A Reliability Analysis For Riverkeeper

HERSCHEL SPECTER

mhspecter@verizon.net

June, 2019

ABOUT THE AUTHOR

Herschel Specter, President of Micro-Utilities, Inc., holds a BS in Applied Mathematics from the Polytechnic Institute of Brooklyn and a MS from MIT in Nuclear Engineering. He is a Licensed Professional Engineer in the State of New York. He has had a long association with the Indian Point nuclear power plants starting as a member of the Atomic Energy Commission (now the Nuclear Regulatory Commission) where he was the Licensing Project Manager for the original licensing of the Indian Point 3 nuclear plant in the 1970s. In the 1980s the New York Power Authority hired Mr.Specter to manage the defense of Indian Point 3 in a federal adjudicatory trial in the wake of the Three Mile Island nuclear accident in Pennsylvania. Prior to joining NYPA, Mr. Specter served at diplomat rank for 5 years at the International Atomic Energy Agency in Vienna, Austria where he headed up an international effort writing design safety standards for nuclear power plants.

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.

TABLE OF CONTENTS

1.0 Executive Summary

The Indian Point 2 nuclear power plant is scheduled to permanently close on April 30, 2020 and Indian Point 3 exactly one year later. Last year these nuclear plants produced 16,334 gigawatt-hours of electricity, enough to supply 25% of New York City's and 25% of Westchester County's electricity. Where will the electricity come from to replace these highly productive, greenhouse gas free, power plants? This report details past and present failures by NY State to answer this question. Further, this report describes a worst case scenario where a very large gas plant is built on the Indian Point site after the nuclear plants are decommissioned.

NY State has failed to answer the Indian Point replacement question at least three times in the past five years. First there was the 2014 to 2016 time period when Entergy, the owner of these power plants, sought to have the expiring licenses of these power plants extended, as many nuclear plants across the country had successfully done. Nobody, including governmental leaders in Albany, knew if the Nuclear Regulatory Commission would grant these license extensions. What was known at that time were the conclusions reached by NYISO, New York's Independent Systems Operator, that unless these nuclear plants were able to continue to operate, NY State would immediately enter a condition of failing to meet the State's own electricity reliability criterion. Further, this unsatisfactory reliability condition would only worsen with time. In spite of NYISO's dire warnings, year after year, the State did not produce a plan to deal with this distinct possibility. This was clearly irresponsible.

The second failure to deal with the closure of the Indian Point power plants came on January 9, 2017. On that day NY State announced the impending closure of these two nuclear plants. In his press release that day, the Governor of NY made a commitment to the people of New York ***"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 NYISO reported[1] 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 concerned about the effects of climate change. Riverkeeper[2], 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 Indian Point to gas. Silence is consent.

More recent information, described in this report, show that even with all three gas plants operating there will be a significant shortfall in electricity generation, compared to Indian Point. Further, it is doubtful if two of these three gas plants are actually available to replace Indian Point. Finally, NYISO has stated that a highly local analysis (a zonal capacity risk assessment analysis) must be performed to demonstrate that all affected locations, especially Westchester County, will have

[1] "Generator Deactivation Assessment Indian Point Energy Center", NYISO, December 13, 2017.

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

adequate electricity. It is not enough to add up megawatts of capacity to demonstrate reliability; it also requires detailed analyses of the local transmission system. In spite of declaring that this local analysis is essential, NYISO has not performed this analysis. Why?

Much has changed since January, 2017. The world is experiencing the effects of climate change much sooner than thought before. Important environmental groups like the Union of Concerned Scientists and the Environmental Defense Fund, once opposed to nuclear power, now seek to prevent the premature closure of existing nuclear plants. Reaching an all-renewable energy future has turned out to be much more difficult that thought before, as observed in Germany's Energiewende program which is failing to meet its own goals on time. In the United States, retired economically stressed nuclear plants were not replaced with renewable energy, but with fossil fuels. No level of government, be it international or local, is effectively dealing with climate change.

People are becoming aware that replacing carbon-free nuclear plants with fossil fuels, principally natural gas, does double damage. It is not the same as replacing a nuclear power plant with greater efficiency. When nuclear plants are replaced by gas, the carbon dioxide (CO_2) emitted from these fossil fueled replacements erase the greenhouse gas (GHG) reduction achievements gained by renewable energy sources. For example, if Indian Point were fully replaced by gas, about 7 million metric tons of CO_2, would be released into the atmosphere each year. In less than three years this huge annual insult to the environment would totally negate the cumulative environmental benefits achieved by all of NY State's wind turbines and solar panels since 2003. Further, NY State is planning to build a huge off-shore wind farm, 9000 megawatts, to be competed by 2035. It will take until about 2038 before the cumulative GHG reductions from this mammoth off-shore wind farm matched the GHG releases from the gas replacements for Indian Point. A break-even date of 2038 is far too late when climate scientists state that this existential threat to the planet must start to be turned around in just 12 years hence.

New York State is in a bind. If it does replace Indian Point with gas it destroys its own REV program and more, creating a huge environmental problem. If it does not replace the electricity that Indian Point produces, a major reliability challenge would immediately occur. What is needed is a combination of greater efficiency, renewable energy, and a large source of carbon-free electricity that would reliably operate in NYISO zones G,H, I, or J. So far only Indian Point has achieved this. At the other extreme there is a worst case scenario where a 2,000 to 2,600 MW gas burning facility is constructed right at the existing Indian Point site.

2.0 New York State has Never Produced an Adequate IP Replacement Plan

2.1 The RNAs of the 2014 to 2016 Time Period

Every year, NYISO issues a Reliability Needs Assessment (RNA) report that analyzes the ongoing status of New York's electrical power system. Each RNA determines if the State is meeting its own electricity reliability criterion and offers actions that might be taken if its analyses indicate that problems lie ahead. During the years 2014, 2015, and 2016 Entergy came before a Licensing Board of the Nuclear Regulatory Commission (NRC), seeking to have the licenses of Indian Point 2 and 3 extended, as many other nuclear utilities had successfully done. Entergy's license extension efforts were opposed in court by NY State and Riverkeeper. Although the licenses of Indian Point 2 and 3 expired during this lengthy legal procedure, the NRC permitted continuing plant operation while the court remained in session. During these three years no one knew if the decision of the court would be to extend these licenses or to shut down one or both nuclear plants. NYISO's RNAs for these three years, 2014, 2015, and 2016, were very similar. NYISO concluded that, if the Indian Point plants continued to operate, New York State's reliability criterion would be met. If, however, the Indian Point plants were to close, the State would immediately be unable to meet its own reliabilty criterion and that reliability challenges would worsen over time[3]. Although the State recognized the jeopardy of a license extension denial by the NRC Licensing Board, **it never produced a plan to deal with this possibility, thereby putting New Yorkers at considerable economic risk.**

The risks associated with the closure of Indian Point compounds the ongoing risks of an over-aged electric supply system in New York City, as shown in Figure A-1. This over-aged electricity supply system is subject to "imminent deactivation" according to NYISO, i.e., there could be failures at any time. Indian Point supplies 25% of New York City's electricity and 25% of Westchester County's electricity. As bad as this over-aged electrical infrastructure problem is, the NYISO 2019 Power Trends report identifies additional electricity supply problems. For example[4], ***"New York City passed legislation in December 2017 that will prohibit the combustion of fuel oil numbers 6 and 4 within utility boilers by 2020 and 2025, respectively. The rule is expected to impact 2,946 MW of generation in New York City."*** In the meanwhile the growing use of electric vehicles caused an inflection point in 2018 in terms of electricity use. For many years peak electricity demand has been slowly decreasing. However, the impact of increasing electrified transportation has put an end to this downward trend, as discussed in this latest NYISO Power Trends report. Additionally, utilities like Consolidated Edison, have declared moratoria on new applications for gas hook-ups because of gas shortages or inadequate gas pipeline capacity. It may take several years before these moratoria are resolved. One of the largest sources of air pollution and respiratory health effects in New York City comes from the burning of fossil fuels to supply space heating and hot water. Burning fossil fuels for space heating and to heat water also releases significant volumes of GHG. Should gas be used ti heat buildings or to produce electricity or, better yet, not at all? New York City will need far more clean electricity to eliminate the fossil fuel usage

---

[3] The NRC, in September, 2017, extended the licenses of Indian Point 2 until April 30, 2024 and Indian Point 3 until April 30, 2025.

[4] NYISO Power Trends 2019, page 39.

from its end use sectors of transportation, space heating, and making hot water. In summary, the planned closure of Indian Point comes at time of major uncertainties brought on by new demands for electricity while major long-standing sources of supply may be removed or fail. New York State's track record on maintaining major infrastructures, like NYC's subway system, has not been stellar.

NYISO uses the term LOLE, the Loss of Load Expectation, to express the electrical system's reliability and has established a minimum LOLE of 0.10/year criterion. A LOLE of 0.10/year means that, probabilistically, there should not be a one day loss of load (a blackout) more frequently than once in ten years. LOLEs larger than 0.10 do not meet NYISO's reliabilty criterion. Table A-1 summarizes the results of the 2014, 2015, and 2016 RNAs as they relate to Indian Point.

TABLE A-1 RNA Results for the 2014 to 2016 Time Period

Year	With IP Operating	Without IP Operating
2014	LOLE ≤ 0.10	***"Significant violations of transmission security and resource adequacy would occur in 2016 if the Indian Point plant would retire as of that time."*** Without IP a LOLE of 0.31 was calculated for 2016 in this RNA, equivalent to a possible one day blackout every 3.2 years.
2015	LOLE ≤ 0.10	***"Substantial uncertainties exist in the next ten years that will impact system resources...Depending on the units affected, the NYISO may need to take swift actions to maintain reliability."***
2016	LOLE ≤ 0.10	***"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 criteria would occur immediately in 2017."***

2.2 NY State Still Does Not Have a Legitimate Replacement Plan for Indian Point

2.2.1 After the 2014 to 2016 Time Period

The January 9, 2017 announcement of the impending closures of IP2 and IP3 changed everything. Unlike past years when the future of the Indian Point plants was uncertain, there were now specific closure dates. This also meant that NYISO finally had to present a plan to deal with the reliabilty issues these closures would initiate. The NYISO plan, contrary to the Governor's commitment, involved the use of three gas plants under construction. The largest of these three gas plants, Cricket Valley, is expected to be completed by 2020 and this coincides with the announced IP2 closure date. It appears that the announced IP closure dates were determined by the Cricket Valley construction schedule.This implies that the use of gas to replace Indian Point was already known when the Governor made his announcement to only use emissions-free replacement energy sources.

In its December 13, 2017 Generator Deactivation Report, NYISO described a three step replacement process to deal with the IP closures. First, three gas plants under construction at that time would be used to replace Indian Point. Second, NYISO evaluated a scenario where these three gas plants were assumed not to be available. Here a total of 2,000 to 2,600 Compensatory MWs would be installed in Zones G,H, I, or J, with the first installment of 100 megawatts due in 2021. If these Compensatory Megawatts were not installed, NY State's LOLE reliability criterion would immediately not be met once Indian Point closed, as shown in TABLE A-2. NYISO calculated that the LOLE would jump from 0.043/yr in 2020 to 0.108/yr in 2021 should the electricity from Indian Point not be replaced. By 2027, the LOLE would deteriorate to 0.168/yr without these Compensatory Megawatts. A LOLE of 0.168/yr implies a possible one day blackout every 5.9 years. Third, if these Compensatory Megawatts were not available NYISO stated that resource needs ***"would need to be met by one or more types of solutions including generation, transmission, energy efficiency and demand response measures."*** Each of these three replacement scenarios is examined next.

TABLE A-2 Compensatory Megawatts

Year	LOLE	Expectation of a one day system loss of load, once in:	Compensatory MW
2018	0.031	32.3years	
2019	0.028	35.7 years	
2020	0.043	23.3 Years	
2021	0.108	9.3 years	100 MW within Zones G, H, I, or J
2022	0.116	8.6 years	200 MW within Zones G, H, I, or J
2023	0.123	8.1 years	200 MW within Zones G, H, I, or J
2024	0.143	7.0 years	400 MW in G or 300 MW within Zones H, I, or J
2025	0.152	6.6 years	500 MW in G or 400 MW within Zones H, I, or J
2026	0.167	6.0 years	600 MW in G or 400 MW within Zones H, I, or J
2027	0.168	5.9 years	600 MW in G or 400 MW within Zones H, I, or J

2.2.1.1 With All Three Gas Plants Operating

The two Indian Point nuclear power plants together have a large capacity, 2054 MW. Further, these power plants operate almost all the time, recently with a capacity factor around 91%. As a result of having a large capacity and operating a very high percentage of the time, these carbon-free power plants produce an enormous amount of electricity, some16,334 gigawatt-hours (GWH) in 2018. By comparison, in 2018, New York State's on-shore wind turbines produced 3,985 GWH at a capacity factor of 26% and photovoltaics produced 47 GWH at a 14% capacity factor.

NY State plans to replace Indian Point with a combination of three gas plants, the 621.7 MW CPV gas plant, plus the 1020 MW Cricket Valley gas plant, plus the 120 MW Bayonne Energy Center uprate[5]. The combined capacity of these three gas plants is 1761.7 MW which results in a capacity shortfall of 292.3 MW, or about 14.2% less capacity than the two Indian Point power plants.

NY State imposes air quality limitations on these gas plants. For example, CPV plant is limited to a release of 2,164,438 short tons of CO_2 per year (1,947,994 metric tons/year) and the Cricket Valley is limited to a release of 3,597,898 short tons per year (3,238,108 metric tons/year). These air quality limits set the maximum number of GWH these plants can produce per year. For the CPV plant the maximum output is estimated to be 4,531 GWH /year, Cricket Valley 7,720 GWH/year and for the Bayonne Uprate an estimated 680 GWH/year for a total of 12,931 GWH/year. The energy credit given here for the Bayonne Uprate may be overstated. This facility is used for peaking power and would not typically operate like a base load plant. Further, the Bayonne Uprate design is not as environmentally efficient as the combined cycle CPV and Cricket Valley plants. It is estimated that the Bayonne Uprate produces about 27% more CO_2 per kilowatt-hour than these modern combined cycle plants. These factors were accounted for in estimating the Bayonne Uprate electricity output, assuming it performed as a base load power plant.

For 2018 the Indian Point electricity production was 16,334 GWH. Since the three gas plants would have a combined output of 12,931 GWH, there is a shortfall of 3,403 GWH or 20.8% of the Indian Point electricity production. Energy efficiency improvements and contributions from solar and non-solar distributed generation behind-the-meter will help close this 3,403 GWH shortfall. Nonetheless, the dominant replacement for Indian Point envisioned in the NYISO reports is through greater use of gas.

2.2.1.2 Without the Bayonne Uprate Gas Plant

There are doubts that the Bayonne Uprate gas plant can be considered as a replacement to Indian Point. First, it is designed to be a peaking plant, not a base load plant like Indian Point. Considering the Bayonne Uprate peaking plant as a potential replacement for the base load Indian Point nuclear plants is like trying to fix a problem in one's basement by working on the roof. As a peaking plant the Bayonne Uprate plant only operates for short periods of time per year, which is advisable considering its higher CO_2 release rate per kilowatt-hour. Further, this Bayonne Uprate plant already is in service to meet NYC's peak electricity demands. In order to serve NYC, a 6.4 mile submarine cable was constructed between Bayonne, New Jersey and Brooklyn, New York. It is not obvious why a peaking plant located far from Indian Point and already in service to Brooklyn could be consider as a possible replacement for the base load Indian Point plants located many miles away.

Without the Bayonne Uprate's 120 MW operating in a base load manner, the shortfall in capacity would increase from 292.3 MW to 412.3 MW causing a capacity shortfall relative to Indian Point of about 20%. There would also a be an electricity reduction of about 680 GWH per year. This would increase the electricity shortfall from 3,403 GWH per year to 4,083 GWH per year, comparable to a 25% shortfall compared from Indian Point.

2.2.1.3 Without the CPV Plant

[5] The December, 2017 NYISO Deactivation Report listed the CPV plant at 678 MW, but the latest NYISO Gold Book has changed this to 621.7 MW.

There are also concerns that the 621.7 MW CPV plant can not be counted on as a replacement for Indian Point because this power plant is already serving New York City. Because CPV plant is much more efficient than the present over-aged gas plants in New York City it replaces there is a reduction of 500,000 metric tons of carbon dioxide per year, according to CPV literature. This is a significant reduction in GHG releases for the State. To put this into perspective, the whole solar energy program promoted by NY State only produced 47 Gigawatt-hours in 2018 which would only reduce greenhouse gases by 25 metric tons if used to replace over-aged gas plant electricity generation like the CPV plant does. If the CPV plant were instead used to replace a portion of Indian Point's output, not only would this reduction of 500,000 tons of carbon dioxide be lost, the carbon-free electricity from Indian Point would be replaced by a fossil fueled electricity. This would increase the GHG releases by about 1,947,994 metric tons per year relative to the Indian Point nuclear plants. This would be a double set back for the environment with a combined swing of 500,000 + 1,947,994 = 2,447,994 metric tons of GHG or about 2.4 million metric tons each year.

Without both the Bayonne Uprate and the CPV there would be a total difference of 1,034 MW of capacity compared to Indian Point, resulting in a 50.3% shortfall in capacity and a total shortfall of 7,720 GWH per year compared to Indian Point, equal to a 52.7% electricity shortfall. These results are displayed in Table A-3. A shortfall of this magnitude might create electricity shortages during the peak demand periods of the air conditioning season.

2.2.1.4 The Cricket Valley Plant

The Cricket Valley plant is expected to produce about 66% more electricity than the CPV plant. If it is also able to replace over-aged gas plants in NYC like the CPV plant does, this would be an additional GHG reduction of about 831,000 metric tons of GHG per year. On the other hand, if Cricket Valley were used to replace GHG free Indian Point, this would increase GHG releases by about 3,230,000 metric tons per year, a swing of about 4.1 million metric tons each year.

Should both the Bayonne Uprate and the CPV plant be unavailable to replace Indian Point there is little value in trying to replace less than half of the Indian Point output by using the Cricket Valley plant, especially when using the Cricket Valley plant to replace over-aged gas plants in NYC has both environmental and system reliability benefits. If the CPV and Cricket Valley were not used to replace over-aged gas plants in NYC, but were used to replace Indian Point, the combined GHG swings of the CPV and Cricket Valley plants would be 2.4 + 4.1 = 6.5 million metric tons per year.

2.2.1.5 Conclusion

For both reliability and environmental reasons the use of these three gas plants to replace Indian Point is undesirable and perhaps unobtainable. The choice is clear: these gas plants should be used to support the needs of NYC, as they were originally planned to do.

TABLE A-3 Gas Capacity and Electricity Shortfalls Compared to Indian Point

Replacement Plan	% Shortfall in capacity relative to Indian Point.	% Shortfall in electricity production relative to Indian Point.
Present NY State Plan using the CPV, Cricket Valley, and Bayonne Uprate gas plants to replace Indian Point.	14.2	20.8
Bayonne Uprate not available because uprate is: (1) Used for peak demands, not base load demands like Indian Point, and/or (2) Already dedicated to meeting NYC's peak demands, uses a 6.5 mile submarine cable from Bayonne to Brooklyn.	20.1	25.0
Both Bayonne Uprate and CPV not available. CPV is already displacing over-aged gas plant generation in NYC, reducing GHG releases by 500,000 metric tons per year.	50.3	52.7
No gas plants available, causing an immediate system reliabilty violation that would worsen with time. Shortfalls partially offset by greater efficiency and behind-the-meter solar.	100.	100.

2.2.2 Compensatory Megawatts

Should these three gas plants be unavailable other compensatory actions would have to be taken to prevent a possible energy shortage situation. NYISO explained the purpose of its Compensatory Megawatt analyses:***"This assessment also determined that following the deactivation of Indian Point Energy Center, the reliability of the existing system can only be maintained if sufficient replacement sources of power are added within the Lower Hudson Valley (Zones G-J)"***. As shown in TABLE A-2 if the three gas plants were not available there would be an immediate shortage of electricity once Indian Point closed, with a LOLE of 0.108 in year 2021 and deteriorating to a LOLE of 0.168 by 2027. A LOLE of 0.168 implies a possible one day blackout every 5.9 years. This would be an intolerable situation so NYISO calculated, year-by-year, how many Compensatory MWs must be added to maintain an acceptable LOLE. It is likely that NYISO's calculated Compensatory MWs only brings the LOLE back to 0.100 and not the 0.031 of year 2018. The first of these Compensatory MWs is needed quite soon, by 2021, soon after Indian Point 2 is scheduled to shut down. NYISO calculates that between a total of 2,000 to 2,600 Compensatory MWs will be needed between 2021 and 2027. This 2,000 to 2,600 MW is in the range of the 2054 megawatts of capacity that exists at Indian Point and similar to the total 1818 MW that NYISO assumed for the three gas plants in its Generator Deactivation report.

There is almost no description of how these Compensatory MWs are to be generated. We only know that they are to be generated in the Lower Hudson Valley and New York City, zones G,H,I, and J. What we do know is that these Compensatory Megawatts will not come from any off-shore wind farm since no electricity is expected to be put on the grid until 2024. These Compensatory Megawatts also will not come from on-shore wind farms. No wind farms exist today in the G,H,I, and J zones and none are planned. We also know that NYISO makes projections of future electricity demands in builds in the behind-the-meter sources of electricity and the demand reductions brought about energy efficiency in their computer models. Therefore one can assume that the calculated Compensatory Megawatts already reflects the influences of energy efficiency improvements and behind-the-meter solar energy sources of electricity. In any case the low capacity factor of photovoltaics, about 14% in NY State, means that very large collection areas would be necessary to match the Indian Point output of 16,334 GWH. Such large collection areas do not exist in the high population density G, H, I, and J zones. Further, NYISO has explained that PV systems, unless they are supported by very low cost energy storage, are not capable of reducing peak summer or peak winter electricity demands. For example[6], the peak demand in winter in NYC occurs around 6:00 P.M. while the sun sets around 4:00 P.M. Therefore PV systems without storage can not reduce peak demands. Yet it is the peak demands that establish the overall capacity needs of an electricity supply system. We also know that NYISO is not considering another nuclear energy center in zones G,H,I, or J and that this area does not lend itself to major hydro-electric installations. Therefore these Compensatory Megawatts would have to be generated by gas and there would have to be a gas pipeline system to already in place by 2021 to fuel these gas generated Compensatory Megawatts.

Bringing a new gas facility on line takes years, as evident in the many years it is taking to bring the Cricket Valley power plant on line. Installing new gas pipelines in NY State is increasingly difficult. Yet, NYISO’s first block of 100 MW is to be operational by 2021, with annual additions of blocks 100’s of MWs in successive years until 2000 to 2,600 megawatts are installed. NYISO’s calculation of the rapid deterioration of the LOLE immediately after Indian Point shuts down shown in TABLE A-2 is consistent with earlier NYISO analyses. However, NYISO did not explain how installing blocks of 100’s of megawatts over a seven year period overcomes the rapid loss of 2054 megawatts of capacity in a one year time span. The Compensatory Megawatt analysis merely identifies what is needed, but not how to accomplish these needs or what the LOLE would be as these blocks of megawatts are installed. The Compensatory Megawatts analysis is not a real plan.

2.2.3 Beyond Compensatory Megawatts

In the event that neither the three original gas replacement plants nor Compensatory Megawatts are available, NYISO goes on to say ***“In the absence of the expected new generation facilities currently under construction, resource needs, as detailed in Table 1*** **[TABLE A-2 here]** ***of this report, would need to be met by one or more types of solutions including generation, transmission, energy efficiency, and demand response measures.”*** This vague statement may be the forerunner to justifying the construction of a huge gas facility located at the Indian Point site. This possibility is discussed in Section 4 of this report.

[6] NYISO Power Trends 2019, pages 28, 29.

2.2.4 Where is the Westchester County Zonal Capacity Risk Assessment?

New York State has not provided a comprehensive analysis of the impact of the closure of the Indian Point power plants. NYISO's 2018 Reliability Needs Assessment (RNA) on page 39 makes it clear that a zonal capacity risk assessment for Zone H, which includes Westchester County, should have been completed before any final decision can be made about closing down Indian Point.

This 2018 RNA 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".***

The 2018 RNA makes it clear that **the reliability analysis of the closure of Indian point is not yet complete.** Of all the zones in New York State, Zone H, which includes Westchester County, is in a particularly vulnerable situation. Note that in NYISO's 2018 RNA's Figure 28, "Zonal Capacity at Risk", Zone H is identified with the letters EZR, which means Exceeds Zonal Resources.

The need for a zonal capacity assessment is not new; exactly the same warning as presented in the 2018 RNA also appeared in the 2014 RNA. The 2014 RNA issued a strong warning about impacts of the closure of Indian Point ***"Significant violations of transmission security and resource adequacy criteria would occur in 2016 if the Indian Point plant were to be retired as of that time".*** At that time there were no new gas plants available to propose as replacements for Indian Point. Yet, today's proposed gas replacements already result in capacity and energy shortfalls, which gets increasingly severe if any of the power plants within the proposed gas replacements are not actually available.

Not only do the three proposed replacement gas plants present a shortfall in energy production, they are widely scattered with one plant in Bayonne, New Jersey, another in Orange County and the third in Dutchess County. This is clearly a very different grid distribution compared to Indian Point which is concentrated on a 0.40 square miles site, near to the areas of greatest electricity demand and within Westchester County. Although Westchester County is already highly constrained both in capacity and in transmission capability, experience shows that the present zonal arrangement works, even during peak demand periods, provided Indian Point is operational. The alternative widespread gas plant distribution has not yet been shown to be acceptable. NY State has to present, without further delay, a zonal capacity assessment specific to Westchester County to prove that significant violations of transmission security and resource adequacy criteria would not occur. **Not to complete this zonal capacity risk assessment would be irresponsible.**

3.0 NYC's Over-Aged Electricity Supply System

New York City is the economic engine for all of NY State and it is critical that it remains highly functional, e.g., that it has a reliable source of electricity. Satellite areas, like Westchester County, would also be particularly hard hit if NYC had economic difficulties. It is essential that the three gas power plants identified before are dedicated to supporting NYC.

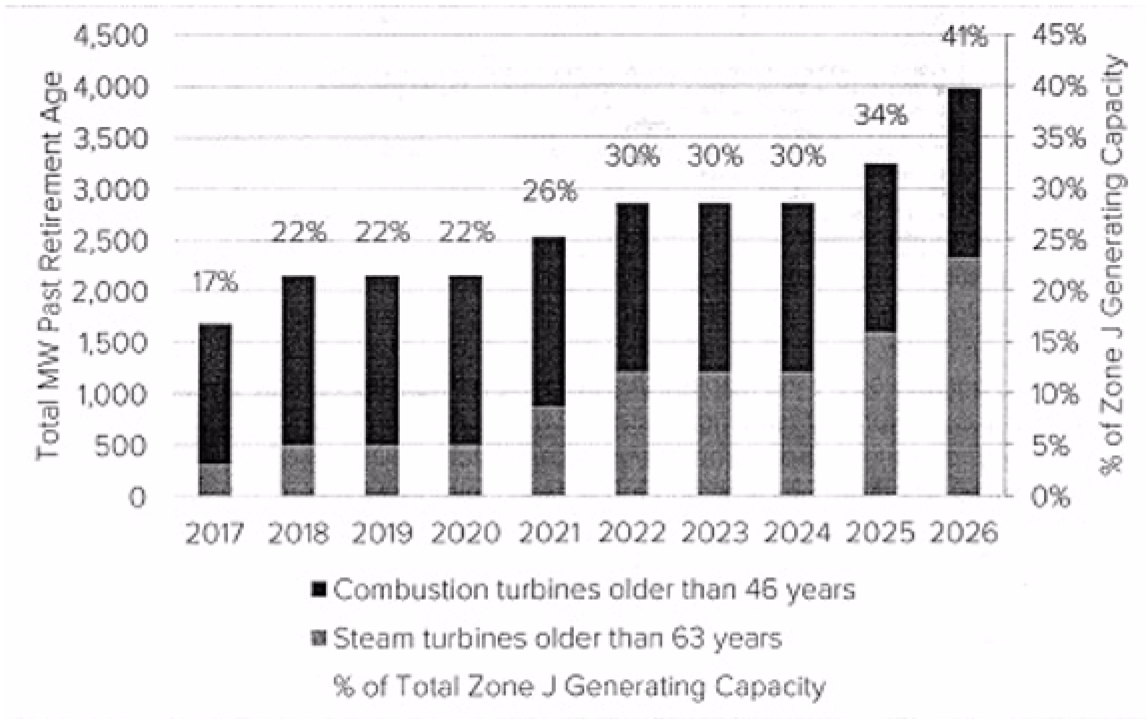
In addition to the potential loss of 25% of its electricity should Indian Point close, NYC is facing several major infrastructure issues. A large fraction of NYC's fossil fueled power plants are beyond the 95% retirement age[7]. Today 22% of NYC's fossil fueled power plants are beyond the point where some 95% of similar technology plants have already been retired. Unless corrective actions are taken, this over-aged percentage will rise to 41% by 2026 (See Figure A-1). Further, NYISO has identified 4,700 circuit-miles of the State's transmission grid in need of replacement at an estimated cost of $25 billion dollars over the next 30 years. In NYISO terminology, this is a condition of **"imminent deactivation".** In simple English this means that they could fail at any time. Certainly the "imminent deactivation" terminology also applies to NYC's over-aged gas power plants. With the closure of Indian Point, two concurrent "imminent deactivations" could exist, one from the over-aged NYC power plants and the other from reliability issues spawned by the Indian Point closure. The NYC subway system, already in disrepair, would be adversely affected if electricity supplies became inadequate.

We are already receiving energy infrastructure warnings. First, there was a spectacular transformer explosion in Astoria, Queens that lit up NYC's skyline in 2018. Then the unexpected gas moratorium declared for lower Westchester County. Nationally there have been other gas shortages, like the one that forced 7,000 people in Newport, Rhode Island to evacuate in single digit temperatures. An upstream pipeline fire resulted in unacceptably low gas pressure in Newport. As NY City expands, the demand for gas will increase, especially as the use of oil in power plants and for home heating is phased out. It is possible that expanding gas demands in NYC will extend the duration of the gas moratorium in Westchester County. One way to deal with gas shortages, as Consolidated Edison has recommended, is through greater use of heat pumps. Yet heat pumps require electricity and electricity shortages caused by the closure of Indian Point may limit the heat pump response to gas shortages.

---

[7] "New York City's Aging Power Plants: Risks, Replacement Options, and the Role of Energy Storage" Strategen Consulting, September 20, 2017.

FIGURE A-1 Over-Aged Gas Power Plants in New York City



4.0 A Worst Case Scenario

In the USA some new gas fueled power plants are being erected on the sites of former coal plants. This has happened at a number of locations within New York State. There are multiple advantages in refurbishing old coal plant sites. Having a registered property with a commercial zoning and possible other licenses and permits, is advantageous. There may be cost savings in using the existing switch yards, intake and discharge channels, administrative buildings, parking lots, lighting, emergency power, security, local roads, and so forth. Local governmental agencies, like Town and County governments, appreciate the jobs that are created and the benefits of having a major new industrial facility on their tax rolls. Having existing transmission lines right at the site is very valuable. Indian Point, located in a highly constrained transmission corridor, makes its existing transmission lines most valuable.

The Indian Point site has all the above benefits and one more major one. **It has a large gas pipeline running right through the site.** The Indian Point site is very small, only 0.40 square miles. Did the gas industry choose to route a major gas pipeline right through this very small area with the expectation that this ideal site could eventually house yet another large gas plant? NYISO's 2,000 to 2,600 MW of Compensatory Megawatts might be met with a single facility, perhaps with two Cricket Valley-sized gas plants fed by the existing gas pipeline.This would be much more preferable than piecemeal additions of 100 MW blocks as listed in TABLE A-2. There would be no concern about not performing a zonal capacity risk assessment. With the same power output as the Indian Point nuclear plants and placed at the same location, this potential gas plant(s) would look the same to the grid as the present Indian Point plants do.

Since it would take a number of years to construct such a new gas plant, NYISO might have to turn to the highly polluting peaker plants in NYC and run them more often to compensate for the loss of the Indian Point electricity. If there isn't enough gas to meet this additional load on these peaker plants, NYISO might turn to burning oil when necessary, using dual fuel plants in NYC. The additional health effects of this stop-gap manoeuvre could be significant.

The GHG released from such a huge additional gas facility at Indian point would add to the GHG emissions the Bayonne Uprate, CPV, and Cricket Valley plants. With this additional gas facility GHG would be about double than those presented earlier in this report.

A major new gas plant at Indian Point would be especially onerous for Riverkeeper. The Riverkeeper facility in Ossining would be downwind and might be exposed to poorer air quality conditions. The doubling of the GHG emissions would do harm to the Hudson River and surrounding areas through increased frequencies of climate change effects, such as more frequent large storms and warmer Hudson River water. Lastly, a large gas facility at Indian Point would result in continuing to add heat the Hudson River, as the Indian Point nuclear plants do now. This would defeat a major Riverkeeper goal.

NYISO has stated that ***"In the absence of the expected new generation facilities currently under construction, resource needs, as detailed in Table 1 of this report, would need to be met by one or more types of solutions including generation, transmission, energy efficiency, and demand response measures."*** It is possible that the generation and transmission words in this NYISO statement could be interpreted as justifying a huge gas plant at the Indian Point site, using the existing transmission lines.

Everyone who is concerned about the environment should seek to prevent this worst case scenario from happening.