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nationalgrid

Lockport-Batavia Line 112

Rebuild Project

Exhibit E-4

Engineering Justification

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EXHIBIT E-4: ENGINEERING JUSTIFICATION

E-4.1 ENGINEERING JUSTIFICATION AND RELATIONSHIP TO EXISTING FACILITIES

National Grid's 115kV T1510 Lockport-Batavia Line 112 is an important element of National Grid's transmission system in Western New York where it is part of a 115kV west-to-east network from Lockport to Batavia and Rochester. This network includes the Lockport-Batavia Existing Lines 107 and 108 and the Lockport-Mortimer Existing Lines 111, 113 and 114 lines. Line 112 directly serves Birdseye Foods and connects to the Oakfield Station which serves a 34.5kV network.

The purpose of this Project[1] is to rebuild an approximately 21.7 mile section of Line 112 between the line's first transmission line structure (Structure 1-2, outside the Lockport Substation) and Structure 211. This reconstruction would be done by replacing one hundred seventy-eight (178) deteriorating steel tri-legged "aeromotor" structures and all existing 428 kcmil, 636 kcmil AAC conductor and shield wire along Existing Line 112. These facilities are over one hundred ten (110) years old and have reached the end of their service lives.[2]

The significant deterioration levels of Existing Line 112 have caused numerous incidents resulting in either limited capacity operation or total electrical failures with customer outages. Frequent and extensive maintenance has been required on Existing Line 112 over the past several years. This has included the replacement of a number of structures on an as-needed or emergency basis.

In its current condition, Existing Line 112 does not meet the current National Electrical Safety Code ("NESC"), which is of a more recent vintage than the original line, which was constructed in the early 1900s. Bringing Line 112 up to current NESC requirements is consistent with (1) standard industry practice, and (2) the requirements of the Public Service Commission, which by order dated January 5, 2005 in Case 04-M-0159 mandated adherence to the NESC. With

1 In this exhibit, the term "Applicant" and numerous other capitalized terms are defined in the Glossary included in this Application.

2 The steel tri-leg structures are located between Structures 6 and 211. The portion of the Lockport-Batavia Line 112 east of Structure 211 (*i.e.*, from Structure 212 to the Batavia Substation) are wood poles in overall good asset condition and do not require replacement.

completion of this Project, National Grid will improve the safety, performance, and reliability of its transmission system.

E-4.2 RELIABILITY, ECONOMIC BENEFITS AND SYSTEM IMPACT STUDIES

E-4.2.1 Reliability

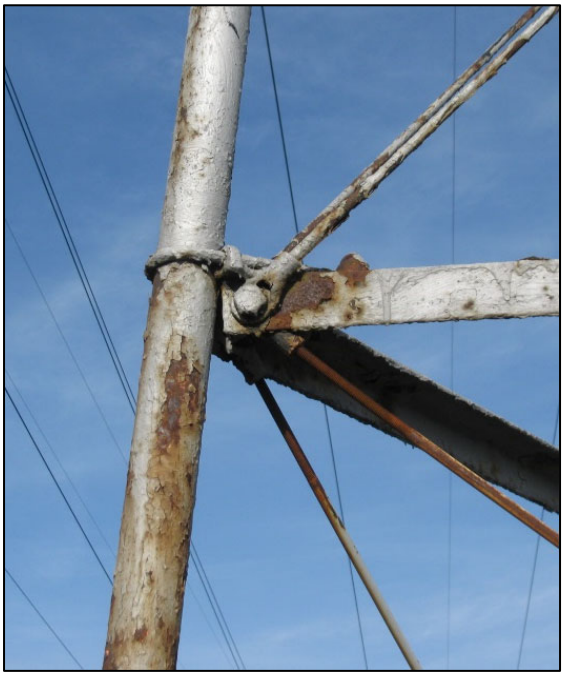
The original aeromotor tri-leg towers consist of three concrete-filled steel pipe legs joined with compression splices mechanically fixed utilizing ½ inch U-bolts. The legs rest on cast steel base plates secured to concrete pier foundations, with each tower leg affixed to its pier by two (2) anchor bolts. Failure of either the U-bolts or anchor bolts would cause structural instability that has a high probability of resulting in failure of the structure. National Grid's Asset Management Department has observed several structures with anchor bolts severed or significantly weakened as a result of significant losses in their cross area. Large spalled sections of concrete are also common in the foundation piers associated with the tri-leg structures. These original concrete piers are only 12" wide and do not have reinforcing steel. Corrosion in the anchor bolts has placed an unconfined compressive force on the concrete pier. This has resulted in large sections of concrete separating from the main body of the pier, exposing the anchor bolts. Also, the cross bracing on many tri-leg towers is bent or broken.[3] Figures E-4.2.1-1 through E-4.2.1c illustrate these asset condition concerns.

FIGURE E-4.2-1 BENT AND BROKEN BRACINGS

[3] In 2016, National Grid repaired broken or damaged cross bracing on thirty-seven (37) tri-leg towers to minimize risk of tower failures.

FIGURE E-4.2-2 SPALLED CONCRETE AND EXPOSED ANCHOR BOLTS

FIGURE E-4.2-3 TYPICAL CONCRETE FILLED PIPE WITH COMPRESSION U-BOLTS



National Grid utilizes a screening tool to help in the prioritization of all 115kV and above circuits when considering future transmission condition-based refurbishment projects. The screening tool considers the number of customers served by a line, its connected generation, its stranded load, peak load, and congestion, its potential to impact system reliability and security, and its asset condition. Line 112 was found to fall within the top quartile of lines with respect to their importance to the National Grid New York transmission system.[4]

Performance history summarized in Figure E-4.2-4 below shows that, of the thirty five (35) outages on Existing Line 112 between January 1, 2013 and July 30, 2020, the majority were caused by weather or an unknown reason. This suggests the structures are not resilient enough to sustain operation during storms due to their degrading condition.

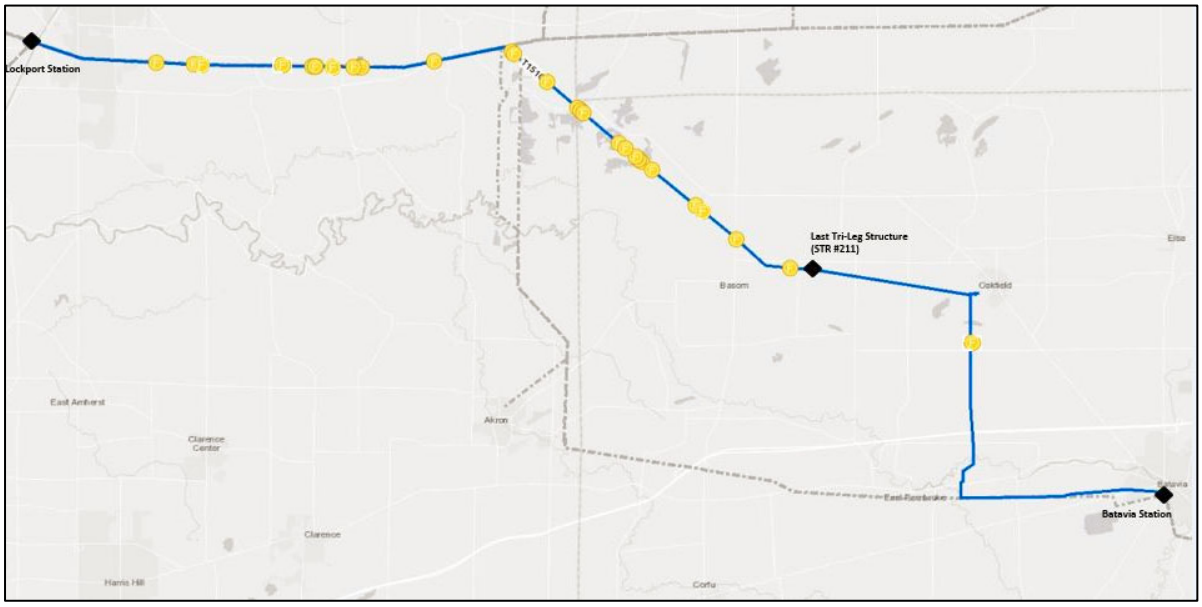
FIGURE E-4.2-4 LOCKPORT-BATAVIA LINE 112 INTERRUPTIONS

Lockport-Batavia #112 Interruptions January 2013 - July 2020	
Cause	Count
Weather/Lightning	16
Unknown	13
Station	2
Line Equipment/Splice	2
Osprey	2
Total	35

Furthermore, for the line outages with distance-to-fault or patrolled problem identification information included in their reporting, all but one (1) of the failures was located within the section of Existing Line 112 with steel tri-leg structures as illustrated below in Figure E-4.2-5.

[4] The screening methodology National Grid uses to prioritize its 115kV and above circuits is described more fully in Section 2.A.2.1.3 on Page 13 of Chapter 2A of its annual Report on the Condition of Physical Elements of Transmission and Distribution Systems, last filed with the Public Service Commission on October 12, 2022 in Case 20-E-0380.

FIGURE E-4.2-5 LOCATION OF STEEL TRI-LEG STRUCTURES



Field inspections in 2006 resulted in the replacement of five (5) steel tri-leg towers (Structures 59, 123, 131, 172 and 185) in 2008 with wood pole single-circuit davit arm tangent structures. Steel Structures 147 to 159 were not inspected because of their limited access within the Tonawanda Wildlife Management Area ("TWMA").

Due to their deteriorated condition, the steel tri-leg towers are not able to support the minimum Occupational Health and Safety Administration ("OSHA") requirement that the anchor point for a lineman's safety connection to a structure member be able to withstand a force of 5,000 lbs. Therefore, it is not safe for linemen to climb the towers to perform maintenance or restoration work. This necessitates use of a bucket truck for locations outside of the TWMA.

Segment 4 Existing, located within the TWMA, needs to be relocated to a new route which will allow easier access for National Grid crews to perform maintenance and shorten restoration time in the event of a tower failure (see Figure 3-2).

Replacing the deteriorating Existing Line 112 facilities will decrease the likelihood of potential line outages due to equipment failures. Upgrading access roads and rerouting the line around the TWMA will greatly improve response time and decrease maintenance costs. Furthermore, reconductoring the 428 AAC and 636 AAC will replace all the existing splices and increase the limiting element within that 21.7 milelong section.

After years of repair and monitoring, Existing Line 112 was found to be in such a degraded state that a complete rebuild is necessary in order to adhere to National Grid's standards.

E-4.2.2 Economic Benefits

The proposed rebuild of Line 112 will be done in accordance with a comprehensive, state-of-the-art design incorporating transmission structures that meet National Grid's standards. The Project will provide a more cost-effective solution for the continued long-term maintenance and operation of the transmission line. The alternative of emergency replacement of individual structures on an as-needed or annual basis and the accompanying disruptions to service is not recommended.

E-4.2.3 System Impact Studies

Following completion of the Project, no material change to the transmission network is expected. The power flow on a circuit is a function of the circuit impedance and the impedance of the circuits that make up the surrounding system. Though Line 112 is proposed to be rebuilt, Rebuilt Line 112 will continue to operate at 115kV and the impedance of the rebuilt circuit will change only marginally from the existing value. The surrounding system is also not changing due to this Project. It will result in little to no change in line loading, power flows or voltage at the substations in the area.

The Project will rebuild approximately 21.7 miles of the existing 35.0 mile-long circuit. The portions of the circuit to be replaced do not include the overall thermally limiting components. Thus, there will be almost no change to the rating of the overall line. The only change will be to the Summer Short Term Emergency ("STE") rating of the line, which will increase by 1 MVA.

Since the Project consists of the replacement of an existing transmission line, no material change to the electrical system is expected. Following completion of the Project, Rebuilt Line 112 will continue to operate at 115 kV with virtually no change in line loading, power flows or voltage at the substations in the area. To demonstrate this, a study was performed where the pre- and post-contingency flows on the circuit were determined for summer peak study conditions.

[redacted]

[redacted]

Given the minimal change in system power flows and ratings attributed to the Project, a system impact study *(i.e.,* voltage, thermal and stability analyses) was deemed unnecessary and was not performed. The New York Independent System Operator ("NYISO") confirmed the Company's determination in an e-mail message to National Grid dated January 5, 2021 (see Attachment E-4-1 attached hereto).

E-4.2.4 Impact of a Delay in the Construction Schedule

The proposed rebuild of Line 112 up to Structure 211 is scheduled to be completed in March 2027. A delay in this in-service date will mean continued deteriorating system performance and reliability, additional costs due to labor and material price escalation, additional costs associated with unexpected replacement of damaged structures, and increasingly high risk of unplanned outages and disruption in service due to failure of the existing structures, conductors and static wires.

Lockport-Batavia 112

Rebuild Project

Exhibit E-4

Engineering Justification

Attachment E-4-1 (NYISO correspondence)

Subject	**FW: EXT || RE: Lockport - Batavia #112 Project**
From	Maher, Jeffery M.
To	Gentile, David P.
Sent	Thursday, April 1, 2021 9:03 AM

David,
NYISO has reviewed the Lockport – Batavia #112 Project and has determined that the project does not require a System Impact Study. This determination was presented to the Transmission Planning Advisory Subcommittee on February 2, 2021.

Jeff Maher
National Grid Transmission Planning

From: Nguyen, Thinh T. <TNguyen@nyiso.com>
Sent: Tuesday, February 2, 2021 3:08 PM
To: Maher, Jeffery M. <Jeffery.Maher@nationalgrid.com>
Cc: Domino, Mark F. <Mark.Domino@nationalgrid.com>; Interconnection Support <InterconnectionSupport@nyiso.com>; Williams, Quentin P <QWilliams@nyiso.com>; Dixon, Kirk J. <KDixon@nyiso.com>
Subject: RE: EXT || RE: Lockport - Batavia #112 Project

Hi Jeff,

It was presented at today TPAS meeting for information, but please note that the effective date of such request was on January 5, 2021, which was the date that NGrid provided the confirmation that they intended to move forward with the project.

Thanks.

Thinh

New York ISO
Independent System Operator
Thinh T. Nguyen | LinkedIn

Sr. Manager, Interconnection Projects

10 Krey Boulevard, Rensselaer, NY 12144

Ph: 518-356-6025 | www.nyiso.com

From: Maher, Jeffery M. <Jeffery.Maher@nationalgrid.com>
Sent: Tuesday, February 2, 2021 3:03 PM
To: Nguyen, Thinh T. <TNguyen@nyiso.com>
Cc: Domino, Mark F. <Mark.Domino@nationalgrid.com>; Interconnection Support <InterconnectionSupport@nyiso.com>; Williams, Quentin P <QWilliams@nyiso.com>; Dixon, Kirk J. <KDixon@nyiso.com>
Subject: [EXT] RE: EXT || RE: Lockport - Batavia #112 Project

***** EXTERNAL email. Please be cautious and evaluate before you click on links, open attachments, or provide credentials. *****

Thinh,
Can you confirm that the #112 project was presented at TPAS and determined to be non-material.
Thanks

From: Maher, Jeffery M.
Sent: Tuesday, January 5, 2021 2:46 PM
To: Nguyen, Thinh T. <TNguyen@nyiso.com>
Cc: Domino, Mark F. <Mark.Domino@nationalgrid.com>; Interconnection Support <InterconnectionSupport@nyiso.com>; Williams, Quentin P <QWilliams@nyiso.com>; Dixon, Kirk J. <KDixon@nyiso.com>
Subject: RE: EXT || RE: Lockport - Batavia #112 Project

Thinh,
This project will be moving forward soon. National Grid grants permission for the findings to be presented at the February TPAS meeting.

Thanks for your quick review.

From: Nguyen, Thinh T. <TNguyen@nyiso.com>
Sent: Tuesday, January 5, 2021 2:37 PM
To: Maher, Jeffery M. <Jeffery.Maher@nationalgrid.com>
Cc: Domino, Mark F. <Mark.Domino@nationalgrid.com>; Interconnection Support <InterconnectionSupport@nyiso.com>; Williams, Quentin P <QWilliams@nyiso.com>; Dixon, Kirk J. <KDixon@nyiso.com>
Subject: EXT || RE: Lockport - Batavia #112 Project

Hi Jeff,

Happy New Year!

As indicated in Transmission Expansion and Interconnection manual, a System Impact Study (SIS) would be required for an LTP project if such project either (i) reduces the transfer capability of a NYISO

interface by greater than 10 MW or increase the transfer capability of a NYISO interface by greater than 25 MW; or (ii) change the classification of affected facilities to NPCC BPS facilities.

NYISO concurs with your assessment that the proposed LTP project does not meet the threshold to trigger a SIS.

Will you move forward with the project? If so, in accordance with NYISO procedure, I need to present such finding to TPAS for review and concurrence, and subsequently report to OC for information. Would you like this to be included on the February TPAS meeting agenda? If so, will you grant me the permission to report such finding to TPAS for the meeting materials? If so, please respond to me by Tuesday, January 12, 2021. If not, we could report to TPAS at another later meeting; however, please note that within thirty (30) Calendar Days after issuance of the determination, if NGrid does not advise the NYISO to proceed with the proposed project, the request will be deemed to be withdrawn.

Thanks.

Thinh

New York ISO
Independent System Operator
Thinh T. Nguyen | LinkedIn

Sr. Manager, Interconnection Projects

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From: Maher, Jeffery M.
Sent: Tuesday, December 8, 2020 3:18 PM
To: Nguyen, Thinh T. <TNguyen@nyiso.com>
Cc: Domino, Mark F. <Mark.Domino@nationalgrid.com>
Subject: Lockport - Batavia #112 Project

Thinh,
National Grid has a project to rebuild a major portion of our Lockport – Batavia 115kV circuit #112. This project is being driven by the need to address the condition of the towers and conductor, but will increase the rating of the circuit and result in a small change to the impedance of the circuit.

The project will trigger the need to file an Article VII, which we plan to do in 2021. Part of the Article VII filing will involve a discussion of system studies and if appropriate a System Impact Study would be included. In this case, we believe that the project would have virtually no impact on the flows in the area or impact transfer limits and as such believe that a System Impact Study is not necessary. We would like the NYISO to concur that an SIS is not required in this case.

Please let us know what information National Grid would be required to submit to support this position.

Jeff Maher
National Grid Transmission Planning