels (photovoltaics), on-shore, and off-shore wind power, and, possibly, increased use of hydropower from Canada. In addition to these sources of electricity, increased use of energy efficiency would be emphasized.

4.2 Capacity Estimates of Non-Carbon Electricity and Energy Efficiency

Extensive use has been made of NYISO's 2019 Gold Book to estimate non-carbon sources of electricity and bulk electricity demand reductions associated with improved energy efficiency. With regard to improved energy efficiency, only those improvements that are projected to occur in NYISO Zones G, H, I, and J are counted. With regard to producing carbon-free electricity that might replace Indian Point, their source locations could be anywhere in NY State, on-shore and off-shore, and from Canada.

4.2.1 Solar PV Impacts

Table 1-9b of NYISO's 2019 Load & Capacity report lists 4,149 GWh of Solar PV Impacts Behind-the-Meter by year 2024. In 2018 only 49 GWh of solar PV was generated. Therefore the projected gain in solar PV between 2018 and 2024 is 4,100 GWh. By 2025 another 4,412-4,149 = 263 GWh is expected to be produced.

4.2.2 Upstate On-Shore Wind Power

The existing on-shore capacity for wind power is 1,984 megawatts, and another 4,313 megawatts is projected⁵. Assuming that 50% of this additional wind power capacity is operational by 2024, the total capacity wind power capacity would come to $1,984 + 2,157 = 4,141$ megawatts. Based on present wind power performance of 3,985 GWh, these 4,141 megawatts should produce about 8,316 GWh by 2024. By 2025 this should increase to about 9,182 GWh.

4.2.3 Off-Shore Wind Power

The Offshore Wind Policy Options Paper⁶ provides data on the capacity and capacity factors for the large off-shore wind farm that NY State plans to build off of Long Island. According to Table 17 of this report, 400 MW should be operational by 2024 at a capacity factor of 43.9%. By 2025 another 400 MW should be operational at a capacity factor of 44.8%. This results in 1,538 GWh in 2024 and another 1,570 GWh by 2025. Consistent with NY State reports, it is assumed that 50% of the 2024 and 2025 off-shore wind power electrical output is dedicated to replacing Indian Point with the other 50% transmitted to Long Island.

⁵ Figure 25, Power Trends 2019, NYISO.

⁶ "Offshore Wind Policy Paper", NYSERDA, Jan.29, 2018.

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4.2.4 Greater Efficiency

Table 1-8a of NYISO's 2019 Load & Capacity report lists the cumulative reductions in annual energy use, relative to year 2018. For zones G, H, I, and J by 2024 these four zones are projected to use 3,316 GWh less electricity than they did in 2018. By 2025 an additional 715 GWh worth of electricity reductions is expected because of energy efficiency.

4.2.5 Initial Conclusions

The sum of sections 4.2.1 through 4.2.4 comes to about 16,501 GWh by 2024 and another 2,629 GWh by 2025. Based on these results it appears that by 2024 to 2025 there could be enough capacity and energy production to replace IP2 and IP3 with a combination of renewable energy sources and energy conservation.

While the above conclusion is encouraging, it is incomplete. It will still be necessary to deal with the intermittent nature of renewable energy and a detailed energy storage analysis would be required. A more comprehensive analysis might indicate that adding some hydropower from Canada results in a more cost effective and reliable mix of energy sources.

It is also critical to have a transmission network that integrates all of these sources of electricity. Recent events, described next, may provide an answer to the transmission line issue.

4.3 New Transmission Projects

On April 8, 2019 the NYISO Board of Directors announced its selection of two transmission projects to meet public policy needs. As stated in the Board's press release, ***"The selected transmission projects will benefit consumers by increasing delivery of environmentally desirable power to meet state energy goals, relieving congestion, and replacing aging infrastructure to bolster system reliability and resilience."*** These projects will add the largest amount of free-flowing transmission capacity to the State's grid in more than 30 years.

Of particular interest is the transmission project called Segment B which would enhance the State's transmission capacity from Albany down to the Town of Pleasant Valley in Dutchess County in the Lower Hudson Valley. (See Figure A-1⁷). Segment B is to be at least 900 MW and is scheduled to be completed by December, 2023. When completed, bringing upstate electricity down to the Lower Hudson Valley should overcome the transmission barrier that NYISO identified in its December 13, 2017 Generator Deactivation report. Further, Segment B is necessary to make full use of Segment A which upgrades the transmission capacity in Western New York. In order to increase the flow of clean electricity from Western New York down to the Lower Hudson Valley and New York City, the State would need to construct both Segments A and B.

These new transmission projects, Segments A and B, support the Governor's commitment to replace Indian Point only with emissions free sources. Note that the size of the Segment B project is at least 900 MW. This should almost be enough to replace IP2, provided this transmission line can also carry about the same number of megawatt-hours as IP2 produces. The construction

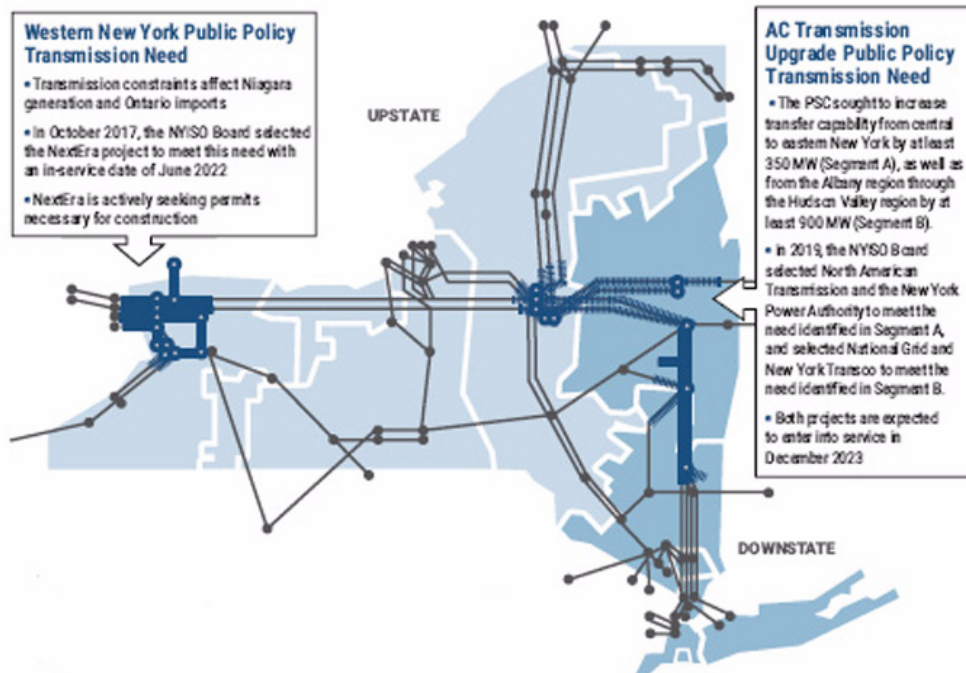
⁷ Figure A-1 reproduces Figure 26 in NYISO's 2019 Power Trends report.

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schedule for Segment B is also favorable. The completion date of December, 2023 is within the IP2 extension date of April 30, 2024. NYISO's wording is that Segment B will be at least 900 MW. It must be determined how much larger than 900 MW Segment B has to be in order to carry the necessary amount of clean energy needed to replace Indian Point.

The first application of Segment B should be to replace IP2 with clean energy by April 30, 2024. If the NYISO projections are fairly accurate then ample clean replacements should be available. With regard to IP3, there is an additional year, until April 30, 2025, to increase the capacity of Segment B to a total of about 2000 MW. If there are obstacles to fully using the clean energy sources discussed in sections 4.21 through 4.24, consideration should be given to increasing the importation of hydropower from Canada.

FIGURE A-1 Public Policy Transmission Needs in New York State



With an increase in the Segment B transmission capacity beyond 900 MW, including additional clean energy from Canada if necessary, a contribution from on-shore and off-shore wind power, bulk power demand reductions achieved by energy efficiency, and electricity from behind-the-meter solar energy, the three replacement criteria for IP2 and IP3 may be realized. Developing the details of this outline should proceed as soon as possible.

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5.0 Stakeholder Benefits

All stakeholders benefit from an extension in the closure dates of Indian Point.

5.1 Westchester County

Westchester County would benefit from an extension in the closure dates of the two Indian Point units. Westchester relies on Indian Point for 25% of its electricity. Westchester also has many thousands of residents who commute daily into NYC to earn a living. It is in Westchester's best interest to support an economically viable NYC by having Indian Point continue to supply 25% of NYC's electricity and to support the use of the three new gas plants identified by NYISO for NYC, and not as a replacement for Indian Point.

If the two Indian Point units continue to operate through 2024 and 2025, respectively, then:

- a. Many more local jobs, tax revenues, school and community programs would continue. The loss of 1100 direct jobs and the loss of about \$32 million dollars in local tax revenue per year would be delayed by four years. Local real estate values should continue at present levels,
- b. Local jurisdictions would have more time to plan for the inevitable closure of these plants,
- c. There would be more time for the decommissioning funds to grow,
- d. There would be more time to build a national waste facility that would accept the nuclear wastes that have accumulated at Indian Point. It is beneficial to operate Indian Point as close as possible to the time when this national waste facility would become operational. This would reduce the time that nuclear wastes remained on the site, during which time they may prevent the site from becoming a source of new tax revenue and jobs,
- e. Several economic analyses have indicated that the closure of the Indian Point plants will result in a spike in the cost of electricity in Westchester. Delaying such a cost spike benefits the citizens of Westchester.

5.2 New York City

NYC already has an electricity reliability issue. Losing 25% of its electricity upon closure of Indian Point could be crippling.

NYC has a large and growing fraction of its gas plants that are significantly over-aged and should be retired. These over-aged plants not only represent a reliability challenge, they are less efficient than modern gas plants. This makes them more expensive to run and their GHG releases and air pollution effects per kilowatt-hour exceed more modern gas plants. New gas plants in the Lower Hudson Valley should be used to replace older gas plants in NYC and not be used as a replacement for Indian Point.

If electricity shortages begin to occur in NYC because of failures in the group of over-aged plants, or because of population growth, hotter summers, greater demand from electrified space and hot water heating and more electrified vehicles, the City may have to resort to burning oil in dual use (gas or oil) electric power plants to meet these increasing demands for electricity. Burning oil in a

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densely populated area creates serious health issues, especially for people with respiratory difficulties, like asthma. NYC already has a program to phase out burning oil, but electricity shortages tied to the IP closure may prevent this program from being fully implemented. Closure of Indian Point could result in worsening air pollution with severe health effects. It is far better to wait on these closures until all the pieces needed for a clean energy replacement are in place.

In this age of gas moratoriums, having the diversity of supply that Indian Point provides is a big plus.

5.3 Riverkeeper

There are multiple reasons for Riverkeeper to support an extension in the Indian Point closure dates, starting with its own Mission statement. Riverkeeper's Mission is to *"Protect the environmental, recreational and commercial integrity of the Hudson River and its tributaries and safeguard the drinking water of nine million New York City and Hudson Valley residents"*.

Climate change will make achieving this Mission Statement much more difficult, if not impossible. One major concern is the projected increase in the frequency and intensity of hurricanes like superstorm Sandy. According to Riverkeeper's observation of the impact of Hurricane Sandy on the Hudson River, *"The amount of pollution released by this storm is staggering"*. To its credit, Riverkeeper⁸ has alerted people to this growing hazard.

More frequent powerful hurricanes are not the only climate change impacts on the Hudson River. Climate change causes other extreme events like droughts, excessive rain falls, insufficient snow melts that feed our reservoirs and Hudson tributaries. Long periods of very high temperatures may reduce dissolved oxygen concentrations in the Hudson River, affecting many forms of aquatic life there.

Riverkeeper's opposition to using a fossil fuel to replace carbon-free Indian Point was clearly stated⁹ soon after NYISO made known its plans to replace Indian point with gas. Other Riverkeeper reports¹⁰ also demonstrate its focus on reducing the use of fossil fuels.

By signing the Closure Agreement, Riverkeeper has already agreed to extending the dates of the Indian Point closures if the conditions discussed before are met.

Supporting this four year extension is consistent with Riverkeeper's Mission Statement.

⁸ "Sandy's Devastating Impact to Hudson River Includes Widespread Toxic Spills." Riverkeeper, (10/30/2012).

⁹ "Checking it twice: grid operator says electric system reliable without Indian Point", Riverkeeper, (12/15/2017).

¹⁰ "Why we say "no" to new fossil fuel projects like the CPV power plant and Valley Lateral Pipeline", Riverkeeper, (01/05/2018).

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5.4 Entergy

Entergy has consistently stated that closure of the Indian Point plants is based on economic considerations. Entergy has an obligation to its shareholders to maximize their income. It is this same obligation to its shareholders that should encourage Entergy to support a four year extension, i.e., a four year extension would be economically beneficial to Entergy. Note that all aspects of the Closure Agreement would continue unaltered by this extension.

5.4.1 Subsidies

Entergy would need to be made financially whole by the State of New York if it continued to operate Indian Point. This has been done with the four upstate nuclear plants and the same financial processes could be applied to Indian Point. It is estimated that IP2 + IP3 would qualify for a subsidy of up to \$320 million dollars per year¹¹, likely far in excess of its actual needs. With a level of subsidy that is consistent with actual Indian Point financial needs, Entergy would not be at financial risk by continuing to operate Indian Point. Entergy needs to quantify what level of financial support it needs for Indian Point to be economically viable.

5.4.2 Decommissioning

The actual decommissioning of Indian Point will be conducted by Holtec. This might be accomplished with a license transfer from Entergy to Holtec, if permitted by the NRC, or with Entergy keeping the present licenses, but acting as a Project Manager directing the work of Holtec. Under either situation a larger decommissioning fund is beneficial. It is expected that a four year extension would increase the amount of money in the decommissioning fund. Further, the larger the decommissioning fund, the more likely the NRC and local governments would be comfortable with the license transfer to Holtec option. An IP extension of four years should not affect the role of Holtec in any meaningful way.

5.4.3 Carbon Taxes

There is increasing political activity to support some kind of a national carbon tax. If this does become law, the value of Indian Point would increase immediately. If the size of the carbon taxes were high enough, Entergy would no longer need to be subsidized by New York State and might even return to profitability. In the meanwhile subsidies would prevent economic losses. This appears to be a no-risk situation for Entergy, with the potential for Entergy's shareholders to obtain additional financial benefits if a national carbon tax scheme is enacted.

¹¹ A Zero Emissions Credit (ZEC) of up to \$19.59/ kilowatt-hour for upstate nuclear plants is allowed by NY State. At a production rate of about 16,337 GWh/year the allowable New York State subsidy for Indian Point could be as large as \$320 million dollars per year.

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5.5 The Governor of New York

If the present Indian Point Closure schedule goes forward this would stain the Governor's legacy. Therefore the greatest benefactor to an extension of the closure dates of the Indian Point units could be the Governor of New York. It would underscore the foresight he exhibited in 2017 by building in the possibility of an extension in the Agreement he signed. This extension would automatically provide more time to implement the Governor's commitment to replacing Indian Point with emissions-free sources while supporting adequate system reliability. An extension would provide more time to protect the REV program and the CCPA and this should be welcome news to the environmental community.

The Governor would save the State large sums of money, perhaps several hundred million dollars per year, if the subsidy for the Indian Point units is smaller than the environmental Social Cost of Carbon, should gas replace Indian Point.

The Governor would gain the appreciation from local citizens in Westchester by delaying the loss of over 1100 jobs and over \$32 million dollars per year in local taxes. If there were a four year extension local real estate values and local taxes should remain as they are now for that duration. This would be particularly appreciated by retirees living near Indian Point.

The Governor would gain the appreciation of people in New York City by reducing their chances of experiencing an electricity shortage or blackout. People in New York City would also applaud the Governor for taking steps to avoid burning oil in dual use electric power plants because of electricity shortages brought on by the Indian Point closure.

Upstate New Yorkers, particularly those who receive financial benefits from wind power and/or imported Canadian hydropower, would also support efforts to bring more upstate clean energy to downstate areas.

The Governor would once again show leadership by recognizing that changing realities require him to reset his priorities, by continuing to be an environmental leader by enforcing his commitment to carbon-free sources of electricity and by shielding New Yorkers from an electricity price hike and hardships caused by gas moratoriums.