Submission of Indicated New York Transmission Owners
For Authority to Construct and Operate Electric Transmission Facilities in Multiple Counties in New York

Case 13-M-0457

Exhibit E-4
Engineering Justification

Knickerbocker to Pleasant Valley 345 kV Transmission Line Project (KB-PV)

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KNICKERBOCKER TO PLEASANT VALLEY
345 KV TRANSMISSION LINE PROJECT
(KB-PV)

EXHIBIT E-4: ENGINEERING JUSTIFICATION

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EXHIBIT E-4: ENGINEERING JUSTIFICATION

E-4.1 Summary of engineering justification for proposed line, showing its relation to Applicant's existing facilities and the interconnected network

The Public Service Commission ("Commission") instituted this proceeding in 2012 "to examine possible solutions to the problem of persistent congestion on portions of the New York Transmission System."[2] The congestion problem has been well documented in the 2011 and 2013 New York Independent System Operator ("NYISO") Congestion Assessment and Resource Integration Studies ("CARIS"), the 2012 New York State Transmission Assessment and Reliability ("STARS") report, and the U.S. Department of Energy Draft "National Electric Transmission Congestion Study". Resource adequacy and transmission reliability issues have also been described in the 2014 NYISO Reliability Needs Assessment ("RNA").

In addition to congestion, reliability and resource adequacy, the transmission system in New York faces the following challenges:

- Aging infrastructure, which reduces resiliency to extreme weather events
- Limited capacity to address changes to the state generation portfolio
- Need to create a new NYISO capacity zone encompassing Load Zones G, H, I, and J ("New G-J Local Capacity Zone"), which could be avoided by increasing the UPNY/SENY transmission capacity
- Limited capacity to integrate renewable energy resources in the western part of the state
- Limited access to generation sources that would lower emissions
- Limited ability to expand the bulk transmission system
- Limited system robustness to respond to system operational needs.

As a long-term solution to these problems, the following project is proposed: the construction of a new 345 kV overhead electric transmission line from a new Knickerbocker Switching Station in the Town of Schodack, Rensselaer County, New York to the Pleasant Valley Substation in the Town of Pleasant Valley, Dutchess County, New York over a distance of approximately 54.2 miles ("KB-PV," the "Knickerbocker to Pleasant Valley 345 kV Transmission Line," the "KB-PV Project," "KB-PV," or the "Project").

[2] Case 12-T-0502 – Proceeding on Motion of the Commission to Examine Alternating Current Transmission Upgrades.

The Project will increase the UPNY/SENY interface capability and significantly decrease congestion. The Project will replace some infrastructure that is over 80 years old.

E-4.1.1 New York Transmission System Congestion

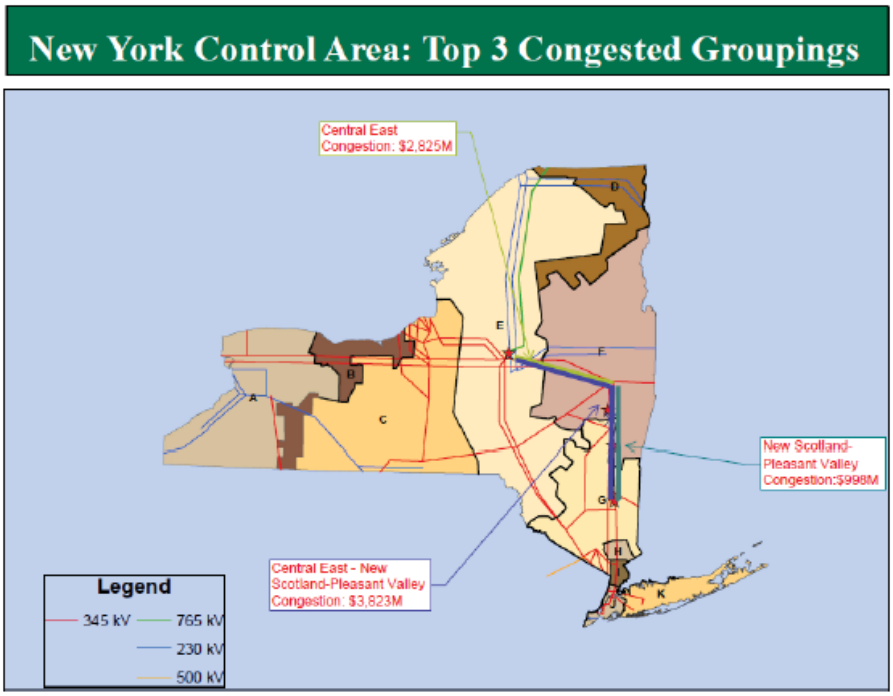
The electric transmission system moves power from across the State in a generally west to east, north to south direction. The western and northern regions of the State are net exporters of electric generation, whereas the more heavily populated southeastern regions of the State are net importers of electricity. Much of the existing and potential generation in the western and northern regions of the State can produce at a lower total cost than the generation in the southern and eastern regions of the State. While there remains a need for local generation in the downstate region, many producers and consumers across the State can benefit if electricity exports can increase from upstate to downstate. For example, while consumers in some areas of the State will have access to lower-priced electricity, suppliers in other areas of the State will have an increased opportunity to compete for sales throughout the State if transmission congestion across Central East and UPNY/SENY is reduced.

Currently, transmitting electricity between regions in the State is limited by the lack of sufficient transmission transfer capability. When export flows reach the transmission transfer capability, the transmission system becomes constrained, or congested, and less efficient local generation is needed to meet customer needs. These constraints have a negative environmental, reliability, and cost impact on consumers.[3]

CARIS 2013 reported on the top three congested groupings in the New York Control Area ("NYCA") and are shown in Figure E-4-1. The three groups are Central East to New Scotland to Pleasant Valley, New Scotland to Pleasant Valley, and Central East, which are the target interfaces for this proceeding. The total projected "demand$ congestion"[4] across these groups through 2022 is approximately $3.8 billion.

[3] According to the NYISO's 2013 CARIS report, these constraints increased wholesale electricity cost to New York consumers by approximately $6.7 billion from 2008-2012.
[4] Demand$ congestion is the congestion component of load payments. Refer to the 2013 CARIS report for a further explanation of "demand$ congestion".

Figure E-4-1: New York Control Area: Top 3 Congested Groupings*



* From *2013 CARIS Report, NYISO, Dec. 9. 2013. Congestion value is the present value of congestion over a ten year period in 2013 dollars.*

The STARS initiative examined the economics and reliability benefits of eliminating these constraints by replacing and/or expanding existing transmission infrastructure, including advancing projects that might be needed in the future based on transmission condition assessment. The STARS initiative has demonstrated that transmission projects will increase upstate to downstate normal transfer capability on critical transmission interfaces, as shown in Table E-4-1 below.

Table E-4-1: Increase in Upstate to Downstate Normal Transfer Capability (Source: 2012 STARS Report)

NYISO Transmission Interface	Base Case Limit (MW)	New Limit (MW)	Net Increase (MW)
UPNY/SENY	5,942	7,462	+1,520
Central East	3,151	3,595	+444

E-4.1.2 Aging Transmission Infrastructure

New York's transmission grid is aging. Over 80% of the high voltage electric transmission system has been in-service for over 30 years. According to the comprehensive STARS analysis, which began in 2008, approximately 4,700 of the State's 11,000 miles of high voltage transmission lines may need to be replaced in the next 30 years. The aging infrastructure presents an increasing reliability and resiliency concern and therefore new transmission facilities are needed. Some of the transmission facilities located through the Mohawk Valley and Hudson Valley regions are over 80 years old. They are not constructed to the most recent design standards, and as such, may not provide the most resiliency during times of extreme weather events.

E-4.1.3 Resource Adequacy

To ensure adequate supplies of electricity during the peak electric demand periods of the year, the total generation installed must exceed the peak load by a reliability reserve margin such that consumers can expect a major service outage no more than one day in ten years. The size of this margin is affected by the presence of transmission constraints which prevent some generation upstate from reaching the higher load regions downstate.

As the reserve margin continues to narrow with generation retirements, it is imperative that the electric system be free from constraints to allow generation anywhere on the system to reach the load. The Energy Highway Blueprint noted the importance of planning for contingencies that are not considered in the NYISO's Reliability Planning Process. In response to that concern, the Commission initiated a proceeding to address such contingencies. The first contingency addressed by the Commission is the reliability risks to the transmission grid in the event that the Nuclear Regulatory Commission does not renew the license for Indian Point Energy Center ("IPEC") by the end of 2015.[5] While the uncertain future of IPEC adds a significant reliability threat that needs to be addressed with transmission upgrades, these upgrades will mitigate the impact from other generator retirements. New York's generation portfolio is dynamic and will change as economic and regulatory drivers change. A robust and well planned transmission system is necessary to have the flexibility to address contingencies that may occur in the future and to avoid significant reliability impacts or significant cost impacts due to the need for uneconomic gap solutions as a result of generation retirements.

[5] *Energy Highway Blueprint* at pp. 48-49.

Equally important, with adequate transmission, generators that have become uneconomic or obsolete would be permitted to retire, and it would not be necessary to keep such generators in service through uneconomic contracts because they are needed to maintain reliability. For example, the approximately 500 MW Danskammer generating plant in the lower Hudson Valley was set to be decommissioned in 2014 until the plant's owner signed a four-year capacity sales contract with Central Hudson. However, Danskammer's future is uncertain beyond the four-year capacity contract term. The potential for generating plants such as Danskammer to mothball or retire on short notice can lead to reliability problems on both a local and a bulk system level and would be addressed by the Project. However, transmission projects have long lead times and they are typically not a viable option to address reliability concerns caused by unit retirements unless they are planned well in advance.

E-4.1.4 Brief Description of the Interconnected Network

The relationship of the Project to the interconnected network is illustrated on Figure E-4-2.

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Figure E-4-2: Interconnection Area for the Project

[Submitted under separate cover to the ALJs for confidential treatment because it contains critical infrastructure information.]

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E-4.2 Summary of anticipated benefits with respect to reliability and economy to Applicant and interconnected network

As stated earlier, the STARS report is the first major report describing the benefits of a transmission project like the Project. Further reports, including the 2013 CARIS report, testimony of the NY Transco before FERC[6], and New York transmission owner and NYISO comments to the Commission[7] in this proceeding, continue to describe the benefits of additional transmission across the congested Central East and UPNY/SENY interfaces. Through the development of these alternatives, many more system benefits have been identified and are detailed in the following sections.

E-4.2.1 Projected Reliability Benefits

Capacity

Transmission infrastructure investment provides tangible reliability benefits that result from a more robust transmission system. These reliability benefits include increased emergency transfer capability, improved resource adequacy, and a reduction in the amount of generation required to maintain system reliability. The standard reliability metric used in New York State and nationally is Loss of Load Expectation ("LOLE"). This is a measure of the likelihood that there will not be enough generation to serve the entire load. The accepted LOLE standard is a lack of generation to serve load one day in ten years, or 0.1 days/year, or lower. It should also be noted that the STARS report quantified the LOLE benefit associated with adding additional transmission infrastructure by determining the amount of generation that would be needed to achieve New York's higher level of system reliability. The report estimated that this value is between 300 to 400 MW of future generation. The STARS report demonstrated that a transmission project could eliminate the need for this additional generation, providing a potential annual savings in the range of $55 million to $218 million, which could vary year to year.

The Project will reinforce the transmission system, increase transmission capacity and therefore it is expected to improve the system reliability. The increased capacity allows for more remote generation to serve the needs of a local area. As an example, increased transmission capacity into the Hudson Valley region would likely have fully mitigated the need for the new G-J Local Capacity Zone recently created by NYISO and FERC.

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[6] NY Transco testimony filed with FERC on December 4, 2014 in Docket No. ER15-00572-000.

7 "Comments filed by the New York Transmission Owners in response to the NYS Register Notice Concerning the Proposed Public Policy Transmission Needs/Public Policy Requirements, as Defined Under the NYISO Tariff (I. D. No. PSC-45-14-00002-P) and in connection with the Alternating Current Transmission Proceeding 13-E-0488," filed with the Commission on December 24, 2014, and "Comments of the New York System Operator, Inc." filed with the Commission on December 29, 2014 in Case 14-E-0454, et al.

Aging Infrastructure

The Project will replace aging structures, some over 80 years old, with new, more modern facilities. Between Knickerbocker and Pleasant Valley the 115 kV system will be reconfigured, removing one double-circuit line north of the proposed Churchtown Switching Station and two double-circuit lines to the south totaling approximately 86 miles. This directly addresses one of the Energy Highway Blueprint objectives to upgrade aging infrastructure which will improve system reliability.

Operational Flexibility

In the NYISO's comments[8] to the Commission regarding this proceeding, they outline numerous economic, operational, and resiliency benefits that transmission would bring to New York State. They include: additional production cost savings associated with reduced transmission energy losses, reduced congestion due to transmission outages, mitigation of extreme events and system contingencies, mitigation of weather and load uncertainty, reduced cost due to imperfect foresight of real-time system conditions, reduced cost of cycling power plants, reduced need for (and costs of) ancillary services, and mitigation of the need to rely on "Reliability Must Run" contracts or similar arrangements.

The Project will be adding an additional parallel transmission path across a constrained interface. This addition is expected to provide greater operational flexibility to allow for maintenance outages during higher demand periods of the year and during periods of greater weather uncertainty. Further, as the NYISO noted above, the operational flexibility provided by the Project will likely reduce cost of cycling power plants and potentially the need for some ancillary services. Operational flexibility provides the system operators greater latitude to operate the system efficiently and reliably.

E-4.2.2 Projected Economic Benefits

Congestion Relief

As demonstrated in the NYISO 2013 CARIS Report, Demand$ congestion represents the congestion component of load payments which ultimately represents the cost of congestion to consumers. Production costs are the total costs incurred by generators to produce power within a region. These include costs for fuel, maintenance and emissions. The ten year projected demand$ congestion savings in 2013 dollars is expected to be approximately $1.7 billion and the statewide production cost savings is

[8] Ibid, page 7-8.

estimated to be $210 million with a transmission based solution.[9] This benefit is a direct result of increasing transfer capability from upstate to downstate New York, thereby freeing constrained (bottled) economic and renewable generation in western and northern New York.

Economic analyses have not been completed for this Project. However based upon the increased transfer capability the Project provides, it is reasonable to believe that the production cost savings and the demand$ congestion savings will be significant.

Economic Development

The Project is estimated to cost approximately $523 million in 2014 dollars.[10] As a result of this investment, the New York State economy will reap significant economic development benefits in the form of increases in employment and increases in local tax revenues.

Based on analyses performed by the Working Group for Investment in Reliable and Economic Electric Systems (the "WIRES" group) in conjunction with the Brattle Group, this $523 million of investment will support an estimated 2,200 direct full time equivalent ("FTE") jobs and approximately 6,800 total FTE jobs.[11] The directly supported jobs represent those related to domestic construction, engineering, and transmission component manufacturing. Indirect job stimulation represents suppliers to the construction, engineering, and equipment manufacturing sectors as well as jobs created in the service industries (i.e. food and clothing) supporting those directly and indirectly employed.

The Project is also estimated to increase annual local tax revenue by approximately $10 to $16 million.[12] The majority of this increased local tax revenue will flow to the upstate and western regions of New York.

[9] NYISO 2013 CARIS Report, p. 56.
[10] Applicant NYISO Analysis Filing dated Jan 7, 2015, Attachment 3, Table 1.1: Capital Cost Estimate. A capital cost estimate will be provided with Part B of the final Article VII application.
[11] The direct and total job numbers are based on generic information included in the May 2011 report entitled *Employment and Economic Benefits of Transmission Infrastructure Investment in the U.S. and Canada*, which was developed by the WIRES group in conjunction with the Brattle Group. The report concluded that every $1.0 billion of transmission investment supports 4,250 direct FTE years of employment and 13,000 total FTE equivalent years of employment. This report can be found at the following link: http://www.wiresgroup.com/images/Brattle-WIRES_Jobs_Study_May2011.pdf.
[12] The estimated annual local tax revenue is based on a factor of approximately 2-3% of project capital costs.

E-4.2.3 Other Projected Benefits

Emissions Reductions

The STARS analysis of a portfolio of transmission infrastructure improvements found that there was a significant decrease in statewide emissions. Specifically, it was estimated that the net statewide benefit would be a reduction in CO_2 emissions of 227,000 tons and NO_x emissions of 83 tons annually. These calculations were based on an increase in fuel diversity stemming from the ability to tap into upstate generation (downstate is principally comprised of natural gas and fuel oil generators).

Per NYISO[13], "Increased transmission capacity would further advance the integration of renewable energy resources in the State. Most of the growth in wind capacity and output is taking place upstate and in the western portion of New York. However, the demand lies in the Lower Hudson Valley, New York City and Long Island regions. More transmission capacity would increase the ability to dispatch renewable resources more frequently. That would help to attract additional renewable development while lowering emissions."

Studies have not been performed to assess the emissions reductions benefits of the Project. However, based on the STARS analysis and the fact that this Project provides a significant relief of constraints to allow more environmentally friendly as well as more renewable generation to flow across the transmission system, it is expected to allow for a significant amount of emissions reductions

Leveraging Existing Rights of Way

The Project represents approximately 54 circuit miles of 345 kV transmission facilities. If they were to be constructed on all new ROW, they would require the acquisition of additional property to accommodate the ROWs needed. However, because the Project leverages the re-use of previously disturbed land along existing ROW, the need for additional ROW is eliminated. This represents a large reduction of land that could be potentially impacted as compared to being developed completely as a greenfield project. The Project KB-PV Project will be designed such that transmission infrastructure that needs to be replaced will be completed in an efficient, environmentally friendly, and cost-effective manner. In addition, economies of scale will be created by replacing and expanding existing transmission facilities with new higher voltage lines or by adding to existing capacity. Using existing ROWs will also enable the Project

[13] "Comments of the New York System Operator, Inc." filed with the Commission on December 29, 2014 in Case 14-E-0454, et al, page 9.

to be built faster than if new land had to be acquired.

Expandability

"Expandability" is defined as the proposed electric system additions' capability to serve system load increases and interconnect new generating facilities in the long-term. The Project improves system Expandability of the bulk transmission system by providing one additional 345 kV station hub and an additional 345 kV transmission path through the region.

E-4.3 Proposed completion date, and impact on Applicant's systems and of others' of failure to complete on such date

As detailed in the January 7, 2015 filing, the Project is proposed to be placed in service in September 2019.

Delays to the schedule of one or more of the components will result in continued system constraints, along with the costs associated with those constraints.

E-4.4 Appropriate system studies

The December 2014 Commission Order requires a notice that the System Reliability Impact Studies / System Impact Studies (SRIS / SIS) are in progress (study scope accepted and work underway pursuant to a Study Agreement with the NYISO).

An SIS for National Grid's Knickerbocker to Pleasant Valley 345 kV line project (Queue #384) was completed in July 2013. National Grid plans to confer with the NYISO to seek a determination whether the minor modifications to the 115 kV system in the area of Columbia and Dutchess Counties constitute a material modification from the previously completed SIS. The Applicant has prepared a revised scoping document and is ready to start the NYISO review process shortly after this filing.

E-4.5 A general demonstration of how, and to what extent, the proposed transmission Project meets the congestion relief, system reliability, reduction in regional air pollution and greenhouse gas emissions and the other benefits and objectives identified by the Commission in Case 12-T-0502

An SIS for National Grid's Knickerbocker-Pleasant Valley 345 kV line project (Queue #384) was completed in July 2013. The project reviewed in this SIS increased the N-1 normal thermal transfer capability on the UPNY/SENY interface by 1,250 MW and the Central East N-1 normal thermal interface increased by 400 MW. Using the most up-to-date modeling information available, internal studies

continue to show an UPNY/SENY N-1 normal thermal increase of approximately 1,100 to 1,200 MW and a Central East N-1 normal thermal increase of approximately 300 to 350 MW. As explained earlier, this will significantly reduce congestion. The STARS and CARIS study results, as summarized earlier in this submittal, provide indicative values of the expected levels of congestion relief.

The Project also brings additional benefits that meet the objectives of the Energy Highway Blueprint. These include both reliability and economic benefits. Reliability improvements will be realized through the additional interface transfer capability and the replacement or upgrade of aging infrastructure. Economic benefits will be realized by the increase in jobs, increase in local tax revenue, and congestion reduction. By reducing transmission constraints, the Project will also facilitate development of renewable generation throughout the State, reducing air pollution and greenhouse gas emissions. Other significant environmental benefits will result from the Project's minimal impact on land through the use of existing rights of way.

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