Energy Efficiency and Renewable Energy Cannot Replace Indian Point

April 2020

HERSCHEL SPECTER

mhspecter@verizon.net

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.

Acknowledgements

The author wishes to thank Dr. Leonard Rodberg for his valuable help in analyzing the unusual event of the simultaneous shutdown of both Indian Point 2 and Indian Point 3 during March, 2019. Mr. Tom Zambito of the LoHud newspaper generously helped out too.

EE plus RE Cannot Replace Indian Point

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

Every nuclear plant in the United States that has recently closed has been replaced by fossil fuels; none by energy efficiency and none by renewable energy. Indian Point 2 (IP2) is scheduled to close on April 30, 2020 and Indian Point 3 (IP3) a year later. They will be replaced by gas, unless NY State reverses its policies.

New York State has never had an acceptable plan to replace Indian Point (IP) and does not have one now. An acceptable plan would replace base loaded IP with a reliable and sufficient source of carbon-free electricity. IP already achieves this while producing 80% of the carbon-free electricity in the Lower Hudson Valley. New York's nuclear units are highly reliable, running over 90% of the time. The highly productive IP plants generated more than 16,300 GW-hrs of clean electricity last year, meeting 25% of the electricity needs of NYC and Westchester County.

Replacing IP with gas would continue the string of energy planning failures by NY State and certain environmental groups that has been going on for years. What this report shows is that the latest replacement scheme, as proposed by the Public Service Commission (PSC), will also fail. Indian Point cannot be replaced by energy efficiency (EE) plus renewable energy (RE) within the scheduled closure dates and likely not for many more years.

The feasibility of EE + RE replacing IP is examined from three perspectives. First, it is shown that there are no historical data that support this PSC scheme. Further, there was a unique opportunity in March, 2019 for the PSC to demonstrate that EE + RE could replace IP, but the evidence shows that this did not happen. Second, there is a discussion showing that the basic replacement process used by the PSC is flawed. Third, there is a review of how EE and RE differ. Renewable energy puts electrons directly on the grid. EE also cannot put electrons directly on the grid but requires the intermediate step of using gas-fired power plants. The net result of this is to increase gas usage. **Replacing Indian Point with EE + RE doesn't work.**

Replacing IP with gas would be a huge environmental blunder. If IP were completely replaced by gas an additional 7 million metric tons of carbon dioxide, CO_2, would be released into the atmosphere year after year. If methane leakage from gas supply systems were accounted for, the number of tons of carbon dioxide equivalent, CO_2e, would exceed 7 million metric tons per year. A greenhouse gas (GHG) release of this magnitude would negate the whole purpose of NY's recently passed Climate Leadership and Community Protection Act. For example, New York plans to build the world's largest 9,000 megawatt off-shore wind farm by 2035. Because of the huge volume of GHG coming from the IP gas replacement plants year after year, it would not be until after 2040 that this giant off-shore wind farm showed a net reduction in accumulated GHG. A break-even date after 2040 is far too late to meet CLCPA mandates or to be effective in dealing with climate change.

It is well established that burning fossil fuels in power plants has health effects, especially respiratory health effects. For example, Astoria, Queens, close to the Ravenswood gas plant, is known as Asthma Alley. The Covid-19 virus attacks the respiratory system and people with pre-existing conditions like asthma, are at a heightened risk from this pandemic. If gas use is increased to replace Indian Point, especially in Environmental Justice areas, this could add to the large number of consequences unfolding daily. **Replacing IP with gas must not be allowed.** This conclusion is supported by wide group of people ranging from Governor Cuomo[1] to the Natural Resources Defense Council[2] (NRDC) to Riverkeeper[3].

Like the rest of the nation, New York faces a long road to economic recovery once this pandemic is over. This difficult economic recovery should not be further hobbled by shortages of electricity because IP was prematurely closed. Unemployment figures are skyrocketing. Can anyone justify putting over 1000 well paid employees and contractors out of work at a time like this? Are we willing to lose the hundreds of millions of dollars in tax revenues and community support each year that IP provides? The IP closure is the result of fear mongering fictions, like the false claim that an evacuation out to 50 miles would be necessary if an accident occurred. Evacuations beyond two miles are unnecessary and detrimental. Can any decision to close Indian Point survive scientific scrutiny?

With no viable non-carbon replacement scheme available, with very serious environmental and health consequences tied to greater use of gas in NYC, with many debunked myths about IP, with a need to create jobs, not destroy them, an emergency energy meeting should be called to prevent the IP2 closure until after this Covid-19 crisis is over and the economic recovery is well under-way.

2.0 The Presentation

On September 25, 2019, during a meeting of the Indian Point Closure Task Force (see Figure A-1), the PSC made a presentation (see Figure A-2) about replacing Indian Point with a combination of renewable energy (RE) and energy efficiency (EE). This PSC presentation has been described by Mr. Paul Gallay, President of Riverkeeper[4]: *"Since that time, NYS Public Service Commission figures document increases in renewable energy generation and reductions in demand that will exceed the amount of energy generated by the first Indian Point reactor, by the time it closes in 2020. In 2020 and 2021, a roughly similar amount of renewables and efficiency will come on line, replacing the energy supplied by the second reactor when it also shuts down in 2021."*

There is good reason for Riverkeeper to support this PSC presentation. In order to justify its actions to bring about the closure of Indian Point, another large and reliable source of carbon-free electricity had to be found. For years Riverkeeper relied on the Synapse report[5] that it and the

---

[1] Governor Cuomo's 2017 State-of-the-State address "Replacement Power Will Be In Place That Adds No New Carbon Emissions...".

[2] "Transitioning Away From Uneconomical Nuclear Power Plants", Dale Bryk and Jackson Morris, NRDC Issues Brief, November, 2018.

[3] "Riverkeeper pledges legal action against efforts to replace Indian Point with gas", Tom Zambito, Lohud newspaper, April 6, 2018 and "Why we say "no' to new fossil fuel projects like the CPV power plant and the Valley Lateral Pipeline", Paul Galley, Riverkeeper, January 5, 2018.

[4] "Riverkeeper Statement Regarding the Champlain Hudson Power Express", Riverkeeper, November 18, 2019.

[5] "Clean Energy for New York", Synapse Energy Economics, Inc., February 23, 2017.

NRDC had co-sponsored. The Synapse report claimed that IP could be replaced by a combination of enhanced energy efficiency and hydropower from Quebec, Canada, in a project identified as the CHPE, the Champlain Hudson Power Express. In spite of warnings from outside experts that the Synapse report had serious technical and administrative defects, Riverkeeper persisted in its support of CHPE. All this recently changed when Riverkeeper decided to withdraw its support of the CHPE. Riverkeeper offered two reasons for its withdrawal from CHPE. One reason was that the CHPE project would require the construction of dams that would be harmful to indigenous people in Canada. The dominant reason, however, appears to be the second reason offered: *“These changes have driven our decision to no longer support the TDI Project, which has yet to break ground despite original projections that it would come on line earlier this year.”*

Even without the dam issue Riverkeeper was in a difficult position because the whole CHPE project was years behind schedule and might never get built. Without CHPE what would Riverkeeper claim to be the clean energy source that would be ready to replace Indian Point 2? Riverkeeper needed another source of clean electricity to replace CHPE that would be reliable, sufficient, and operational by April 30, 2020. Therefore the PSC’s EE + RE presentation is crucial to Riverkeeper to continue to argue for IP’s closure.

If the PSC presentation collapses, what does Riverkeeper do then? Does it choose fossil fuels over Indian Point? Does Riverkeeper face the fact that its promotion of emergency response fictions has backfired and the resultant increase in GHG releases could lead to more frequent category 5 hurricanes like Superstorm Sandy[6], a large source of pollution of the Hudson River?

3.0 EE + RE Cannot Replace IP

3.1 Historic Data

In the over 40 years that IP2 and IP3 have operated there has never been an instance where either EE or RE has replaced any of the electrical output of IP2 or IP3. However, there are data that show that EE has displaced gas, as discussed later in this report.

3.2 A Unique Opportunity

3.2.1 Introduction

A unique opportunity presented itself in March, 2019 for the PSC to demonstrate that EE and/or RE has the potential to replace IP. At the same time that the Indian Point 3 nuclear unit was shut down during a normal refueling outage, Indian Point 2 automatically shut down when a generator malfunctioned. According to reporter Thomas Zambito *“When Indian Point experienced an unplanned total shutdown in March, natural gas’ contribution to the grid ticked upward while renewable sources like wind and solar continued to play a minor role”*. Further, Zambito wrote, *“With an assist from the grid’s overseers, the state’s energy sources shifted in a way that could offer a preview of what’s to come in the years ahead when Indian Point is scheduled to shut down for good.”*[7] This shift is towards greater use of gas. It was fortunate that this simultaneous loss of IP2 and IP3 occurred in March when the demand for electricity was at a seasonal low.

---

[6] “Sandy Devastating Impact to Hudson River Includes Widespread Toxic Spills”, Riverkeeper, October 30, 2012.

3.2.2 The RE Contribution

The NYISO dashboard was used to examine this unusual event and results are presented in Figure A-3 where the outage dates for IP2 and IP3 are plotted, as are the energy contributions from different energy sources. The simultaneous loss of both IP2 and IP3 was dealt with by increasing the energy from hydropower, gas, and dual use (gas/oil) sources. One important observation is that the contribution from wind power and from other renewable energy sources, not including hydropower, was small before, during, and after this dual outage. **During that time of need, RE, defined here as wind power and solar energy, did not and could not respond to the loss of both IP2 and IP3.** This lack of response is to be expected because neither wind power nor solar energy is a dispatchable source of electricity. A source of electricity is "dispatchable", as defined here, means that the amount of electricity from this source can be increased or decreased in order to keep the grid's electricity supply and demand in equilibrium. Hydropower in New York can be increased by using water drawn from upstream water impoundments, and is thus dispatchable. If the normal supply of electricity unexpectedly decreases, as was the case in this unusual event, actions can be taken to increase the water flowing through the hydro turbines. Similarly, within limits, more gas can be burned in the gas turbines if necessary to keep the electricity supply equal to the demand. Neither wind power nor solar energy are dispatchable sources of electricity. If more electricity is needed one can't make the winds blow harder or the sun shine brighter. Similarly, in situations where the supply of electricity on the grid already is in equilibrium with the demand, excess wind power and/or excess solar energy may have to be wasted in order not to overheat the grid. Until there are large amounts of dedicated energy storage, wind power and solar energy will not become dispatchable like hydropower with its upstream water storage capability. So even among renewable energy sources there are differences with wind power and solar energy having less flexibility than dispatchable hydro power. Nuclear power is dispatchable also, albeit not as capable of dealing with rapid changes in demand as well as gas turbines do. Because of their low fuel costs, nuclear power plants are most economical when they are operated at high capacity factors,i.e., they are well suited to be base load plants.Wind and solar energy are not well suited to be base load plants. Finally, hydro capacity in NY State is not expected to grow significantly beyond what it contributes now.

In addition to the fundamentally different characteristics between wind power and solar energy compared to nuclear power plants like IP, it is necessary to consider how limited wind power and solar energy are in New York at this time. Wind power only provides for about 2.6% of the State's electricity consumption and other renewable energy sources are even smaller at 1.8%. Last year the IP units produced 10.1% of the State's electricity consumption, over twice what wind plus other renewables produced.

The small contribution, the lack of dedicated energy storage, the inherent intermittency and variability characteristics, the lack of historic supporting data, and the non-performance during the March, 2019 dual outage, appear to rule out RE as a plausible replacement for IP for the foreseeable future. If EE + RE are to replace Indian Point, the bulk of this would have to be accomplished by EE.

---

[7] "Natural gas filled the gap when Indian Point shut down for nearly two weeks, data show", Thomas Zambito, Rockland/Westchester Journal News, April 2, 2019.

The fundamental characteristics of RE are very different from the characteristics of nuclear power. For example, Indian Point produces a constant amount of electricity, summer and winter. Solar energy production varies daily and also with the season. In winter months the output from solar panels ends before the peak winter demand occurs which is after sunset. Even if solar energy could match the MW-hrs of Indian Point, the time distribution of these MW-hrs are totally different. Attempting to equate RE to nuclear power involves a lot more than just comparing RE MW-hrs to Indian Point MW-hrs, as was done in the PSC presentation.

3.2.3 The EE Contribution

NYISO records of this unique opportunity in March, 2019 do not show any contribution from EE to fill in the gaps created by this unexpected dual closure. If the EE contribution in March, 2019 was as large as indicated in Figure A-3, then why is it that EE plus increases in hydropower + wind + other renewable sources were not sufficient to replace IP during this dual outage, thereby eliminating the use of gas? This question is addressed later.

FIGURE A-1 Indian Point Closure Task Force Meeting

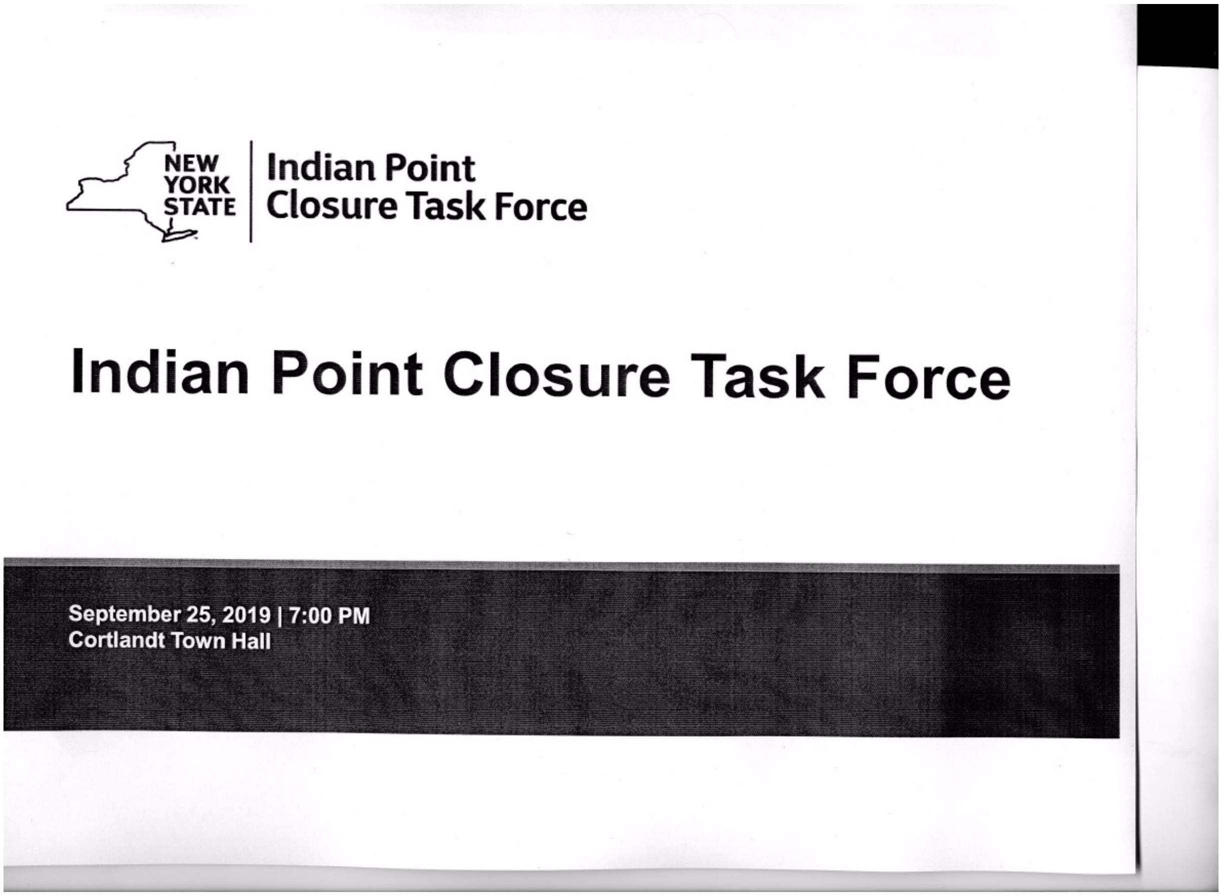


FIGURE A-2 PSC Presentation

Community Inquiries – EE & RE

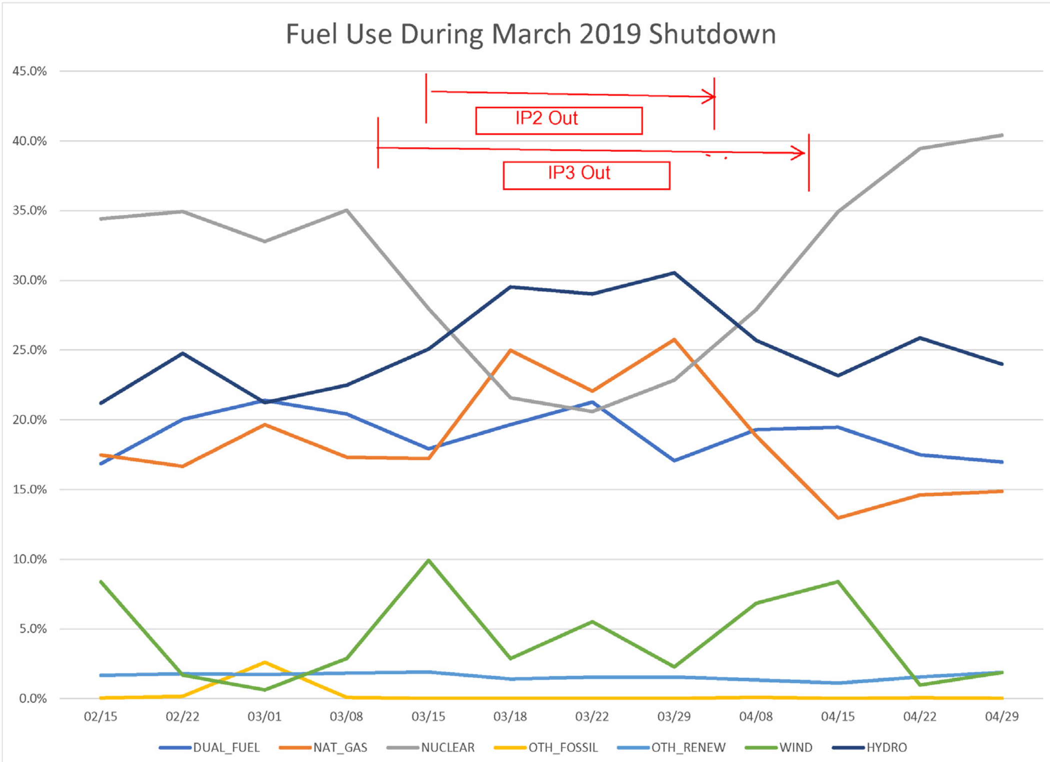
Achieved and Projected Energy Efficiency and Renewable Energy in NYS, 2011-2021 (MWh)

Achieved EE 2011-18[1]	8,354,434
Projected EE 2019-21[2]	*5,072,000*
Achieved RE 2011-18[3]	3,775,636
Projected RE 2019-21[3]	*5,574,127*
Total EE/RE 2011-21	**22,776,197**
Total IPEC Output[4]	**16,334,000**

1. Includes EEPS, ETIP, & CEF. Gross direct savings of IOUs and NYSERDA. Figures do not include ancillary savings. Per DMM EEPS Reporting Application (07-M-0548) and EE scorecards filed in DMM (15-M-0252)
2. Base targets + Dec 2018 Order targets (18-M-0084) + Targets from Appendix D of Dec 2018 Order (18-M-0084)
3. Includes solar, fuel cells, ADG, on-site wind, solar thermal, and large-scale renewables.
4. 2019 NYISO Gold Book

NEW YORK STATE | Indian Point Closure Task Force

FIGURE A-3 Fuel Use During March, 2019 Shutdown



4.0 A Fundamental Flaw in the PSC Analysis

When it comes to a complex electrical system like New York's, the sum of the parts is not equal to the whole. The sum of the RE parts, like wind turbines and solar panels, and the sum of the energy reducing parts, like energy efficient light bulbs, smart thermostats, better insulation, all expressed in MW-hrs, is not equal to the MW-hrs that Indian Point produces, even if these MW-hrs sums were numerically identical. One has to account for the restraints imposed on the transfer of electricity by the grid itself. The RE parts and the EE parts are spread out all over New York. In a precise analysis one would have to locate where each RE part and each EE part was located in the State, then determine all the pathways within the transmission system starting from these initial locations down to the end use systems served by Indian Point, like NYC's subways, and then, for each pathway, the ability to transfer electricity along each segment of each pathway.

A fundamental flaw in the PSC analysis is that it did not account for the restraints imposed by the grid itself. Without such an analysis one does not know what fraction of the EE + RE MW-hrs actually delivers electrons to the end uses served by IP.

The impact of the grid on the ability of electricity generators to deliver electricity to various end uses is not a new concern. NYISO has been making similar analyses called Zonal Capacity at Risk Analyses. NYISO has pointed out that 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 shortage of electricity might occur.

The 2018 NYISO Reliability Needs Assessment stated: *"The zonal capacity at risk assessment identifies a maximum level of capacity that can be removed from each zone without causing NYCA LOLE 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 locations."*

NYISO has provided an important insight when it analyzed the possibility of replacing Indian Point with three gas plants located at three different sites. NYISO made it clear that adding up the capacities from three gas plants does not prove that they are sufficient to replace Indian Point, even if their total capacities matched that of Indian Point. It takes a zonal capacity at risk assessment to demonstrate that combinations of multiple sources at different locations are sufficient to replace a single larger source of electricity. Such assessments are highly location dependent. It is not just the sizes of electricity sources, it is also how much electricity from these sources is actually deliverable, considering all the constraints that the interconnecting grid imposes on them. EE + RE represents many more small sources of electricity than three gas plants and they are spread out over many more locations. Unless a zonal capacity at risk assessment is made for all the EE + RE sources, just comparing their MWh sum to Indian Point's MWh production is insufficient.

5.0 Energy Efficiency (EE)

5.1 Differences Between RE and EE

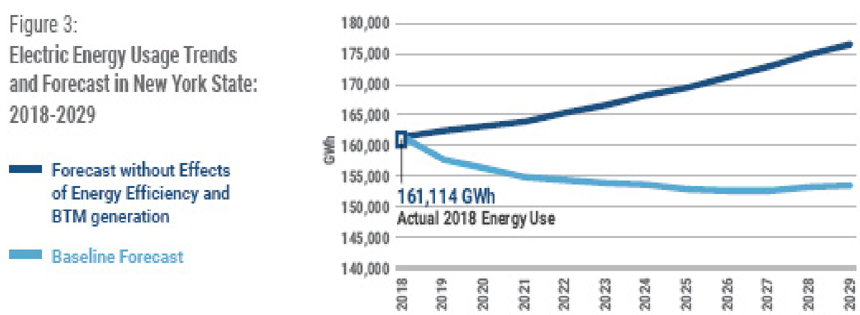
RE, like wind turbines and utility level solar panels, produce electricity that is added to the grid, as shown in Figure A-3. There is no line on Figure 3 representing energy efficiency because EE does not produce electricity but rather saves it. Since both nuclear power and hydropower are used to their maximum, EE does not reduce electricity generated by these sources. Similarly, EE does not reduce the number of electrons put on the grid by wind power and solar panels. Where then did EE save electricity?

The answer to the above question is that EE reduces gas usage. NYISO provides information about energy efficiency in Figures 3 and 4 of its 2019 Power Trends report, reproduced in this report. Figure 3, reproduced as FIGURE A-4 below, shows that there are significant Gigawatt-hour reductions in forecast electric energy usage because of energy efficiency. **Because of EE, these projected reductions are in gas usage and have significant environmental benefits.** For example, in year 2027 there is a projected decrease in electric energy use, i.e., gas use, of about 22,000 Gigawatt-hours due to the benefits of energy efficiency. This would result a GHG savings of about 9.4 million metric tons of CO_2 in just one year, compared to having gas burned in a modern combined cycle plants.

By lowering the demand for electricity EE reduces gas usage. When a gas plant's usage of gas is decreased due to energy efficiency it has an increase in reserve gas burning capacity, i.e., the power plant's capacity factor decreases because EE reduces gas usage, but the maximum ability of this gas plant to produce electricity does not change, i.e, although the gas plant's capacity factor decreases because of EE, its capacity does not. For example, the new Cricket Valley plant has a capacity of 1020 MW. Even if there were extensive implementation of EE and the Cricket Valley plant was used less often, its capacity would remain at 1020 MW. Should there be an unanticipated demand for electricity, similar to the March, 2019 Indian Point unusual event, the gas plant could increase its output to the same capacity factor it had before. The additional electrons the gas plant could generate is because EE gave this gas plant a larger reserve capability. This also means is that the way EE is manifested in situations of unusual demands is by greater amounts of gas fired electricity. This is profoundly different from RE. RE produces carbon free electricity. EE has to go through the intermediate step of having a power plant increase its output. EE does not deliver electrons directly to the end uses like RE does.

This observation has large impacts on the PSC analysis in that if EE were used to replace Indian Point it would be done by burning more gas. As such, EE would fail to meet the criterion of not replacing Indian Point with gas.

FIGURE A-4 Energy Efficiency Impacts on Electric Energy Forecasts, GWh



NYISO's Figure 4, reproduced as FIGURE A-5 below, shows the impact of energy efficiency on the peak megawatts needed in the electricity supply system. Peak electricity demand in New York is mostly met by burning gas. Any other use of EE, such as attempting to replace the Indian Point nuclear units, is an inferior use of EE compared to reducing peak gas demand.

FIGURE A-5 Electric Peak Demand in New York State, Actual & Forecast, MW