REPORT ON THE CONDITION OF PHYSICAL ELEMENTS OF TRANSMISSION AND DISTRIBUTION SYSTEMS

CASE 20-E-0380

THE STATE OF NEW YORK PUBLIC SERVICE COMMISSION

THREE EMPIRE STATE PLAZA

ALBANY, NY 12223

SEPTEMBER 30, 2024

nationalgrid

Table of Contents

Chapter 1. Executive Summary

Pursuant to Appendix 17, Section IV of the Joint Proposal approved by the New York Public Service Commission (PSC) January 20, 2022, in Case 20-E-0380 *et al.*,[1] Niagara Mohawk Power Corporation d/b/a National Grid ("National Grid" or the "Company") submits this biennial report on the physical condition of its transmission and distribution ("T&D") facilities.

The Company's primary mission is the safe and reliable delivery of electricity to customers and the transmission of electricity to support regional electricity markets. This report outlines the results of inspections and analyses of the Company's assets. Presently, the physical elements of National Grid's T&D infrastructure are generally adequate to provide safe and reliable service. However, this report highlights asset and system conditions that require both continued monitoring and evaluation, as well as asset and system conditions that require investment to ensure continued safe and reliable service. The asset and system conditions identified in this report guide the development of the Company's capital investment and maintenance plans.

1. A. 1. Asset Condition

The Company evaluates asset condition to determine which assets should be replaced before their performance negatively impacts the provision of safe and adequate service. The physical elements of National Grid's T&D facilities in New York have a service life ranging up to 100+ years of age. While many assets have passed their typical asset life, detailed engineering evaluations of conductors and structures continue to show that 'older' assets are in serviceable condition. Often assets require only repair and selected replacement, not complete rebuilds. The station equipment service life has also been extended through the use of diagnostic test results and equipment class history to guide replacement decisions. Thus, an asset's projected service life is sometimes used to identify assets requiring further engineering analysis and, in asset planning, it is a factor that can help predict the volume of assets that will require replacement in the future.

1. A. 1. 1. Transmission System

National Grid's transmission system comprises transmission lines and substations operating at 69kV, 115kV, 230kV, and 345kV. National Grid has approximately 5,720 circuit miles of 69kV, 115kV, 230kV, and 345kV lines. These facilities are extensively interconnected with facilities owned by other transmission owners in New York, surrounding states, and Canada. National

[1] Cases 20-E-0380 *et al.*, Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Niagara Mohawk Power Corporation d/b/a National Grid for Electric Service, *Order Adopting Terms of Joint Proposal, Establishing Rate Plans and Reporting Requirements* (January 20, 2022).

Grid has 53 miles of underground transmission cable in service. Additionally, there are 193 transmission substations in New York.

Overall, the condition of National Grid's bulk power transmission system (345kV and 230kV) is safe and adequate to provide service, though there are issues in each asset class that present condition and obsolescence concerns. Likewise, the 115kV system is generally safe and adequate for service; however, there are specific areas of poor condition. Specific areas of interest include:

1. A. 1. 1. 1. Structures

There were ten (10) steel structures graded at visual level 5 (significant pitting) and eight (8) steel structures graded at visual level 6 (very severe deteriorations) that required investment in 2022. There were no steel structures graded at visual level 5 or 6 in 2023 (See Table 2A-7). The Company has annual inspection programs to identify and replace any priority reject wood poles when they are identified as broken, rotting or leaning on a scale of 1 – 3 with 1 being the highest replacement priority. There were one hundred sixteen (116) priority reject poles in 2022 and eighty-five (85) priority reject poles identified in 2023 (See Table 2A-10).

1. A. 1. 1. 2. Phase Conductors

Conductor, static wire, and splice issues and failures pose safety and reliability risks. The overhead line refurbishment program provides a systematic long-term approach to address issues related to conductor condition, shield wires, supporting hardware, and splices. Lines that have had multiple conductor failures over the previous five years due to condition issues are also being addressed.

1. A. 1. 1. 3. Substations

A number of transmission substations have significant asset condition and configuration issues that will require major refurbishment projects rather than individual asset replacement. National Grid is developing substation rebuild projects for Lockport, Lighthouse Hill, Inghams, Boonville, Oneida, and Homer Hill. Also, redeveloping/developing projects for Rotterdam, Yahnundasis, and Greenbush substations.

1. A. 1. 1. 4. Circuit Breakers

The oil circuit breaker population is experiencing degradation requiring additional maintenance and creates system reliability and customer service concerns. A circuit breaker replacement strategy was approved in December 2010 to address oil circuit breakers that pose the greatest safety and reliability concerns. A list of potential breaker replacement candidates is discussed in Chapter 2A. Many of these breakers will be replaced as part of their respective station rebuilds.

1. A. 1. 1. 5. Transformers

National Grid has over 500 transformers in service. There are approximately 90 power transformers on the transmission system that have been placed on a "watch list" that provides for closer monitoring of condition and performance. Surveillance and regular dissolved gas analysis ("DGA") sampling enables the Company to prioritize transformer replacements appropriately. The transformer watch list is dynamic and reviewed every six months. Transformers are added and removed based upon the test results and asset condition review.

1. A. 1. 1. 6. Protection and Controls

National Grid maintains approximately 11,000 individual protection relays on the transmission system. Approximately 72% of the transmission relay population consists of electromechanical and solid-state relays on which degradation, such as worn contacts and frayed wiring insulation, is expected. Calibration drift was also found in electromechanical and solid-state relays, indicating electrical/mechanical component failures (i.e., capacitors, coils, resistors). Further, solid state relays exhibit problems such as card failures and obsolescence. A strategy was approved to replace the relays. In general, the replacement plan will be implemented on a line-by-line basis.

Other asset groups and details of the performance of these assets are also provided in Chapter 2A, along with descriptions of programs to address concerns relating to these assets.

1. A. 1. 2. Sub-Transmission System

National Grid's sub-transmission system consists of approximately 3,022 circuit miles of lines at 23kV, 34.5kV, and 46kV and 12kV (serving as Sub-T). A portion of the sub-transmission system is interconnected with other sub-transmission systems, making it critical to both serving National Grid customers and ensuring a safe and reliable electrical grid for all of New York. National Grid has 609 miles of underground transmission cable in service.

Overall, the condition of National Grid's sub-transmission system (12kV, 23kV, 34.5kV, and 46kV) is generally safe and adequate for service; however, there are specific areas of poor condition. Specific areas of interest include:

1. A. 1. 2. 1. Overhead System Assets

The Company has annual inspection programs to identify and repair any steel tower when there are loose bolts, structural damage, or a tower leg broken, using a scale of 1 – 3 with 1 being the highest priority. There were ten (10) steel structures with structural damage graded at visual level 3 that required investment by 2024. There were twenty-one (21) steel structures with structural damage graded at visual level 3 that required investment

by 2025. There were five (5) steel structures with structural damage graded at visual level 3 that required investment by 2026. (See Table 2B-3). The Company has annual inspection programs to identify and replace any priority reject wood poles when they are identified as broken, rotting, or leaning on a scale of 1 – 3 with 1 being the highest replacement priority. There was one (1) wooden structure with structural damage graded at visual level 1, two (2) wooden structures with structural damage graded at visual level 2, and eighty-eight (88) wooden structures with structural damage graded at visual level 3 identified in 2021. There were two (2) wooden structures with structural damage graded at visual level 1, eight (8) wooden structure with structural damage graded at visual level 2, and one hundred and nineteen (119) wooden structures with structural damage graded at visual level 3 identified in 2022. There were nine (9) wooden structures with structural damage graded at visual level 1, five (5) wooden structures with structural damage graded at visual level 2, and three hundred and sixty one (361) wooden structures with structural damage graded at visual level 3 identified in 2023 (See Table 2B-4).

1. A. 1. 2. 2. Underground System Assets

Underground cables identified as poor performers and verified as being in poor condition continue to be replaced. There are approximately 609 circuit miles of sub-transmission cable. The replacement of Paper Insulated Lead Cable (PILC) is prioritized as part of system planning.

1. A. 1. 3. Distribution System

The Company's distribution system comprises of lines and substations operating at 15kV and below. There are approximately 512 distribution substations providing service to customers. There are approximately 36,634 circuit miles of overhead primary wire and approximately 8,064 circuit miles of underground primary cable on the system supplying over 400,000 overhead, padmount, and underground transformer locations.

With certain exceptions noted in this report, the distribution system is generally in safe and adequate condition to provide electric service. National Grid continues to gather data and monitor assets proactively to ensure any adverse trends are identified. Inspection and Maintenance program activities generate asset condition information and remediate asset condition issues. Program work on the distribution system is summarized in Exhibit 3.

1. A. 1. 3. 1. Overhead System Assets

For calendar years 2022-2023, approximately 518,553 distribution pole inspections were completed, representing approximately 20 percent of the population. Based on these inspections, approximately 4,403 poles have been identified as requiring replacement over the next three years.

Also based on calendar years 2022-2023 inspections, 102 overhead transformers (out of a total population of approximately 346,586) were identified as candidates for replacement over the next three years.

1. A. 1. 3. 2. Underground System Assets

There were approximately 5,911 manholes and vaults inspected in calendar years 2022 and 2023. The inspection results can be found in Exhibit 3.

1. A. 1. 3. 3. Distribution Substations

While generally adequate for providing safe and reliable service, these systems require investment to address condition-related degradation in the areas of primary equipment and secondary protection and control cabling insulation.

1. A. 1. 3. 4. Indoor Substations

National Grid has sixty-one (61) substation locations in Upstate NY that are classified as "Indoor Substation". The oldest indoor substation locations were built between the 1920s and the 1940s and are targeted for station rebuild or retirement. There are forty-four (44) locations constructed between the 1920s and the 1940s, and of those substation locations, twenty-four (24) have been rebuilt. Additionally, there are three (3) indoor substation locations that were constructed after the 1940s that have been rebuilt, for a total of twenty-seven (27) indoor substation rebuilds.

1. A. 1. 3. 5. Metal-Clad Switchgear

Metal-clad equipment, when deteriorated, is prone to water and animal ingress which could lead to failures. The Company has utilized advanced testing techniques based on electro-acoustic detection to identify potential issues. The initial review using these techniques identified a number of locations where minor repairs or refurbishments are recommended.

1. A. 1. 3. 6. Power Transformers

Of the six hundred and sixty-two (662) operating distribution transformers, there are twenty-two (22) power transformers that supply the distribution system that have been placed on a "watch list" and are being monitored more closely. A contingency plan has been identified for transformers on the watch list.

1. A. 1. 3. 7. Circuit Breakers

National Grid has approximately 3,967 circuit breakers and 191 spares on the distribution system. Based upon condition, obsolescence or poor performance, certain families of breakers are targeted for replacement or refurbishment.

1. A. 1. 3. 8. Protection and Controls

Approximately 18,000 in-service relay systems that protect distribution station equipment are electromechanical types that do not support modern fault recording and analysis. Moreover, a number of these relays are no longer supported by the manufacturer and replacement parts are no longer available.

Other asset groups and details of the performance of these assets and any programs developed to address concerns relating to these assets are described in Chapter 2.

1. B. 1. Organization of Filing

The remainder of this document consists of the following:

- Chapter 2 - Asset Condition focuses on the details of physical assets on the system and provides further insights into the condition of those assets as they relate to transmission, sub-transmission, and distribution systems.

- Chapter 3 - Exhibits that support this Asset Condition report.