NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

In the Matter of a Renewal and Modification of a State Pollutant Discharge Elimination System ("SPDES") Permit Pursuant to article 17 of the Environmental Conservation Law and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York parts 704 and 750 *et seq*. by Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian Point 3, LLC, Permittee,

DEC # 3-5522-00011/00004
SPDES # NY-0004472

-and-

In the Matter of the Application by Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear Indian Point 3, LLC, and Entergy Nuclear Operations, LLC for a Certificate Pursuant to §401 of the Federal Clean Water Act.

DEC # 3-5522-00011/00030
DEC # 3-5522-00011/00031

DIRECT TESTIMONY OF ROBERT M. FAGAN REGARDING AIR EMISSIONS AND ELECTRIC SYSTEM RELIABILITY IMPACTS OF CLOSED-CYCLE COOLING, ON BEHALF OF INTERVENORS RIVERKEEPER, INC., SCENIC HUDSON, INC., AND NATURAL RESOURCES DEFENSE COUNCIL, INC.

A. Background and Experience

Q. Please state your name, business address and occupation.

A. My name is Robert M. Fagan. I am a Principal Associate at Synapse Energy Economics, 485 Massachusetts Ave., Cambridge, MA 02139.

Q. Please describe your educational and professional background and qualifications.

A. I hold an MA from Boston University in Energy and Environmental Studies (1992) and a BS from Clarkson University (then Clarkson College) in Mechanical Engineering (1981). I have completed additional course work in wind integration, solar engineering, regulatory and legal aspects of electric power systems, building controls, cogeneration, lighting design and mechanical and aerospace engineering.

I am a mechanical engineer and energy economics analyst, and I have analyzed energy industry issues for more than 25 years. My professional activities focus on many aspects of the electric power industry, in particular:

- Economic and technical analysis of electric supply and delivery systems
- Wholesale and retail electricity provision
- Energy and capacity market structures
- Renewable resource alternatives, including on-shore and off-shore wind and solar PV
- Assessment and implementation of energy efficiency and demand response alternatives.

I have expertise with respect to the complexities of, and the interrelationships between, the technical and economic dimensions of the electric power industry in the United States and Canada. My areas of focus include: wholesale energy and capacity provision under market-based and regulated structures; transmission use pricing, encompassing congestion management, losses, LMP, and alternatives; financial and physical transmission rights; and transmission asset pricing (e.g., embedded cost recovery tariffs).

My experience includes in-depth knowledge of physical transmission network characteristics; related generation dispatch/system operation functions; technical and economic attributes of generation resources; regional transmission organization (RTO) tariff and market rules structures and operation; and Federal Energy Regulatory Commission (FERC) regulatory policies and initiatives, including those pertaining to RTO and ISO development and evolution. I also have expertise with respect to the assessment of technical and economic dimensions of wind and solar power integration into utility power systems, and in utility demand side management and demand response impacts on the power system. My resume, which accurately reflects my background and experience, is included herewith as **Riverkeeper Exhibit 108**.

Q. What were you asked to do in preparing your testimony?

A. Riverkeeper asked me to assess the potential impacts to energy reliability and electric power sector air emissions associated with the construction and operation of a closed-cycle cooling system as the "best technology available" (BTA) for the Indian Point nuclear power plant, in order to inform the analysis being conducted by the New York State Department of Environmental Conservation (NYSDEC) under New York's State Environmental Quality

Review Act (SEQRA). For this portion of the State Pollutant Discharge Elimination System (SPDES) proceeding, Riverkeeper asked Synapse to provide an analysis of how an outage at the Indian Point Energy Center ("IPEC") to accommodate the installation of a closed-cycle cooling system would affect New York power sector emissions of CO_2, NO_X and SO_2 and electric power sector reliability. Riverkeeper also asked me to assess whether the operation of a closed-cycle cooling system at Indian Point would affect New York power sector emissions of CO_2, NO_X and SO_2 and electric power sector reliability.

With the assistance of colleagues, I have prepared a report entitled "Indian Point Energy Center: Effects of the Implementation of Closed-Cycle Cooling on New York Emissions and Reliability" which memorializes my analysis and supports this testimony. My report is attached hereto as **Riverkeeper Exhibit 109**. I will present a supplemental analysis with respect to interim and permanent seasonal fish protection outages in subsequent hearings, which I understand will follow the April 2014 hearings on closed-cycle cooling.

Q. What materials have you reviewed in preparation for your expert report and testimony?

A. The bibliography of our report lists the key documents reviewed for Synapse's analysis. We relied primarily upon New York State Public Service Commission (NYSPSC) Orders and Rulings, New York State utility company filings, and New York Independent System Operator (NY ISO) materials. In particular, Orders and filings in the NYSPSC Cases 12-E-0503 (Indian Point Contingency Planning) and 12-T-0502 (Alternating Current (AC) Transmission Upgrade Proceedings) and information available in the NY ISO 2013 Load & Capacity Data ("Gold Book") report informed our analysis.

We also reviewed report sections pertaining to closed-cycle cooling construction outages and closed cycle cooling operational parasitic losses and operational thermal efficiency losses contained in the following reports:

- June 2013 Tetra Tech Report entitled Indian Point Closed-Cycle Cooling System Retrofit Evaluation prepared on behalf of Department Staff;

● December 2013 TRC Report entitled New York State Environmental Quality Review Act, Entergy Response Document to the Tetra Tech Report and the Powers Engineering Report prepared on behalf of Entergy (hereinafter referred to as "December 2013 TRC Entergy Response Document");

● February 2010 Enercon Report entitled Engineering Feasibility and Costs of Conversion of Indian Point Units 2 and 3 to a Closed-Loop Condenser Cooling Water System, (with attachments);

● December 2013 NERA Report entitled "Impacts to the New York State Electricity System if Indian Point Energy Center Were Not Available" (APPENDIX E to December 2013 TRC Report) (hereinafter referred to as "NERA 2013 Electricity System Report"); and

● December 2013 NERA Report entitled "Wholly Disproportionate" Assessments of Cylindrical Wedgewire Screens and Cooling Towers at IPEC."

B. Methodology/Approach

Q. How did you model air emission impacts stemming from Indian Point outages for the construction of closed cycle cooling?

A. We used the Ventyx Market Analytics PROSYM model, which is a production cost model that simulates the operation of the electric power system with a high degree of spatial and temporal resolution. The PROSYM model is one of a number of industry standard models available to simulate electric power system operation, and it is generally accepted as an electric power system planning tool. Critically, it reflects the marginal operating costs of electric power resources and the inherent transmission system limitations on power flow. The U.S. Environmental Protection Agency (EPA) includes PROSYM among the models it considers available for quantifying air pollutant greenhouse gas (GHG) emission effects for clean energy initiatives.[1] PROSYM is an hourly dispatch model, with economic unit commitment, which is

[1] See, for example, an EPA background paper *Assessing the Multiple Benefits of Clean Energy*, Chapter 4.2.2, "Quantifying Air and GHG Emission Reductions from Clean Energy Measures." Table 4.2.4 (page 1), which lists PROSYM among the "sophisticated" modeling tools available to gauge greenhouse gas emission effects from clean

respective of zone-to-zone transmission path constraints. Its inputs include hourly load projections, generation and demand-side resource cost and performance data, and transmission system representation with associated zone-to-zone limits. Appendix B of my report contains additional descriptive detail of the PROSYM model. We use the model to forecast the change in generation and emissions resulting from outages of the IPEC units.

As part of our analysis, we also modeled outage scenarios under different New York State load and resource assumptions to develop a range of projected emission impacts in New York, over both the near term and the longer term. We analyzed emissions over the 2015-2025 period. The scenario analysis gauges the sensitivity of pollutant emissions to changes in key underlying assumptions – the major factors – that lead to pollutant emissions. An outage at IPEC is one of many factors that influence the level of pollutant emissions in New York.

Q. What IPEC outage scenarios did you consider in your analysis of potential emissions impacts and why?

A. Based on my review of NYSDEC's June 2013 Tetra Tech report and Entergy's February 12, 2010 Enercon report, it is my understanding that the most extensive and the longest full-time closed cycle cooling construction outage proposed would involve both Indian Point units being offline for 42-weeks in order to install a closed-cycle cooling configuration at Indian Point. Tetra Tech, on the other hand, has estimated that construction outages of 30 and 35 weeks for Indian Point Units 2 and 3, respectively, would be required in order to install the proposed Tetra Tech closed-cycle cooling configuration.

With this in mind, we modeled a scenario with IPEC in-service to serve as a baseline, a scenario with IPEC out-of-service beginning in 2016 through 2025 to serve as a bookend, and a scenario that simulated construction outages for the installation of closed cycle cooling for both plants in one-year sequential outages with consideration for the outage timeframes suggested by NYSDEC and Entergy. In particular, this closed-cycle cooling construction outage scenario was conservatively modeled as a one-year outage for each unit, in sequence (in 2017, Unit 3; and

energy resources. Available at http://www.epa.gov/statelocalclimate/documents/pdf/background_paper_1-30-2012.pdf.

2018, Unit 2).[2] We modeled a one-year outage at each plant to reflect a more conservative estimate of time to complete the closed cycle cooling system construction for one unit, relative to the 42-week or 30-week and 35-week estimates from the Enercon[3] and Tetra Tech[4] reports, respectively. We modeled sequential outages as one possible path to a dual-unit retrofit to closed-cycle cooling. We considered this to be a reasonable and logical circumstance. For example, NYSDEC's Tetra Tech report points out that "it is [] unclear why both units must be retrofitted simultaneously."[5] However, our analysis also accounts for and presents the results of a scenario in which closed cycle cooling is constructed concurrently at both units during the same year. In particular, the modeling of our bookend scenario in which both generating units at IPEC are fully out of service from 2016-2025 provides data on emission effects if both units were to be taken out of service simultaneously for any specific one year timeframe for installation of two closed cycle cooling structures, one for each unit. In any event, by examining scenarios in which both Indian Point units are out of service concurrently from 2016-2025, our analysis is conservative and bounds the results in relation to shorter construction outages associated with the construction of closed-cycle cooling.

Q. Please explain why you modelled each outage scenario with different New York State load and resource assumptions.

A. We used two different load projections and two different sets of renewable resource development projections to assess how the emissions effects (with IPEC out of service for sequential year-long outages for the installation of closed cycle cooling) changes over time under

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[2] In this scenario, we also assumed an outage of 60 days in 2016 for both units (in addition to the refueling outage for unit 2 in 2016) and 60 days in 2017 for unit 2 to accommodate possible interim mitigation strategies prior to the installation of closed-cycle cooling. As explained in my report, I am aware that interim mitigation measures will be the subject of a different, later phase of the Indian Point hearing process. Synapse incorporated the 60-day outage assumption in order to reflect and model a more realistic and conservative scenario of closed cycle cooling construction at Indian Point. Synapse is further aware that there will be a range of interim outage scenarios which may be longer or shorter than Synapse's 60-day assumption. We note that Synapse will be providing a separate emissions and reliability analysis to specifically address interim and permanent fish protection outages in connection with the next phase of the hearings in this case, and at that time, Synapse will address a wider range of fish protection outage assumptions.

[3] Enercon, Conversion of Indian Point Units 2 & 3 to a Closed-Loop Cooling Water Configuration (Feb. 12, 2010), Attachment 9, Construction Schedule, Section 1: Conversion of Unit 2 and Unit 3, Section 2: Conversion of Only Unit 2, Section 3: Conversion of Only Unit 3. The sections of this attachment report a 210 day (42 week) outage for either concurrent (Section 1), or individual (Sections 2 and 3) unit construction.

[4] Tetra Tech, Indian Point Closed Cycle Cooling System Retrofit Evaluation, June 2013.

[5] Tetra Tech, Indian Point Closed Cycle Cooling System Retrofit Evaluation, June 2013 at Appendix B (Memorandum from Tim Harvey, Tetra Tech, Inc. to Chris Hogan (NYSDEC) Re: 2003 Enercon Report Review—Revised (Nov. 18, 2009) at 7).

different assumptions for these key factors. Our report contains a table showing the matrix of values used for each of 10 total scenarios: one with IPEC in service with baseline assumptions; four with IPEC fully out of service from 2016-2025 as a bookend; four with IPEC out of service for sequential year-long outages for the installation of closed cycle cooling; and one final scenario with IPEC in service, but using different load and renewable resource development projections than the baseline assumptions.[6]

Q. How did you assess electric system reliability impacts stemming from Indian Point outages for the construction of closed cycle cooling?

A. We did not assess reliability as part of our 8,760-hour modeling of the emission impacts stemming from construction outages for closed cycle cooling. Reliability assessment is done in a different manner. When the NY ISO formally tests for reliability,[7] they use power flow modeling (not air emissions modeling) that focuses on a snapshot in time – one hour of peak stress on the system – under various "worst case" conditions. The various "worst case" conditions tested for reliability include the system with IPEC out of service coupled with the unexpected loss of additional elements of the system, e.g., the loss of two major transmission lines. For example, reliability tests look at whether or not elements of the transmission system are overloaded; or if voltage levels fail to meet threshold values, during such posited extreme events. All of these "worst case" conditions, formally tested by the NY ISO and reported on in the 2012 Reliability Needs Assessment (RNA), presumed IPEC fully out of service as of the summer of 2016. That is the benchmark for testing reliability under any possible outage conditions at IPEC that occur during the summer peak stress period, independent of whether that outage occurs because of closed cycle cooling construction or some form of interim or permanent seasonal outage requirement. Our assessment of reliability examined the NY ISO 2012 RNA results and the ongoing actions being taken by the NYS PSC to ensure reliability violations are not seen in 2016

[6] **Riverkeeper Exhibit 109**, Synapse IPEC Report, Table 3, PROSYM Scenarios Modelled, page 16.
[7] The New York ISO is responsible for reliability of the New York State electric power system.

in the event that IPEC was not in service as of that year.[8] Our report describes our approach to this assessment.[9]

Q. Did your analysis of air emissions and electric reliability impacts consider parasitic losses, generation losses, and thermal efficiency losses associated with the operation of Indian Point with a closed cycle cooling system?

A. NYSDEC's Tetra Tech report describes the parasitic losses and the thermal efficiency losses that would occur as a result of the operation of closed-cycle cooling at IPEC.[10] Those losses equate to a relatively small fraction of the annual energy output of the IPEC units, and a relatively small fraction of the summer capability of the units.[11] From the perspective of reliability concerns, a summer period outage of the IPEC units is a much more important condition to test; if reliability can be ensured under such an outage circumstance, then reliability is also ensured (all else equal) under IPEC operation after closed-cycle cooling is installed and parasitic and thermal efficiency loss effects are permanent. From a system emissions perspective, the thermal efficiency and parasitic loss effects are akin to "noise." For example, those effects can be far exceeded by load forecast variation in New York State.[12] For that reason, it was not necessary to directly account for these negligible changes in IPEC output when modeling New York State emissions impacts.

Q. Can you summarize your conclusion with respect to the impacts to energy reliability and electric power sector air emissions associated with the operation of a closed-cycle cooling system at Indian Point?

[8] Counsel for Riverkeeper has informed Synapse that Riverkeeper's position is that scenarios relating to shutdown of the facility in connection with NYSDEC April 2, 2010 Denial of Entergy's requested Clean Water Act Section 401 water quality certification is properly the subject of review under the National Environmental Policy Act (NEPA) in connection with the Entergy NRC license renewal proceeding rather than under the NYSDEC SEQRA review process. We have analyzed the dual-outage scenario as a "worst case"/bounding scenario as discussed herein without prejudice to that position.
[9] **Riverkeeper Exhibit 109**, Synapse IPEC Report, Section 3.
[10] Tetra Tech, Indian Point Closed Cycle Cooling System Retrofit Evaluation, June 2013, at section 2.3.4 (pages 19-20) and section 2.6 (page 25).
[11] The Tetra Tech report states that parasitic losses would be up to 40.4 MW, and thermal efficiency losses would average 20 MW total (both units) over the course of the year. Tetra Tech, Indian Point Closed Cycle Cooling System Retrofit Evaluation, June 2013, at 19, 25.
[12] For example, the difference between "high" and "baseline" peak load forecast for New York State for 2014 is more than 2,500 MW; and the difference between "high" and "baseline" energy consumption is 2,969 GWh for 2014, equal to an average of 339 MW. NY ISO 2013 "Gold Book", Table I-1, "NYCA Energy and Demand Forecasts with Statewide Energy Efficiency Impacts."

A. There are no system reliability impacts associated with operation of closed-cycle cooling at Indian Point. Projected New York State electric power system air emission effects from operation of closed-cycle cooling are *de minimis*; their net effect is not discernible when considering load forecast variation in the State.

Q. Did you analyze the potential impacts to energy costs as a result of outages and generation losses associated with the construction and operation of closed-cycle cooling at Indian Point?

A. To a limited degree. While our analysis was focused on electric power sector emissions and reliability concerns, our economic dispatch modelling of emissions did allow us to assess differences in wholesale energy prices under different IPEC outage scenarios. We did not explicitly assess capacity price effects or other components of cost for electric power service.[13]

C. Results of Analysis

Q. Please briefly summarize the findings of your report on electric power sector air emissions under different IPEC outage scenarios.

A. Under all outage and resource development scenarios, SO_2 emissions continue to decline in New York State.[14] Under all outage and resource development scenarios, NO_X emissions in New York State decline over time, with upward spikes in emissions only for one or two early years and only for scenarios that do not consider increases in energy efficiency and renewable energy development compared to the baseline.[15] Notably, statewide NO_X emissions decline in all years relative to the base year 2015 even if the IPEC units were out of service for the entire year for the construction of closed cycle cooling in any year, if increased energy efficiency and renewable energy deployment is considered.[16] In scenarios considering increased energy efficiency and renewable energy, with IPEC out of service for the construction of closed cycle

[13] Total costs of retail electricity include wholesale energy costs, wholesale capacity costs, transmission costs, distribution costs, and various other costs borne by the utility company and retail providers. We did not examine those other costs as part of our assessment.

[14] **Riverkeeper Exhibit 109**, Synapse IPEC Report, Figure 8.

[15] **Riverkeeper Exhibit 109**, Synapse IPEC Report, Figure 9. For example, as seen in the data table below the line graph, in the worst case of spiking NO_X emissions, scenario 11 (IPEC both units out of service), NO_X emissions rise from 18.7 thousand metric tons in the base year 2015, to 21.2 thousand metric tons in 2016, and then 19.8 thousand metric tons in 2017. However, by 2018 NO_X emissions are down to 16.2 thousand metric tons, below the 2015 baseline level.

[16] **Riverkeeper Exhibit 109**, Synapse IPEC Report, Figure 9, Scenarios 14 and 34.

cooling, CO_2 emissions decline relative to the base case, through 2019; and thereafter CO_2 emissions tend to flatten out.[17] For modeled scenarios involving the sequential construction of closed cycle cooling at Units 3 and in 2017 and Unit 2 in 2018 that do not consider increases in energy efficiency and renewable energy development, CO_2 emissions increase for the early years (which assumes the units would be out of service for some period for construction during those early years); but even those scenarios show declines relative to base year 2015 CO_2 emissions in the later years of the modeling period (2019-2025) as the IPEC units are back online, and the effects of baseline wind and transmission improvements are seen.[18] Notably, this scenario is conservative since it assumes that the construction outage will occur early within the range of years analyzed and in later years emissions would be progressively less as additional renewable energy sources are available and implemented.

In general, we found a range of possible emissions projections across the State exists for the period 2015-2025, as the level of emissions for CO_2, SO_2 and NO_X varies depending critically on the assumptions made for renewable resource development paths and implementation of energy efficiency across the State. Generally, even under baseline load and resource development conditions, NO_X and SO_2 emissions decline over the 2015-2025 period. Generally, CO_2 emissions exhibit a flatter pattern after 2019, when the full effects of projected transmission improvements in upstate New York are expected.

Q. Please briefly summarize the findings of your report in relation to electric system reliability, and in relation to replacement power under different IPEC outage scenarios.

A. We found that ongoing developments in the Reliability Contingency Plan docket[19] before the NYSPSC, and the AC Transmission Proceeding docket,[20] along with anticipated availability

[17] **Riverkeeper Exhibit 109**, Synapse IPEC Report, Figure 7, Scenarios 14 and 34.
[18] **Riverkeeper Exhibit 109**, Synapse IPEC Report, Figure 7, Scenarios 11 and 31. Scenario 11 sees a CO_2 spike of 5.8 million metric tons in 2016, and scenario 31 sees a spike of 1.6 million metric tons.
[19] New York Public Service Commission Case 12-E-0503.
[20] New York Public Service Commission Case 12-T-0502.

of market-based capacity from existing or new resources,[21] will relieve any reliability deficiency that would result if IPEC was out-of-service for *any* reason as of 2016.[22]

We found that replacement power during times when IPEC would be out of service for the construction of closed cycle cooling is sourced from three major locations: i) imports of power from Quebec, Ontario, PJM and New England; ii) upstate gas-fired resources, and iii) downstate gas-fired resources. Generally, under baseline conditions, New York City gas-fired resources represent roughly 20%-25% of the replacement power. Under conditions where the effect of energy efficiency and incremental development of renewable resources is considered, these energy efficiency and renewable resources make up most of the replacement power; they further help to displace some coal-fired and imported energy, and the resulting residual need is made up of upstate and downstate gas-fired resources, and imported resources.[23]

Q. Please briefly summarize the findings of your report in relation to impacts to wholesale market energy prices that may result from outages and generation losses associated with the construction and operation of closed-cycle cooling at Indian Point?

A. During any outage of IPEC, the wholesale energy market price effects are relatively minimal, and under scenarios with increased levels of energy efficiency and renewable energy deployment, those effects are mitigated considerably.[24] During *operation* of closed cycle cooling, system-wide price effects from the decrease in IPEC net output would be barely discernible from normal variation in prices due to varying load and resource output on the system.

D. Initial Response with Respect to Positions Taken by Entergy

Q. What is your understanding of the positions taken by Entergy in the NERA 2013 Electricity System Report with respect to air emissions and electric system reliability impacts associated with closed-cycle cooling at Indian Point?

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[21] *See*, *e.g.*, NYS PSC Case 12-E-0503, Order Accepting IPEC Reliability Contingency Plans, Establishing Cost Allocation and Recovery, and Denying Requests for Rehearing (November 4, 2013), at pp. 6-7. This Order has been included in Appendix C of my expert report.
[22] *See* **Riverkeeper Exhibit 109**, Synapse IPEC Report, Section 3.
[23] **Riverkeeper Exhibit 109**, Synapse IPEC Report, Tables 1 and 2.
[24] **Riverkeeper Exhibit 109**, Section 2.3.

A. The NERA 2013 Electricity System Report does not assess reliability or air emissions specifically associated with construction and operation of closed cycle cooling at Indian Point. It does assess air emissions and reliability associated an outage of both units at IPEC over 2015-2019.

The NERA 2013 Electricity System Report appears to state that there would be "LARGE" impacts on reliability of the New York State electricity system if both units of IPEC were not available. NERA presumes transmission, energy efficiency and "various additional adjustments" are made to "meet the reliability requirements if IPEC were not available" for the purposes of its capacity and energy price modeling, on which it relies for its emissions assessment.[25] For reliability, the NERA 2013 Electricity System Report relies upon a 2006 study and the NY ISO 2012 RNA in drawing its conclusions,[26] which state that "all else equal, loss of IPEC from the New York State electricity system would have significant adverse impacts on reliability in New York State."[27]

The NERA 2013 Electricity System Report states that increases in CO_2 and NO_X emissions would result if IPEC were not available. It relies on ProMod IV modeling over the period 2015-2019 to assess emission impacts with IPEC fully out of service.

Q. Do you have an initial response and/or opinion with respect to the positions taken by Entergy in the NERA 2013 Electricity System Report in relation to air emissions and reliability impacts stemming from the construction and operation of closed cycle cooling at Indian Point?

A. Yes. Generally, I do not agree with the methodology, analysis, and conclusions contained in NERA's report.

The NERA 2013 Electricity System Report references the results of a 2006 study in support of its conclusion on reliability impacts. It also references the results of the NY ISO 2012 RNA to support its conclusions. However, the report appears to improperly fail to take into account the

[25] December 2013 TRC Entergy Response Document, Section 3.2.3.2; NERA 2013 Electricity System Report at pages S-1 to S-2.
[26] December 2013 TRC Entergy Response Document, Section 3.2.3.2, pages 3-6 to 3-7.
[27] NERA 2013 Electricity System Report at S-1.

transmission, energy efficiency, and "additional adjustments" to system resources that it does use in its air emissions modeling, when it provides a conclusion on reliability. NERA's reliability conclusion is caveated – NERA states "all else equal" when opining on the impact of the loss of IPEC.[28] However, all else is not equal – a fact seemingly recognized by NERA in its inclusion of the NYSPSC Reliability Contingency Plan elements into its air emissions modeling.[29]

NERA's air emission modeling results do not reflect any assessment of impacts under resource development scenarios that include more than baseline levels of energy efficiency, adjusted NYC peak demand to reflect the NYS PSC Reliability Contingency Plan targets,[30] and wind power.[31] NERA's air emissions analysis also does not account for expected future transmission upgrades[32] to critical upstate transmission interfaces that have a significant effect on congestion and the ability to flow more upstate power to downstate New York. All of these factors have a significant effect on New York State emissions. NERA's modeling does not explore the ramifications of these factors.

For these reasons, which I may discuss in further detail in future testimony, I do not believe that NERA's analysis is valid, relevant, or helpful.

D. Conclusion

Q. Please summarize your opinions and conclusions with respect to air emissions and electric system reliability impacts stemming from the installation and construction of closed-cycle cooling at Indian Point.

A. First, electric power sector emissions decline over time across all scenarios of possible IPEC outages for the construction of closed cycle cooling. Importantly, my analysis incorporated a number of conservative assumptions and, accordingly, provides bounding results with respect to air emissions impacts resulting from the construction of closed cycle cooling.

[28] NERA 2013 Electricity System Report at S-1.
[29] NERA 2013 Electricity System Report at S-2.
[30] NERA 2013 Electricity System Report, Appendix D, PROMOD Inputs, page D-9 to D-10 ("Beyond the energy efficiency projected to shave NYC peak demand in the ConEd contingency plan, we do not model additional changes to peak demand projections in our IPEC Not Available scenario.").
[31] NERA 2013 Electricity System Report, Appendix D, PROMOD Inputs, page D-2, Table D-1. Table D-1 of NERA's report includes 3 wind farms totaling 309 MW.
[32] NERA 2013 Electricity System Report, Appendix D, PROMOD Inputs, page D-13 ("We do not model any change to our transmission system in the IPEC Not Available scenario.").

Even under analyzed scenarios where emissions spike during year-long sequential construction outages of Units 3 and 2 in 2017 and 2018, respectively, emissions return to lower levels once the units are back online. In scenarios where we tested the effects of higher levels of energy efficiency, wind and solar PV installation, emissions of SO_2, NO_X and CO_2 declined in all years relative to the base year 2015 with baseline levels of efficiency, wind and solar PV.

Second, reliability is not threatened if IPEC is operating with closed-cycle cooling in place. During construction outages for IPEC closed cycle cooling installation, reliability will not be threatened as long as the planned and approved transmission and energy efficiency resources ordered by NYSPSC are in place as intended by the summer of 2016, and as long as anticipated market-based resource development or reactivation/repair is completed.

Q. Do you hold all of the opinions expressed in your testimony and supporting Report to a reasonable degree of scientific certainty?

A. Yes.

Q. Does this conclude your direct testimony?

A. Yes.

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