New York State Electric & Gas Corporation

Columbia County Transmission Project

Exhibit E-4

Engineering Justification

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EXHIBIT E-4: ENGINEERING JUSTIFICATION

E-4.1 Summary of the Proposed Plan and Its Benefits

The Columbia County Transmission Project consists of construction of a new NYSEG-owned 115-kV switching station (Ghent Switching Station) in the town of Ghent (featuring a three-breaker ring bus configuration) tapping off the National Grid 115-kV Trunk #15, construction of a new 115-kV transmission line (Circuit #726) from the proposed Ghent Switching Station to the existing NYSEG Klinekill substation, and the installation of appropriate equipment upgrades and additions at the existing NYSEG Klinekill substation such as a new 115-kV bus-breaker system at the termination of the new line. These proposed facilities will reinforce the overall NYSEG 115-kV electric transmission system and 34.5-kV sub-transmission system, in particular the network serving the NYSEG Mechanicville Division Chatham Area. By providing an additional 115-kV source to the service area, the project will solve the contingency problems associated with outage of the 115-kV Churchtown – Craryville line. Under peak load conditions, an outage of the 115-kV line Churchtown – Craryville currently will require load shedding in order to avert system voltage collapse in the 34.5-kV network. The required load shedding will be at least 26 MVA under winter peak load conditions, and at least 31 MVA under summer peak load conditions.

The operation of the proposed facilities will enable NYSEG to continue providing adequate and reliable electric service to the NYSEG Mechanicville Division Chatham Area.

E-4.2 Description of Existing Transmission System

The NYSEG Mechanicville Division Chatham area electric system normal source capability is limited by the sources into the system. These sources are: 1) Wynantskill substation, with a thermal capability of 56 MVA, fed from National Grid, which normally serves load up to the Hoag substation only; 2) Stephentown substation, with a thermal capability of 37 MVA, fed from the NYSEG 115-kV line #993, Greenbush – Stephentown; 3) Craryville substation, with a thermal capability of 25 MVA, fed from the NYSEG line #984, Churchtown – Craryville – Klinekill; 4) Klinekill substation, with a thermal capability of 53 MVA, fed from the NYSEG line #984, Churchtown – Craryville – Klinekill.

All four substations are owned by NYSEG. These four sources provide a total capability of approximately 171 MVA.

E-4.3 Need for the Proposed Project

An outage of the 115-kV line Churchtown – Craryville will require load shedding under peak load conditions in order to avert system voltage collapse in the 34.5-kV network. The required load shedding will be at least 26 MVA under winter peak load conditions, and at least 31 MVA under summer peak load conditions. Assuming that the system is operating under contingency conditions, the exposure to either thermal or voltage constraint violations is 4,500 hours (out of a total of 8,760 hours) per year. Presently, in order to eliminate the thermal and voltage constraint violations under these contingency conditions, as many as 9,900 customers (corresponding to 26 MVA during winter and 31 MVA during summer) would need to be dropped under peak load conditions. The actual number of affected customers will depend on actual system load while the Churchtown-Craryville transmission line is out of service. The proposed completion date for the project is December 2015.

E-4.4 Proposed Plan and Its Benefits

The Project will bring a new 115-kV source to the NYSEG Mechanicville Division Chatham Area. This new source will eliminate the need to drop load upon loss of the 115-kV line Churchtown – Craryville. The new 115-kV line will benefit the entire Mechanicville Division Chatham Area which includes the towns of Ghent, Stockport, Chatham, Canaan, New Lebanon, Hillsdale, Austerlitz, Taghkanic, Stephentown, and the Village of Philmont.

The project includes the following components:

- A new 115-kV switching station (Ghent Switching Station) in the town of Ghent (featuring a three-breaker ring bus configuration) tapping off the National Grid 115-kV Trunk #15
- A new 115-kV transmission line from the new Ghent Switching Station in the town of Ghent to the NYSEG Klinekill substation
- An extension of the National Grid Trunk #15 115-kV transmission line into the new Ghent Switching Station

Appropriate equipment upgrades and additions at the NYSEG Klinekill substation such as a new 115-kV bus-breaker system at the termination of the new line.

Table E-4-1 shows calculated thermal MVA flows under system normal peak load conditions on selected lines taking into account project status and seasonal variations of load.

Table E-4-1 Calculated Thermal MVA Flows Under System Normal Conditions

Network Configuration	Line or Transformer	Summer Peak		Winter Peak	
		Pre-Project	Post-Project	Pre-Project	Post-Project
Normal	115-kV Line NG Trunk #15 (Valkin- Hudson)	89.3	N.A.	81.4	N.A.
Normal	115-kV Line Churchtown - Craryville	33.9	12.4	32.5	5.7
Normal	115-kV Line NG Trunk #15 (Valkin – New NYSEG Substation)	N.A.	106.3	N.A.	101.8
Normal	115-kV Line NG Trunk #15 (New NYSEG Substation - Hudson)	N.A.	81.3	N.A.	71.5
Normal	115-kV Line New NYSEG Substation – Klinekill	N.A.	23.9	N.A.	29.3

Table E-4-2 shows calculated thermal MVA flows under emergency peak load conditions on selected lines taking into account seasonal variations of project status and load.

Table E-4-2 Calculated Thermal MVA Flows Under Contingency Conditions

Network Configuration	Line or Transformer	Summer Peak	Winter Peak

		Pre-Project	Post-Project	Pre-Project	Post-Project
Loss of 115-kV Line Churchtown-Craryville	115-kV Line NG Trunk #15 (Valkin – Hudson)	89.6 (With 31 MVA Load Shedding)	N.A.	81.5 (With 26 MVA Load Shedding)	N.A.
Loss of 115-kV Line Churchtown-Craryville	115-kV Line NG Trunk #15 (Valkin – Hudson)	89.5 (With Voltage Collapse at 34.5-kV)	N.A.	82.8 (With Voltage Collapse at 34.5-kV)	N.A.
Loss of 115-kV Line Churchtown-Craryville	115-kV Line Churchtown - Craryville	0.0	0.0	0.0	0.0
Loss of 115-kV Line Churchtown-Craryville	115-kV Line NG Trunk #15 (Valkin – New NYSEG Substation)	N.A.	113.6	N.A.	105.3
Loss of 115-kV Line Churchtown-Craryville	115-kV Line NG Trunk #15 (New NYSEG Substation - Hudson)	N.A.	77.5	N.A.	69.7
Loss of 115-kV Line Churchtown-Craryville	115-kV Line New NYSEG Substation - Klinekill	N.A.	35.3	N.A.	34.6

Table E-4-3 shows calculated bus voltages under system normal conditions on selected buses taking into account project status and seasonal variations of load.

Table E-4-3 Calculated Per Unit Bus Voltages Under System Normal Conditions

Network Configuration	Bus	Summer Peak		Winter Peak	
		Pre-Project	Post-Project	Pre-Project	Post-Project
Normal	Churchtown 115-kV	0.999	1.004	1.01	1.005
Normal	Valkin 115-kV	1.017	1.014	1.02	1.015

Table E-4-3 Calculated Per Unit Bus Voltages Under System Normal Conditions

Network Configuration	Bus	Summer Peak		Winter Peak	
		Pre-Project	Post-Project	Pre-Project	Post-Project
Normal	Stephentown 115-kV	1.011	1.014	1.005	1.008

Table E-4-4 shows calculated bus voltages under contingency conditions on selected buses taking into account project status and seasonal variations of load.

Table E-4-4 Calculated Per Unit Bus Voltages Under Contingency Conditions

Network Configuration	Bus	Summer Peak		Winter Peak	
		Pre-Project	Post-Project	Pre-Project	Post-Project
Loss of 115-kV Line Churchtown-Craryville	Churchtown 115-kV	1.009 (With 31 MVA Load Shedding)	1.009	1.007 (With 26 MVA Load Shedding)	1.007
Loss of 115-kV Line Churchtown-Craryville	Valkin 115-kV	1.017 (With 31 MVA Load Shedding)	1.009	1.019 (With 26 MVA Load Shedding)	1.013
Loss of 115-kV Line Churchtown-Craryville	Stephentown 115-kV	1.009 (With 31 MVA Load Shedding)	1.013	0.993 (With 26 MVA Load Shedding)	1.007
Loss of 115-kV Line Churchtown-Craryville	Churchtown 115-kV	1.007 (With Voltage Collapse at 34.5-kV)	1.009	1.005 (With Voltage Collapse at 34.5-kV)	1.007
Loss of 115-kV Line Churchtown-Craryville	Valkin 115-kV	1.014 (With Voltage Collapse at 34.5-kV)	1.009	1.016 (With Voltage Collapse at 34.5-kV)	1.013
Loss of 115-kV Line Churchtown-Craryville	Stephentown 115-kV	0.901 (With Voltage Collapse at 34.5-kV)	1.013	0.887 (With Voltage Collapse at 34.5-kV)	1.007

E-4.5 Impact of a Delay in the Construction Schedule

Given the existing system and load levels, the contingency involving the outage of the 115-kV Churchtown - Craryville transmission line will necessitate load shedding of at least 26 MVA under peak load conditions in order to avert system voltage collapse conditions. A delay in the construction schedule will expose as many as 9,900 NYSEG customers to increased potential loss of service due to this contingency.

E-4.6 System Impact Study

In consultation with the New York Independent System Operator (NYISO) and with National Grid (NG), NYSEG determined that a System Impact Study (SIS) is not necessary for the Columbia County Transmission Project. The NYISO indicated that if the changes in transfer limits are 10 MW or less on each of the interfaces, an SIS is not necessary. National Grid, together with NYSEG, arrived at the conclusion that these changes were indeed less than 10 MW after performing suitable calculations.

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